Monitoring Report

UNFCCC Clean Development Mechanism Project

Hubei Eco-farming Biogas project Phase I

CDM Registration Reference Number: 2221

Monitoring period to be Verified: 19/02/2009 – 31/08/2009

Hubei Qingjiang Zhongye Company Ltd.

Date: October 30, 2009

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1 Background

Hubei Eco-farming Biogas project Phase I (hereafter refer to as Hubei project) has been registered as CDM project by the UNFCCC on February 19 2009 under reference number 2221. 【The first monitoring period for Hubei Eco-Farming Biogas Project Phase I started on February 19, 2009.】

The purpose of the monitoring report is to calculate and clarify the emission reductions achieved by this project activity for periodic verification. This monitoring report covers the activity from February 19 2009 to August 31 2009 as the 1st monitoring period.

Further background on this project can be found in the Project Design Document (PDD) and associated documents, which is available on the UNFCCC website:

http://cdm.unfccc.int/Projects/DB/TUEV-SUED1218669721.67/view

2 General description of the project activity

2.1 Project Activity

The proposed project activity is a bundle of 33,000 household-level activities, which, recover methane from biogas digesters with pig manure as fermentation material and utilize the generated biogas to displace fossil fuel for cooking and heating. In addition, the recovery and utilization of biogas from digested slurry in a biogas digester reduced CH_4 emission from the slurry that would otherwise have been stored in a deep pit. Detail description on project activity can be found in A4.2 of PDD.

2.2 Types of the Project Activities

Approved methodologies Version 12 of AMS-I.C titled “Thermal energy for the user with or without electricity” and Version 01 of AMS-III.R titled “Methane recovery in agricultural activities at household/farm level’ were applied.

2.3 Project participants

The project participants are:

1) Hubei Qingjiang Zhongye Company Ltd., China [Project Owner];
2) The International Bank for Reconstruction and Development (IBRD) as trustee of Community Development Carbon Fund;

3) State of the Netherlands, acting through the Netherlands' Ministry of Housing, Spatial Planning, and the Environment [buyer].

3 Implementation status of the project during the monitoring period

The project installed 33,000 household biogas digesters during 2007 and 2008. More specifically, the project installed 10082 biogas digesters with reactor size of 8 m^3; 14181 biogas digesters with reactor size of 10 m^3; 4167 biogas digesters with reactor size of 12 m^3; and 4,570 biogas digesters with reactor size of 15 m^3. The installation completed before July 2008. Biogas digesters were commissioned after construction and test. All biogas digesters began to generate biogas for daily cooking and heating water before September, 2008.

Table 1: Summary of Biogas Digesters with Different Volume and Constructed in Different County in the CDM Project

County/City	No. of biogas digesters with different digester volume				Total no. of biogas installed 2007-2008 in each county
	8 m^3	10 m^3	12 m^3	15 m3	
Enshi	1,918	2,412			4330
Jianshi	540	4,030			4570
Badong	1,581	2,989			4570
Lichuan	3,043	2,917			5960
Xuan'en		1,833	1,167		3000
Xianfeng				4,570	4570
Laifeng	3,000				3000
Hefeng			3,000		3000
Total	10,082	14,181	4,167	4,570	33000

The project has been completed as planned and described in the Project Design Document (PDD). The project has been continuously operating since the entering into operation.

4 Monitoring systems and procedures, including any quality assurance and quality control system employed by the project activity;

4.1 Monitoring Methodology Applied

The monitoring methodology of version 12 of AMS I.C “Thermal energy for the user with or without electricity” and the monitoring methodology of version 1 of AMS III.R “Methane recovery in agricultural activities at household/small farm level” were applied. http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

Because an expected annual emission reduction is less than 5 tonnes of CO_2 a year per system (biogas digester), option (c) of version 12 of AMS I.C with version 1 of AMS III.R is applied.

In the case of the Hubei Biogas Project, the bundled project activity involves installation of 33,000 household biogas digesters, of the same type, same category and same technology in each county. Therefore, the requirement of a common monitoring plan for bundle under condition for sampling is applicable for this project. The sampling methodology will follow the monitoring requirements of the version 12 of AMS I.C, and version 1 of AMS III.R.

