MONITORING REPORT

(Version 01)

China Tongwan Hydropower Project

(CDM registration reference number: 1590)

The 2nd monitoring period: 1 February, 2009－31 August, 2009

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Prepared by

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General Information

Purpose of a Monitoring Report

The aim of monitoring report is to make sure that the net generated electricity was measured, recorded and reported during monitoring period to ensure real, measurable and verifiable emission reductions.

Project Description

China Tongwan Hydropower Project (hereinafter referred to as "the project') is a newly built hydropower plant, which is located in Zhongfang County of Huaihua City, Hunan Province, P. R. China. The project construction was commenced in March 2005. The total installed capacity of the project is 180 MW (45 MW×4) with expected annual net power supply of 662,000 MWh. The generated electricity by the project is delivered to the regional power grid, i.e. Central China Power Grid (CCPG).

The purpose of the project is to generate electricity by using water resources to alleviate electricity shortage in Central China. The project will contribute to the reduction of GHG emission by displacing part of the electricity supplied by CCPG, which is dominant of fuel-fired power plants.

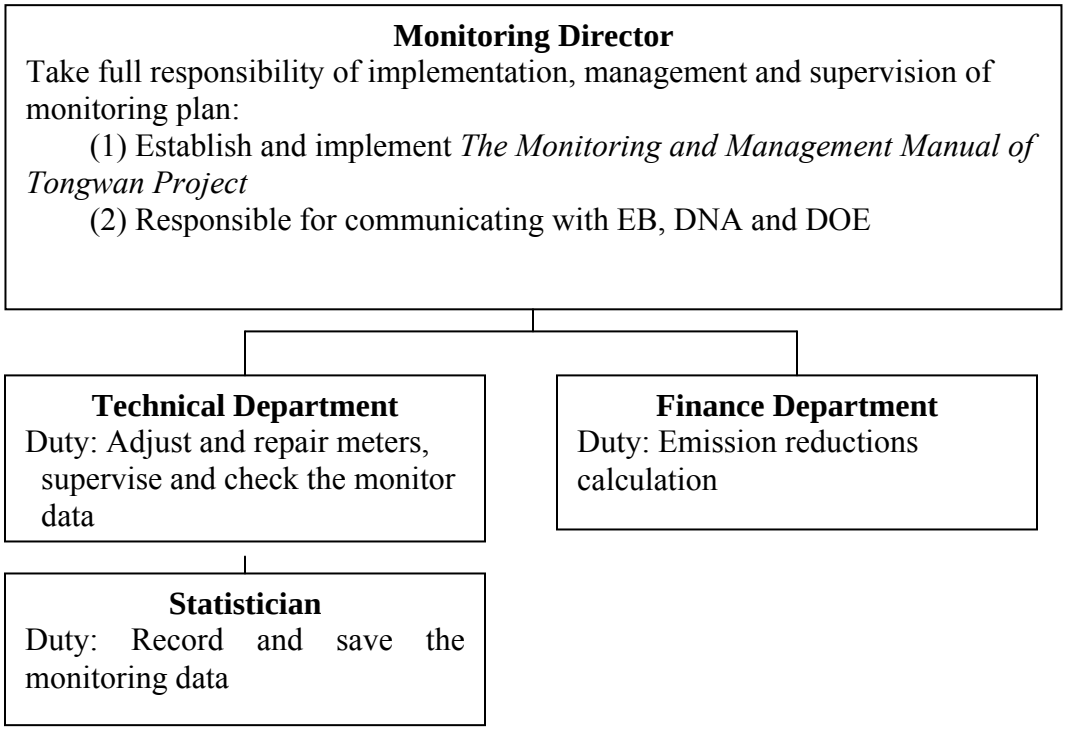
The implementation of the project is as follows:

Event	Time
Project construction	22/03/2005
Registration date	30/10/2008
Crediting period	30/10/2008-29/10/2015 (renewable)
Operation of 1st generator	25/12/2007
Operation of 2nd generator	31/05/2008
Operation of 3rd generator	26/10/2008
Operation of 4th generator	23/12/2008
1st monitoring period	30/10/2008-31/01/2009
2nd monitoring period	01/02/2009-31/08/2009

Monitoring Protocol

Monitoring management structure:

The monitoring management structure is as follow:



The responsibilities of the project staff are as follow:

Monitoring Director: Mr. Liu Changsheng is responsible for the overall management of the monitoring plan and for the internal verification of the monitored data.

