

Monitoring Report

Voluntary Carbon Standard 2007

Yangcun Hydropower Project

Monitoring Period: 01/06/2007-25/05/2008

Date: 19/09/2008

Version 2.0, revised based on DOE's verification findings

Document prepared by:

Marco Hirsbrunner
South Pole Carbon Asset Management Ltd.
m.hirsbrunner@southpolecarbon.com

Leon Wang
South Pole Carbon Asset Management Ltd.
l.wang@southpolecarbon.com

1. Project Background

By means of this Monitoring Report greenhouse gas emission reductions achieved by the project activity “Yangcun Hydropower Station” are being verified and certified as per requirements of the Voluntary Carbon Standard, Version 2007.

Further background information on the project activity can be found in the Project Design Document (PDD) and associated documents, which had already been submitted for validation as per requirements of the Voluntary Carbon Standard, Version 1. The PDD and associated documents are available upon request.

Project Technical Characters

Turbines	Model	HLA630-LJ-152	/
	Manufacturer	Haerbin Small-Scale hydropower Development Co., Ltd.	/
	Units	3	/
	Maximal Water Head	132.9	Meters
	Rated Water Head	119	Meters
	Minimal Water Head	115.8	Meters
	Rated Flow Rate	20.52	m ³ /s
	Rotor Diameter	1.52	Meter
	Rated Power	22.68	MW
	Rated Rotating Speed	500	rpm
	Runaway Speed	950	rpm
	Serial No.	HDX002-1/2/3	/
Generators	Model	SF22-12/3480	/
	Manufacturer	Haerbin Small-Scale hydropower Development Co., Ltd.	/
	Units	3	/
	Rated Capacity	22	MW
	Rated Voltage	10500	V
	Rated Electrical Current	1423	A
	Rated Power Coefficient	0.85	/
	Rated Frequency	50	Hz
	Isolation Class	F	/
	Load	175	T
	Serial No.	HDX002-1/2/3	/

2. Monitoring Background

Section B of the PDD (Application of the baseline and monitoring methodology) provides all details in regard to calculation of emission reductions and the monitoring plan to be followed by the project activity. Both the emission reduction calculations and the monitoring plan are based on the approved CDM methodology ACM0002, Version 6.

3. Monitoring Results

3.1. Monitoring period

This is the second monitoring report of this project activity. It covers the period 01/06/2007 to 25/05/2008.

3.2. Presentation of monitoring results

All monitoring data is available in an Excel spreadsheet. The spreadsheet includes:

1. A summary worksheet containing the results of the VCU calculations for every year of the monitoring period
2. Worksheets for every year of the monitoring period containing the VCU calculations

3.3. Metering equipment accuracy

Monitoring meters are periodically controlled and reach an accuracy of 1.0% for measurement of active power and 2.0% for measurement of reactive power. Please see Annex for more details.

3.4. Calculation methodology

Emission reductions were calculated on the basis of following formulae:

Emission Reductions = Baseline Emissions – Project Emissions – Leakage

where:

Baseline Emissions = Net Electricity Export x Grid Emission Factor

Project uses net electricity export for calculation of emission reductions; hence project emission is considered to be 0:

Project Emissions = 0

Leakage = 0

Hence, the calculation of emission reductions can be summarized in the following steps:

1. Amount of net electricity delivered to the grid is recorded daily and aggregated monthly
2. Monthly figure is multiplied by the Grid Emission Factor calculated as per methodology ACM0002. Grid Emission Factor was calculated in PDD to be 0.94445 t CO₂e/MWh. This grid emission factor is determined ex-ante and fixed during the crediting period.
3. As no project emissions and no leakage need to be accounted for, net emission reductions for the specified monitoring period are equal to baseline emissions

3.5. Emission reductions

The calculated emission reductions achieved by the project activity within the covered monitoring period amount to 319,771 t CO₂e.