4.2 Sampling Methods for Annual Household Survey

The sampling method for annual household monitoring includes following steps:

Step 1: Select 2750[1] participant households randomly in the database of 33000 participant households according to the different volume of biogas digesters. number of households needed for monitoring was calculated. 841 households with $8m^3$, 1186 households with $12m^3$, 343 households with $12m^3$, 380 households with $15m^3$, respectively, was required for monitoring in 8 counties and cities.

Step 2: According to required numbers of households with different volumes in each county, The coordination entity selected randomly households with different volume for each county from the database, and informed the local entity in each county . the The randomly sampling selection is listed in table 2.

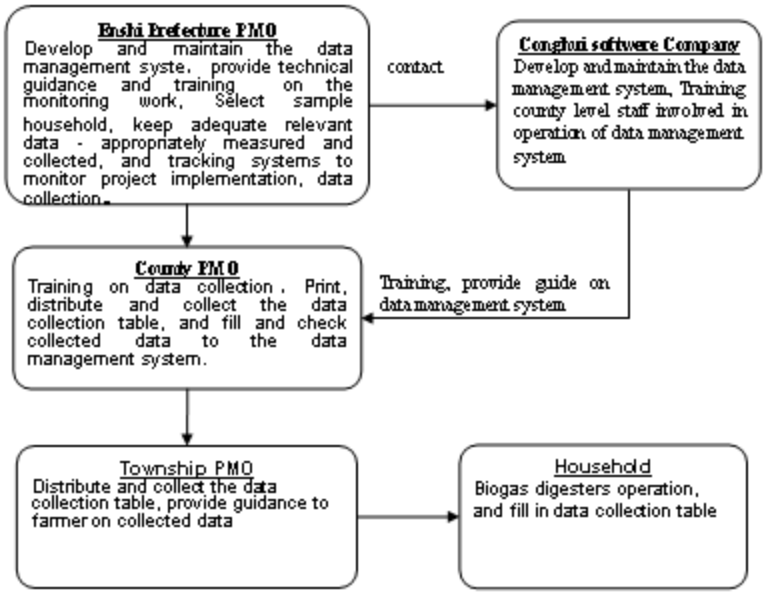
[1] The number of households for the sample is chosen to achieve a 95% confidence with 10% precision for the data collected on the number of households with operating biogas digesters. It is in line with the procedure in “GENERAL GUIDELINES1 FOR SAMPLING AND SURVEYS FOR SMALL-SCALE CDM PROJECT ACTIVITIES”(Version 01)

Table 2: Number of households with different biogas digester volume in each county

County/City	No. of households monitored with different digester volume				No. of biogas monitored in each county
	8 m^3	10 m^3	12 m^3	15 m3	
Enshi	160	200			360
Jianshi	46	334			380
Badong	130	250			380
Lichuan	255	245			500
Xuan'en		153	97		250
Xianfeng				380	380
Laifeng	250				250
Hefeng			250		250
Total	841	1186	343	380	2750

4.3 Quality control (QC) and quality assurance (QA)

4.3.1 Management and operational structure



4.3.2 Quality control

(1) The quality control for installation biogas digesters system:

All the biogas digester systems were installed by certified technicians and need to pass the assessment of county level PMO. All the biogas stoves were distributed to the households after a public bidding process done by the government。

(2) The quality control for monitoring data collection:

To ensure reliable field measurements and data collection quality, the following procedures were applied:

- ✓ Standard Monitoring Procedures and tables for the field data collection were developed and adhered to over monitoring period .
- ✓ Training courses on field data collection and data analyses were held for staff involved in the field work. Training courses ensure that each field-team member is fully aware of all procedures and the importance of collecting data as accurately as requested.
- ✓ The list of the names of the field team and the project leader who join the training and monitoring process were recorded.

- ✓ Any new staff will be trained adequately.
- ✓ Enshi Energy Bureau, as project coordinator kept the monitoring relevant data and records. Data was be archived electronically at the end of each month. The electronic files will be stored in hard disk and cd-rom. In addition, a hard copy printout was archived. At the end of each crediting year, a monitoring report will be compiled detailing the metering results and relevant evidence.
- ✓ Physical documentation such as paper-based maps, diagrams, and environmental impact assessments will be collected and documented in PMOs and Project Entity, together with the project monitoring plan. All data records will be kept for a period of 2 years following the end of the monitoring period.。

4.4 Persons responsible for the monitoring report

Enshi Energy Bureau, as project coordinator will provide the required information for verification to the DOE before and during verification activities. Mr. Chen Shushing from Enshi Energy Bureau, is in charge of the overall responsibility for the monitoring and verification procedure and to act as the focal point for the DOE.