Technical Department: It is consisted of operational employees, the group is leaded by the Mr. Li Binbin. The department is responsible for internal regular maintenance of monitoring equipment and DCS system

Statistician: To conduct the monitoring task strictly based on the monitoring manual and registered PDD. The statisticians are responsible for recording required monitored parameters, for reporting the monitoring results and for reporting the abnormal situation of the project. Each shift is responsible for the works.

Finance Department: Mr. He Hua is responsible for the department. The department is responsible for calculating the emission reductions regularly and for preparing the sales receipts of electricity transaction. The internal audit for CERs calculation is conducted by monitoring director.

Training: The project staffs have been trained respectively regarding operational regulations, quality control, data monitoring & archive and CDM knowledge.

List of the ex-ante parameters: According to ACM0002 (Version 06) and the registered PDD, the ex-ante parameters used for power grid emission factor calculation are as follows:

Parameter	Remark
NCV_i	The net calorific value (energy content) per mass or volume unit of fuel *i*
$OXID_i$	Oxidation factor of the fuel *i*
$F_{i, j, y}$	The quantity of fuel *i* (in a mass or volume unit) consumed for power generation by the relevant provinces *j* in year(s) *y*
Electricity generation of power plants in Central China Power Grid	Electricity generated by province *j* in Central China Power Grid in year *y*.
Internal use rate of power plant	The internal power consumption rate of power plants in province *j* in Central China Power Grid in year *y*.
$EF_{CO2, i}$	The CO_2 emission factor per unit of fuel i
$CAP_{i, j, y}$	Installed capacities of power plant category *i* of province *j* in years *y*
$GENE_{best,coal,}$	The power supply efficiency of most advanced commercialized coal-fired power plants
$GENE_{best,oil/gas}$	The power supply efficiency of most advanced commercialized oil-fired power plants and gas-fired power plants

Note: According to registered PDD, the baseline emission factor is calculated ex-ante and will be fixed during 1st crediting period.

Parameters monitored: The monitoring methodology ACM0002 (Version 06)—"Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources" is used for the project. To be in line with monitoring methodology and the monitoring plan contained in the registered PDD, the following parameters are required to be monitored for the project.

Data / Parameter:	Surface Area
Data unit:	km^2
Description:	Surface area at the full reservoir level
Source of data to be used:	Water Resources Bureau of Huaihua City
Value of data applied for the purpose of calculating expected emission reductions in section B.5	12
Description of measurement methods and procedures to be	The data was measured by Water Resources Bureau of Huaihua City at the start of the operation of the project. According to ACM0002 (Version 06), the data should only be monitored at start of the project during the crediting period. The data is not needed to

applied:	be monitored since the data has been verified during 1st verification. The first verification request has been approved by EB on 21st August 2009.
QA/QC procedures to be applied:	The data measured by Water Resources Bureau of Huaihua City is reliable and creditable.
Any comment:	

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Net generated electricity delivered to CCPG
Source of data to be used:	Measured onsite
Value of data applied for the purpose of calculating expected emission reductions in section B.5	468981.60
Description of measurement methods and procedures to be applied:	The net generated electricity by the project is the difference of power imported from power grid and power exported to power grid. The power imported from power grid and power exported to power grid were measured continuously and were recorded monthly through two bidirectional Master Meters which are installed at the high voltage sides of main transformers.
QA/QC procedures to be applied:	The monitoring data is used for emission reductions calculation. Sales receipts and electricity transaction notes are used for double check to ensure the consistency. The power grid company will provide the electricity transaction notes to project owner in the early of each month. The monitoring director from project entity will check and confirm the electricity transaction notes based on the monitored meter readings. The finance department from project entity will issue the electricity sales receipts and then financial manager Mr. He Hua from project entity will confirm the electricity sales receipts. Finally the power grid company will pay the money to project owner for electricity transactions.
Any comment:	