4. Summary of Monitoring Data and Results

A summary of monitoring data and emission reductions based on aggregated data on a monthly basis are provided in the table below:

Year	Month	Electricity produced (kWh)	Electricity exported (kWh)	Electricity imported (kWh)	Net Electricity exported (kWh)	Emission Reductions (tCO ₂ e)
2007	01/06/2007 - 25/06/2007	36141920	35613600	0	35613600	33,635
	26/06/2007 - 25/07/2007	31732520	31292800	0	31292800	29,554
	26/07/2007 - 25/08/2007	42894800	42336800	0	42336800	39,985
	26/08/2007 - 25/09/2007	47745680	47132800	0	47132800	44,515
	26/09/2007 - 25/10/2007	27411040	27033600	0	27033600	25,532
	26/10/2007 - 25/11/2007	26998200	27130400	0	27130400	25,623
	26/11/2007 - 25/12/2007	14495240	13886400	152600	13733800	12,971
	Total	227,419,400	224,426,400	152,600	224,273,800	211,815

Year	Month	Electricity produced (kWh)	Electricity exported (kWh)	Electricity imported (kWh)	Net Electricity exported (kWh)	Emission Reductions (tCO ₂ e)
2008	26/12/2008 - 25/01/2008	12666840	12487200	415800	12071400	11,401
	26/1/2008 - 25/2/2008	9497280	9328000	420000	8908000	8,413
	26/2/2008 - 25/3/2008	25323480	24921600	0	24921600	23,537
	26/3/2008 - 25/4/2008	30266600	29620800	0	29620800	27,975
	26/4/2008 - 25/5/2008	39207280	40612000	1827700	38784300	36,630
	Total	116,961,480	116,969,600	2,663,500	114,306,100	107,956

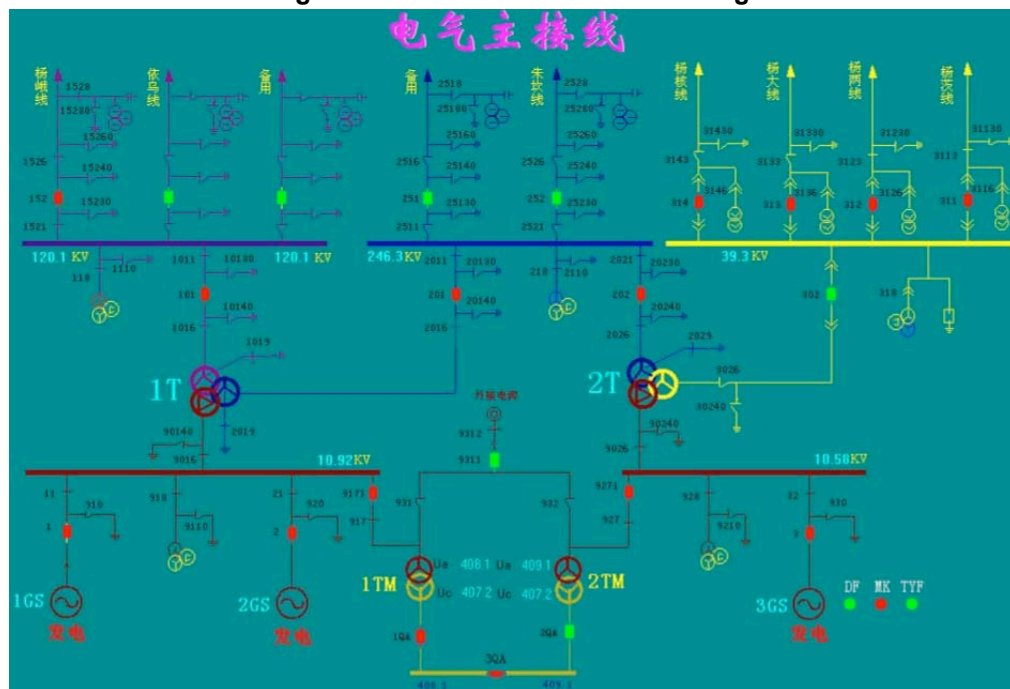
Annex I Additional Information of Monitoring Plan