Dr. Dong Hongmin and Ms. Li Yue from the Institute of Environment and Sustainable Development in Agriculture, Chinese Academy of Agricultural Sciences are responsible for the preparation of the monitoring report, and are not project participants.

5 All parameters required to be monitored and reported at the intervals required by the monitoring plan and the applied methodology

5.1 Parameters required to be monitored and monitoring frequency

Table 3: Monitored data and parameters

ID No.	Data variable	Source of data	Data unit	Recording frequency	Equipment
1. N_{BD}	Total number of household biogas digesters	Project proponents	number	Annually	n/a
2.H	Annual operational hours of biogas digesters	Project proponents	hour	Annually	n/a
3.T	Annual Average ambient temperature at county	Weather station in	℃	Monthly	n/a

	weather station nearby project site	each county			
4. LN	Swine population in each individual household in project case	Project proponents	Number	Monthly	n/a
5. Sludge	Destination of biogas sludge application	Project proponents	n/a	Every application	n/a

5.2 Monitored data

1) Number of biogas digesters constructed under the CDM project activities

Table 4: Number of constructed biogas digesters with different volume in different county

County/City	No. of biogas digesters with digester volume				The latest date for generating biogas
	8 m^3	10 m^3	12 m^3	15 m^3	
Enshi	1,918	2,412			2008-6-1
Jianshi	540	4,030			2008-8-1
Badong	1,581	2,989			2008-5-28
Lichuan	3,043	2,917			2008-5-1
Xuan'en		1,833	1,167		2008-8-1
Xianfeng				4,570	2008-6-6
Laifeng	3,000				2008-4-1
Hef0 eng			3,000		2008-6-24
Total	10,082	14,181	4,167	4,570	

2) Average monthly temperatures and average temperatures during the period of monitoring

Table 5: Average monthly temperature in different county

County/City	Feb	Mar	Apr	May	Jun	Jul	Aug	Average
Enshi	10.2	10.6	16.0	19.9	24.8	27.3	27.0	19.4

Jianshi	9.5	11.0	16.0	19.2	24.4	26.7	26.0	19.0
Badong	8.5	13.8	19.2	22.0	25.3	28.0	29.7	20.9
Lichuan	11.1	12.9	14.7	15.3	18.2	20.4	17.1	15.7
Xuan'en	9.2	10.3	15.4	19.2	24.6	26.6	26.7	18.9
Xianfeng	8.0	9.7	14.3	18.3	22.8	24.6	24.5	17.5
Laifeng	4.9	9.6	11.6	16.5	20.3	25.9	27.4	16.6
Hefeng	9.8	11.2	16.0	19.2	24.1	25.6	26.0	18.8

3) Operating days under different volumes of each county

Table 6: Operation hours during this monitoring period

County name	8 m^3	10 m^3	12 m^3	15 m^3
Enshi	4632	4632		
Jianshi	4627	4630		
Badong	4631	4630		
Lichuan	4632	4632		
Xuan'en		4618	4619	
Xianfeng				4630
Laifeng	4628			
Hefeng			4628	

4) Swine population under different volumes of each county

Table 7: Average swine stock during monitoring period

County name	8 m^3	10 m^3	12 m^3	15 m^3
Enshi	4.7	4.6		
Jianshi	4.6	4.4		
Badong	4.6	4.8		

Lichuan	4.0	4.0		
Xuan'en		4.3	4.5	
Xianfeng				4.6
Laifeng	4.5			
Hefeng			4.3	

5) Sludge soil application

Table 8: Average application times of sludge destination

County name	Dry land(time)				Vegetable field (time)				Paddy field (time)			
	8 m^3	10 m^3	12 m^3	15 m^3	8 m^3	10 m^3	12 m^3	15 m^3	8 m^3	10 m	12 m^3	15 m^3
Enshi	2.4	2.2			1.3	1.4						
Jianshi	2.8	1.7			0.6	0.9						
Badong	0.6	0.8			0.6	0.6						
Lichuan	1.1	1.1			1.7	1.6						
Xuan'en		2	1.4			2	2.3					
Xianfeng				1.5				1.5				
Laifeng	0.8				1.2							
Hefeng			2.3				1					