The generated electricity from 1# generator and 2# generator is transmitted through 10.5 kV line I into 1# main transformer to boost voltage to 220 kV; the generated electricity from 3# generator and 4# generator is transmitted through 10.5 kV line II into 2# main transformer to boost voltage to 220 kV.

Then the electricity is delivered through two 220 kV transmission lines to 220 kV Yangtang Substation and then to power grid.

The seasonal calibration of 2 Master Meters and 2 backup meters have been conducted during the monitoring period:

Item	Serial No.	Accuracy	Last calibration	Calibration during monitoring period	Calibration entity
Master $Meter_1$	03218434	0.2s	18/01/2009	16/04/2009 15/07/2009	Testing and Research Institute of Hunan Electric Power Company, which is authorized by Administration of Quality and Technology Supervision of Hunan Province.
Master $Meter_2$	03218457	0.2s	18/01/2009	16/04/2009 15/07/2009	
Backup $Meter_1$	03218436	0.2s	18/01/2009	16/04/2009 15/07/2009	
Backup $Meter_2$	03218433	0.2s	18/01/2009	16/04/2009 15/07/2009	

The magnification factor of meters is 1,320,000, which is calculated based on voltage ratio of potential transformer (PT) and current ratio of current transformer (CT)

There are totally 6 sets of PT and CT for the project, every 3 sets of PT and CT are for one transmission line. The calibration details of PT and CT are as follows:

Equipment	CT	PT
Serial Number	F2GA F2GB, F2GC, F4GA, F4GB, F4GC	503710, 503708, 503707, 503711, 503709, 503712
Calibration Date	06/12/2007	05/12/2007
Calibration Valid Until	05/12/2017	04/12/2017
Calibration Entity	Testing and Research Institute of Hunan Electric Power Company, which is authorized by Administration of Quality and Technology Supervision of Hunan Province.	

Note: The CT and PT are calibrated as per Verification Regulation of Instrument Transformers in Power System (JJG 1021-2007). As per JJG 1021-2007, the calibration frequency for CT and PT is 10 years.

According to calibration records for PT & CT conducted by Testing and Research Institute of Hunan Electric Power Company on 5th and 6th December 2007:

Rated primary voltage of PT is 220 kV
Rated secondary voltage of PT is 100 V

Then voltage ratio of PT is 2200 (it equals to 220 kV/100 V)

Rated primary current of CT is 600 A
Rated Secondary current of CT is 1 A

Then current ratio of CT is 600 (it equals to 600 A/1 A)

Thus the final magnification factor applied for the meter is:

voltage ratio×current ratio＝2200×600＝1,320,000

Emission Reductions Calculation

The Monitoring Plan clearly states the roles and responsibilities of persons from the project owner who are involved in the monitoring of data by the project.

According to ACM0002, the emission reduction of the project is:

$$ERy = BEy — PEy — Ly$$

Project emissions: The project is a newly built hydropower plant, the power density is 15 W/m^2, greater than 10 W/m^2, PE_y=0

There is a diesel generator used for construction period of the project. The diesel generator will be still used for operation of gates during emergency situation in the future.

The diesel consumption monitoring procedure has been established. The plant staff will monitor the time, aim and quantity of diesel consumption. The data will be cross-checked through diesel purchase receipts and stock changes after project construction completion.