1. Description of Main Electric Connection

Following is the Main Electric Connection Diagram displayed on the interface of the computer-based monitoring system. Normally power generated by the project is exported to grid via YangE 110 kV bus (top-left of the diagram). The 220 kV bus (top-middle of the diagram) is another optional path of power export, which was planned during construction but never used in operation. On the top-right of the diagram there is a 35 kV bus, to which a transformer station and three power stations are connected (the yellow lines).

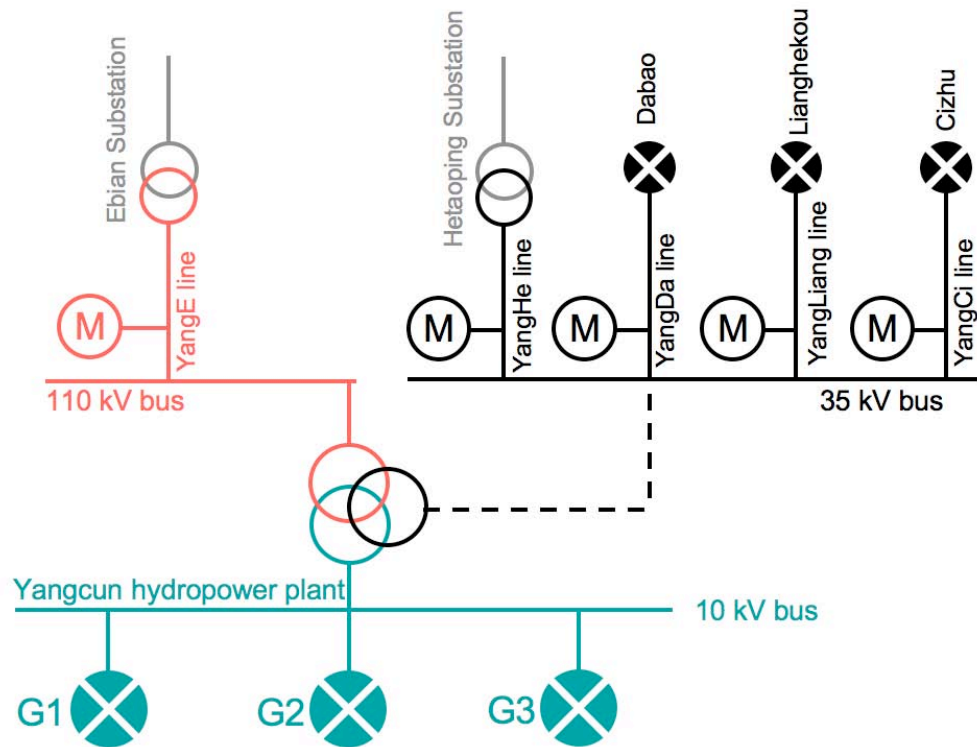
Under normal conditions, 35 kV bus is disconnected with Yangcun hydropower station. When transformer station on 35 kV bus is in maintenance or malfunction, these three hydropower stations connected will use Yangcun station and its 110 kV bus for power export. This amount of bypass power is regarded as “electricity imported from grid” of Yangcun station during monitoring and is deducted from ER calculation.

Fig.1 Main Electric Connection Diagram



A clear and simplified diagram is provided below in Fig.2 with monitoring meters indicated.