6 Information on calibration of monitoring instruments as specified by the monitoring methodology and the monitoring plan

NA

7 Emission factors, IPCC default values, and other reference values used in the calculation of emission reductions

7.1 Methane emission factor

Methane emission factor for deep pit manure management system is calculated according to IPCC Tier 2 approach (formula (1). Default 2006 IPCC values for Bo and VS were applied because there are no national specific values.

$$EF_i = (VS \times 365) \times [Bo \times 0.67 kg/m^3 \times \sum_j \frac{MCF_{ij}}{100} \times MS_{ij}\%] \quad (1)$$

According to the average temperature during the monitoring period, the MCF_{ij} for each county is listed in table 10.

Table 9: MCF_{ij} in each county according to 2006 IPCC Guidelines

County	Enshi	Jianshi	Badong	Lichuan	Xuan'en	Xianfeng	Laifeng	Hefeng
Average T（^{O}C）	19.4	19.0	20.9	15.7	18.9	17.5	16.6	18.8
MCF_{ij}	0.39	0.39	0.42	0.27	0.35	0.32	0.29	0.35

7.2 Emission factor of coal combustion

According to the baseline methodology for small-scale CDM project activity categories I.C titled "Thermal energy for the user with or without electricity" for renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the displaced fossil fuel. In this project, national specific emission factor provided by National Development and Reform Committee (NDRC) will be adopted (www.ccchina.gov.cn). The emission factor for raw coal is 25.8 tC/TJ. Net Calorific Value (kJ/kg) of raw coal is 20908 kJ/kg. Fraction oxidized is 1.

$EF_{Rawcoal}$ =25.8×20908×1×44/12/10^6=1.98 t CO_2/t coal.

Table 10: IPCC default values and other reference values used in the calculation of methane emission factors

Parameters	Data variable	Data source	unit	Value

$VS_{default}$	Default value for the volatile solid excretion per day per animal on a dry matter basis for a defined swine population.	Table 10A-7 and 10A-8, chapter 10, volume 4, IPCC 2006 Guidelines	kg-dm/head/day	0.3
Bo	Maximum methane producing capacity for manure produced by swine	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10	m^3 CH_4 kg^{-1} of VS excreted	0.29
MCF_{ij}	Methane conversion factor for deep pit manure management system	IPCC 2006Guidelines Table 10A-7, chapter 10, volume 4, according to the average T in each county	%	Table 10 below
MS_{ij} %	Fraction of swine manure handled using manure management system j. In this project, 100 percent of manure is stored in deep pit	Project participants	Fraction	100%
LF_{AD}	Methane leakage from Anaerobic digester	IPCC 2006Guidelines	%	10%
NCV	Default net calorific values of cooking coal	Published data by China NDRC (www.ccchina.gov.cn)	kJ/kg	20908
Carbon EF	Carbon emission factor per unit of energy of coal that would have been used in the baseline	Published data by China NDRC (www.ccchina.gov.cn)	tC/ TJ	25.8

8 Reference to any deviation request approved by the Executive Board for the monitoring period in consideration

N/A

9 Calculations of baseline emissions, project emissions, and emission reductions [leakage (if any), including reference to formulae and methods used

9.1 Baseline Emissions

1) CH_4 emission from manure management

$$BE_{CH4,i,k} = GWP_{CH4} \times \frac{1}{1000} \times LN_{i,k} \times EF_i \quad (2)$$

2) CO_2 emission from coal consumption

$$BE_{CO2,i,k} = BG_{Coal,i,k} \times EF_{Rawcoal} \quad (3)$$

3) Total baseline GHG emission calculation per household

$$BE_{y,i,k} = BE_{CH4,i,k} + BE_{CO2,i,k} \quad (4)$$

4) Total baseline GHG emission

$$BE_y = \sum_i (\sum_{k=1} (ND_{i,k} * BE_{y,i,k})) \quad (5)$$

Table 11: Parameters, value and data source for calculating baseline GHG emissions