The diesel used for monitoring period is from project construction party. According to diesel generator usage records, there are only 13 kilograms diesel used during monitoring period. The diesel was used for diesel generator operation for humidity prevention during monitoring period

The emissions from diesel usage are calculated as 0.0415 t CO_2 by using China Energy Statistical Yearbook and IPCC2006 upper values of diesel (net calorific value of diesel in China Energy Statistical Yearbook is 42652 kJ/kg, emission factor of diesel in IPCC default values at the upper limit of the uncertainty at a 95% confidence interval is 20.4 tC/TJ, oxidation factor of diesel is 100%, thus the emissions due to diesel consumption are calculated as 13*42652/1000000000*20.4*100%*44/12=0.0415 tCO_2.)

The emission caused by diesel consumption accounts only 0.0000092% of baseline emission reductions. Thus the trivial emissions from diesel usage can be ignored.

Leakage: According to ACM0002, L_y = 0

Baseline emissions:

The baseline emission during the monitoring period is:

$$BE_y = EG_y \cdot EF_y$$

Where:

EG_y is electricity supplied by the project activity to the grid in year y, in MWh;
EF_y is baseline emission factor in year y, in tCO_2e/MWh.

The monitored data based on meter readings for the project are as follow:

Period	Power export (MWh)	Power import (MWh)	Net power supply (MWh)
01/02/2009-28/02/2009	27869.16	0.00	27869.16
01/03/2009-31/03/2009	64093.92	0.00	64093.92
01/04/2009-30/04/2009	73245.48	3.96	73240.52
01/05/2009-31/05/2009	87489.60	0.00	87489.60
01/06/2009-30/06/2009	84202.80	0.00	84202.80
01/07/2009-31/07/2009	84666.12	0.00	84665.92
01/08/2009-31/08/2009	47419.68	0.00	47419.68
Sum	**468986.76**	**3.96**	**468981.60**

Note: All the meter readings in above table are sourced from 2 Master Meters, the meter readings have been confirmed by grid company. According to Monitoring Records of Master Meters of Tongwan Hydropower Plant provided by power grid company, there was 1 MWh and 0.2 MWh electricity quantity was deducted from April 2009 and July 2009 respectively due to seasonal reactive voltage assessment for 1th season and 2nd season of 2009. Due to the regulation of local Power Grid Company, the monthly cut-off time for power export and power import data is 24:00 of the last day of each month.

The lower data between sales receipts and meter readings are chosen for CERs calculation:

Period	Net power supply based on meter readings (MWh)	Sales receipts (MWh)	Net power supply used for CERs calculation
	A	B	C=Min(A, B)
01/02/2009-28/02/2009	27869.16	27870.20	27869.16
01/03/2009-31/03/2009	64093.92	64093.30	64093.30
01/04/2009-30/04/2009	73240.52	73240.74	73240.52
01/05/2009-31/05/2009	87489.60	87488.60	87488.60
01/06/2009-30/06/2009	84202.80	84203.30	84202.80
01/07/2009-31/07/2009	84665.92	84665.60	84665.60
01/08/2009-31/08/2009	47419.68	47420.00	47419.68
Sum	**468981.60**	**468981.74**	**468979.66**

Note: According to Monitoring Records of Master Meters of Tongwan Hydropower Plant provided by power grid company, there was 1 MWh and 0.2 MWh electricity quantity was deducted from April 2009 and July 2009 respectively in sales receipts due to seasonal reactive voltage assessment for 1th season and 2nd season of 2009. Due to the regulation of local Power Grid Company, the monthly cut-off time for power export and power import data is 24:00 of the last day of each month.

It can be from above table that the total net power supply difference between meter readings and sales receipts is only 0.19 MWh. The difference is due to the financial calculation of grid company. The Master Meter can show 3 numbers after decimal, the 0.001 meter reading represent 1.32 MWh (1.32 MWh＝0.001 meter reading×1320000 magnification factor/1000). The maximum monthly net power supply between meter readings and sales receipts is 1 MWh (May 2009), which is within the 1.32 MWh. Thus the difference between meter readings and sales receipts is acceptable.