Fig.2 A Simplified Diagram of Main Electric Connection Diagram



Position	YangE Line	YangHe Line	YangDa Line	YangLiang Line	YangCi Line
Monitored Parameters	$Elec_{export, 110kV, y}$ $Elec_{import, 110kV, y}$	$Elec_{import, Hetaoping, y}$ $Elec_{export, Hetaoping, y}$	$EG_{Dabao, y}$	$EG_{Lianghekou, y}$	$EG_{Cizhu, y}$
Model	DSSD331-1	DSSD331-1	DSSD331-1	DSSD331-1	DSSD331-1
Accuracy Active	1.0%	1.0%	1.0%	1.0%	1.0%
Accuracy Reactive	2.0%	2.0%	2.0%	2.0%	2.0%
Serial No.	200106287A0317	200104265A0422	200104265A0313	200106287A0478	200106287A0255
Valid Period	30-07-2007 to 29-07-2008				
Certified by	Ebians Measurement and Examination Station				
Certificate No.	E2007073001	E2007073004	E2007073005	E2007073002	E2007073003
Manufacture	Changsha Wasion Meters Co., Ltd.				
Meter reading time	24:00, 25 th of each month				

2. Calculation of Net Electricity Export of Yangcun Station

Based on diagram above, calculation of net electricity export of Yangcun hydropower station will be calculated as following:

$$EG_{Yangcun\ net,y} = Elec_{export,110kV,y} - Elec_{import,110kV,y} - Elec_{import,35kV,y} \quad (1)$$

Where,

$EG_{Yangcun\ net,y}$, net electricity generation of Yangcun hydropower station in year y (kWh);
 $Elec_{export,110kV,y}$, electricity export via 110 kV bus of Ebian substation (YangE line) in year y (kWh);

$Elec_{import,110kV,y}$, electricity import from 110 kV bus of Ebian substation (YangE line) in year y (kWh);

$Elec_{import,35kV,y}$, electricity import from 35 kV bus in year y (kWh), which indicates electricity input from 35 kV bus to Ebian substation:

Electricity input from 35 kV bus is calculate as following:

$$Elec_{import,35kV,y} = EG_{Cizhu,y} + EG_{Lianghekou,y} + EG_{Dabao,y} + Elec_{import,Hetaoping,y} - Elec_{export,Hetaoping,y} \quad (2)$$

Where:

$EG_{Cizhu,y}$ power generation of Cizhu hydropower station in year y (kWh);

$EG_{Lianghekou,y}$ power generation of Lianghekou hydropower station in year y (kWh);

$EG_{Dabao,y}$ power generation of Dabao hydropower station in year y (kWh);

$Elec_{import,Hetaoping,y}$ electricity import from Hetaoping substation in year y (kWh).

$Elec_{export,Hetaoping,y}$ electricity export via Hetaoping substation in year y (kWh).

3. Parameters to be monitored

Parameters that are directly used in emission reductions calculation:

Data / Parameter:	$Elec_{export,110kV,y}$
Data unit:	kWh
Description:	Electricity export via 110 kV bus of Ebian substation (YangE line) in year y (kWh)
Source of data to be used:	Measured by electricity meter with serial number of No. 200106287A0317
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	- Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	

Data / Parameter:	$Elec_{import,110kV,y}$
--------------------------	-------------------------

Data unit:	<i>kWh</i>
Description:	Electricity import from 110 kV bus of Ebian substation (YangE line) in year y (kWh)
Source of data to be used:	Measured by electricity meter with serial number of No. 200106287A0317
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	- Imported electricity from the grid is measured by kilowatt meters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	

Data / Parameter:	$EG_{Cizhu,y}$
Data unit:	<i>kWh</i>
Description:	Power generation of Cizhu hydropower station (YangCi line) in year y (kWh)
Source of data to be used:	Measured by electricity meter with serial number of No. 200106287A0255
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	- Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	Electricity export by 35 kV bus to Cizhu station (Yangci line) is neglected for simplification and conservativeness.

Data / Parameter:	$EG_{Lianghekou,y}$
Data unit:	<i>kWh</i>
Description:	Power generation of Lianghekou hydropower station in year y (kWh)
Source of data to be used:	Measured by electricity meter with serial number of No. 200106287A0478
Value of data applied for the purpose of calculating	

expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	- Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	Electricity export by 35 kV bus to Lianghekou station (YangLiang line) is neglected for simplification and conservativeness.