Parameters	Data variable	Data source	unit	Value
GWP_{CH4}	Global warming potential for CH_4	IPCC	tCO_2e/tCH_4	21
$LN_{i,k}$	Average swine population for household before the installation of biogas digester with different volume k, in County i.	Baseline survey	Number	see table 7
EF_i	CH_4 emission factor for deep pit swine manure management in county i	Calculated using equation (2)	kg CH_4 /swine/yr	see Spreadsheet of calculation of emission reductions
$BG_{Coal,i,k}$:	Average annual coal consumption for household before the installation of digester with volume k, in county i, t coal of each household	Baseline survey	t coal /household/yr	see PDD
$EF_{Rawcoal}$:	Emission factor of raw coal	IPCC	t CO_2/t coal	1.98
$ND_{i,k}$	Numbers of digester with volume k, in county i	Monitoring results	Number	See table 4

9.2 Project Emission

1) CH_4 emission from physical leakages of anaerobic digester

$$PE_{ly} = LF_{AD}\left[GWP_{CH4} \times D_{CH4} \times B_O \times VS_{m,y}\right]/1000 \quad (6)$$

2) Project CO_2 emission from coal combustion

$$PE_{CO2,i,k} = PG_{Coal,i,k} \times EF_{Rawcoal} \quad (7)$$

3) Project GHG emission calculation for each household

$$PE_{y,i,k} = PE_{CO2,i,k} + PE_{ly} \quad (8)$$

4) Total project GHG emission

$$PE_y = \sum_i (\sum_{k=1} (ND_{i,k} * PE_{y,i,k})) \quad (9)$$

Table 12: Parameters, value and data source for calculating GHG emissions under project activity

Parameters	Data variable	Data source	unit	Value
LF_{AD}	Methane leakages from Anaerobic digesters	Table 10A-8 of 2006 IPCC Guidelines Volume 4, and Chapter 10.	%	0.10
D_{CH4}	Conversion factor of m^3 CH_4 to kilograms CH_4	2006 IPCC guideline, See Volume 4, Chapter 10, Page 10.42	kg/m^3	0.67
Bo	Maximum methane producing capacity for manure produced by swine	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10	m^3 CH_4 kg^{-1} of VS excreted	0.29
$VS_{m,y}$	Annual amount of volatile solid treated in the biogas digesters on a dry matter weight basis	Calculated accord default value in 2006 IPCC Guidelines, Volume 4, and Chapter 10	kg of dm per year	0.3
$PG_{coal,i,k}$	Average annual coal consumption of the household after installation of digester with volume k, in county	Baseline survey	t coal of each household	See PDD

	i			
$EF_{Rawcoal}$:	Emission factor of raw coal	Calculated according to AMS I.C.	t CO_2/t coal	1.98
$ND_{i,k}$	Numbers of digesters with volume k, in county i	Monitoring results	numbers	see table 4

9.3 GHG emission reduction per household

$$ER_{y,i,k} = BE_{y,i,k} - PE_{y,i,k} \quad (10)$$

9.4 Calculation of total bundled project GHG emission reductions(ER_y)

$$ER_y = \sum_i (\sum_{k=1} (ND_{i,k} * ER_{y,i,k})) \quad (11)$$

Table 13: Emission reduction

Year	BEy (tCO_2e)	PEy (tCO_2e)	ERy (tCO_2e)
19 Feb, 2009- 31 Aug, 2009	62540	30174	32366

10 Comparison of the actual emission reduction claimed in the monitoring period with the estimate in the registered PDD, and explanation on any significant increase.

The calculated emission reduction is slightly higher than PDD. The reason is that the average temperature during this monitoring period is higher than annual average temperature because the monitoring period covered the summer time. Table 14 is the comparison of average temperature during the monitoring period and the annual average temperature in PDD.

Table 14: Comparison of average temperature during the monitoring period and the annual average temperature in PDD

County	Enshi	Jianshi	Badong	Lichuan	Xuanen	XIanfeng	Laifeng	Hefeng
Annual average T in PDD	16.6	15.5	17.6	13.2	16.0	16.2	16.2	15.9
Average T during monitoring period	19.4	19.0	20.9	15.7	18.9	17.5	16.6	18.8