In order to be conservative, the lower MONTHLY data between meter readings and sales receipts are used for CERs calculation.

Net power supply data is: 468979.66 MWh.

According to Page 25 of registered Tongwan PDD[1]:

The project will involve influencing 3 small hydropower plants, the total installed capacity of the 3 small hydropower plants is 1.35 MW. The 3 small hydropower plants have been compensated by Tongwan project owner. The average annual total power

[1] According to explanation document from design institute, the 3 small hydropower plants are located at the 3 different branches of Yuanshui River while Tongwan is located at Yuanshui River. The 3 small hydropower plants are 11 km, 12 km and 29 km away from Tongwan project site respectively. Due to construction of Tongwan project, the water level of the river is increased. The 3 small hydropower plants are affected by the increased water level. However, after modification of the 3 small hydropower plants, these 3 small hydropower plants are operational as before now. In order to be conservative and in line with the registered PDD, we'd like to abide by the calculation method in the registered PDD for Tongwan project.

generation of the 3 small hydropower plants is 7000 MWh. In order to be conservative, the 3 small hydropower plants are assumed to operate full year. Thus, the annual power generation of 11826 MWh (1.35 MW×8760 h=11826 MWh) is deducted from power supply by Tongwan (66200－11826=650174 MWh) and the method will always be used to calculate the baseline emission during the whole 3 renewable crediting periods.

The monitoring period is 01/02/2009 to 31/08/2009, totally 212 days.

Thus the power generation to 3 small hydropower power plants during monitoring period is:

$$1.35\ \text{MW} \times 8760\ \text{h}/365\ \text{d}^{*}212\ \text{d} = 6868.8\ \text{MWh}$$

$$BE_y = (468979.66 - 6868.80)^{*}0.97504\ \text{tCO}_2/\text{MWh} = 450{,}576\ \text{tCO}_2$$

$$ER_y = 450576 — 0 — 0 = 450{,}576\ \text{tCO}_2$$

The emission reductions generated in the monitoring period is 450,576 tCO_2.

The comparison of the actual emission reductions as well as load factor between the monitoring period and the registered PDD is conducted for the project. In order to further substantiate the comparison, the comparison with the full year data is also conducted for the project.

	Registered PDD (whole year)	**Monitoring period (01/02/2009-31/08/2009)**	**Full year Period (01/09/2008-31/08/2009)**
Load factor	41.98%	51.21%	40.13%
CERs (t)	633,945	450,576	605,405

Note: Load factor=EG_y/180 MW/hours during calculation period.

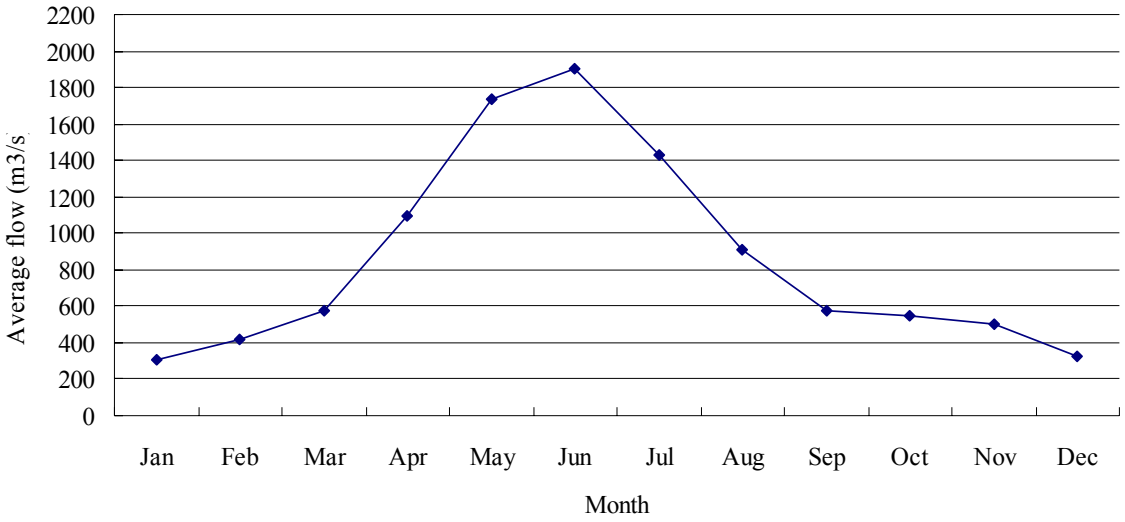
The result in above table shows that the actual emission reductions during the given monitoring period is 21.97% higher comparing with registered PDD. The reasons for the big gap are as follows:

1. The estimated net power supply in the registered PDD is derived from project Preliminary Design Report (PDR). The data is calculated based on 50 years (1951-2000) water resources data. It is highly unlikely that the water resources in a single monitoring period are totally the same with the long term average.

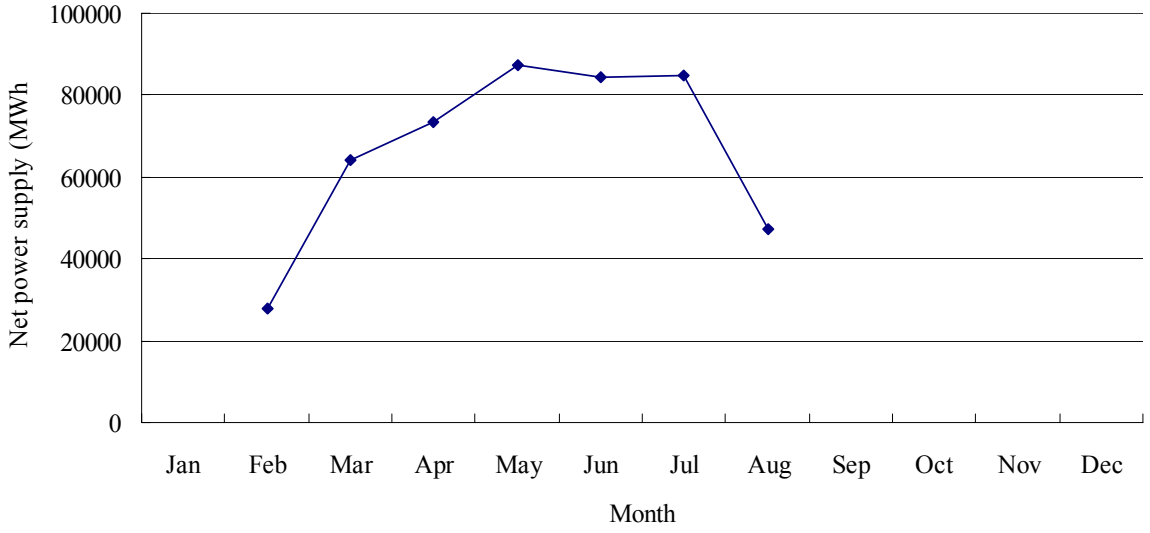
2. The electricity generation of the hydropower plant highly depends on water resources availability. Thus the power generation of the project differs from month to month. The given monitoring period covers the high water flow period (April to Aug) during a calendar year. According to project PDR, the average monthly water resources data at dam site based on 50 years data are as follows:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly average
Average flow m^3/s	305	419	579	1100	1738	1907	1433	907	578	545	503	323	863

Below is the water flow trend during a calendar year based on the data in above table:



The net power supply trend during the monitoring period is as follow:



It can be found from above two graphs that the given monitoring period is corresponding to the 50 years water flow trend.

3. The net power supply data for a full year (1 Sep 08-31 Aug 09, which covers the given monitoring period) are used to compare with the data in the registered PDD. The result shows that the load factor for a full year is 4.42% lower comparing with registered PDD.

Thus we conclude that the gap of load factor between the monitoring period and registered PDD is reasonable. It is due to the availability of water resources.