Data / Parameter:	$EG_{Dabao,y}$
Data unit:	kWh
Description:	Power generation of Dabao hydropower station in year y (kWh)
Source of data to be used:	Measured by electricity meter with serial number No. 200104265A0313
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	- Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	Electricity export by 35 kV bus to Dabao station (YangDa line) is neglected for simplification and conservativeness.

Data / Parameter:	$Elec_{import,Hetaoping,y}$
Data unit:	kWh
Description:	Electricity import from Hetaoping substation in year y
Source of data to be used:	Measured by electricity meter with serial number of No. 200104265A0422
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC proce-	Exported electricity to the grid is measured by kilowatt me-

dures to be applied:	ters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	

Data / Parameter:	$Elec_{export, Hetaoping, y}$
Data unit:	kWh
Description:	Electricity export via Hetaoping substation in year y
Source of data to be used:	Measured by electricity meter with serial number of No. 200104265A0422
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	- Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	

Parameters monitored and recorded for crosscheck/backup purpose:

Data / Parameter:	$EG_{i, Yangcun, y}$
Data unit:	kWh
Description:	Electricity generation by generator i ($i = 1, 2, 3$) at Yangcun hydropower station in year y
Source of data to be used:	Measured by electricity meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	- Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; - Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; - Meters will be calibrated periodically according to relevant national standards.
Any comment:	

Data / Parameter:	$EC_{Yangcun, y}$
Data unit:	kWh

Description:	Electricity consumption by Yangcun hydropower station in year y
Source of data to be used:	Measured by electricity meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measured continuously by a kilowatt meter and recorded on a monthly basis by monitoring personnel. Meter reading time is 24:00 of 25 th each month.
QA/QC procedures to be applied:	▪ Exported electricity to the grid is measured by kilowatt meters, which are controlled by the power grid company; ▪ Trained and qualified staff is responsible for recording electricity export data from the kilowatt meter; ▪ Meters will be calibrated periodically according to relevant national standards.
Any comment:	Electricity consumption by equipments at powerhouses, dam and municipal power consumption will be continuously monitored and recorded on monthly basis.

Annex II Answers to DOE's Findings

CR1: The technical description of the project should be provided more in details in the MR. e.g. the information on key parameters/information of the turbines and generators, electricity export/import monitoring system etc.

Comments: The technical description of the project is provided in Section 1 of the revised monitoring report. Electricity export/import monitoring system information is also provided in Annex I of the report.

CAR1: more information e.g. meter reading time, calibration, accuracy etc. on the meters involved in the monitoring system esp. meter for Elec_{Cimport,35kV}, and Elec_{Hetaoping,y} should be demonstrated more clearly in the MR.

Comments: Please see Annex I of the report. Detailed information about the meters is provided.

CAR2: the monthly invoices for electricity imported from the 35KV bus line (Yangda and Yangzi line should be provided).

Comments: Yangda, Yangzi and Yangcun project share the same project owner, which is Sichuan Dadu River Electric Power Co., Ltd. Electricity exchange between these hydropower stations are internal power exchange without invoices. Electric meters are installed to monitor the electricity exchange in between. These meters are well maintained to be in compliance with relevant regulations and standards.

CAR3: The net electricity calculated in the MR was inconsistent with data and information received during on-site interview. Correction is necessary.

Comments: The monitoring report has been revised regarding following aspects:

- a. In the first version of monitoring report, electricity meters of each generator and meters of power consumption were the basis of emission reduction calculation. In revised monitoring report, reading of grid gateway meters is used for emission reduction calculation.
- b. Reading of electricity meters installed on 35 kV bus is reported in the revised monitoring report to reflect the electricity exchange between Yangcun and 35 kV bus, if there is any.

CR2: Methodologies AMS-I.D., Version 11 was not applied for the project, the revision on MR page 2 is necessary.

Comments: Monitoring report was revised.