MONITORING REPORT OF HENAN XINXIANG 24MW BIOMASS BASED COGENERATION PROJECT

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Project Title	Henan Xinxiang 24MW Biomass based Cogeneration Project
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Monitoring Period	28-10-2009 to 10-07-2011 (both days included)
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1 PROJECT DETAILS

1.1 Summary Description of Project

The Henan Xinxiang 24MW Biomass based Cogeneration Project(hereafter, the project) is located in Huixian County of Xinxiang City, Henan Province, China, and was implemented by Xinxiang Tianjie Bio-Power Generation Co., Ltd.

The project scenario is: the installation of 2*12MW cogeneration plants based on biomass residues; the generation of electricity with 126,709 MWh/yr supplied into Central China Power Grid (hereinafter as CCPG); the generation of heat with 909,200GJ/yr; and the utilization of biomass residues for cogeneration of power and heat. The project don't claim the emission reductions due to displacement of heat, therefore, this project will achieve GHG emissions reduction by displacing the equivalent electricity generated by CCPG with biomass residues fired cogeneration plant which has lower CO_2 emission. In addition, CH_4 emissions will be reduced by avoiding dumping of biomass residues. As a result, the project is estimated to achieve 123,858 tCO_2e emission reductions annually.

The project started construction in June of 2008, and was put into operation since 28-10-2009 (which has been approved by local power grid). The project has been registered as a CDM project on 11-07-2011, the original registered PDD (version 09, dated 28-02-2011) has been revised on 05-030-2013 and approved on 24-05-2013, and the current registered PDD (version 10, dated 05-03-2013) is used as a basic document for this verification. During current monitoring period (28-10-2009 to 10-07-2011), the project has achieved emission reductions of 153,838 tCO_2e.

1.2 Sectoral Scope and Project Type

Sectoral Scope 1: energy industries (renewable sources)

Project Activity: Grid-connected renewable power generation;

The project is not a grouped project.

1.3 Project Proponent

Roles/Responsibilities	Project Owner
Organization:	Xinxiang Tianjie Bio-Power Generation Co., Ltd
Address:	Huangli Village, Wucun Town, Huixian City, Henan Province, China
Post fix/ZIP:	453600
Country:	People's Republic of China
Telephone:	+86 373 6522 193

1.4 Other Entities Involved in the Project

Roles/Responsibilities	VER buyer
Organization:	Climate Bridge Ltd.
Address:	171 Main Street, PO Box 92, Road Town, Tortola, British Virgin Islands
Post fix/ZIP:	VG1110

1.5 Project Start Date

28-10-2009

1.6 Project Crediting Period

28-10-2009 to 10-07-2011, totally covered 1 year and 256 days.

1.7 Project Location

The proposed project activity is located in Huangli Village, Wucun Town, Huixian County, Xinxiang City, Henan Province of China.

The center of the plant has geographical coordinates of 113°30′40″ east longitude and 35°19′50″ north latitude.

1.8 Title and Reference of Methodology

a) The approved methodology that is used:

Approved consolidated baseline and monitoring methodology ACM0006: Consolidated methodology for electricity generation from biomass residues in power and heat plants, Version 10;

b) Methodologies and tools which the approved methodology draws upon:

Approved consolidated baseline and monitoring methodology ACM0002: Consolidated methodology for grid-connected electricity generation from renewable resources, Version 11;

Combined tool to identify the baseline scenario and demonstrate additionality, Version 02.2;

Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, Version 02;

Tool to calculate baseline, project and/or leakage emissions from electricity consumption, Version 01;

Tool to calculate the emission factor for an electricity system, Version 02

For more information regarding the methodology, please refer to the link:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The project started construction in June of 2008, and put into operation since 28-10-2009. Please refer to **Table 1** for details.

Table 1 Timeline of the project implementation status

Activity	Date
Starting date of construction	06-2008
Starting date of 1# Turbine Generator's operation	28-10-2009
Starting date of 2# Turbine Generator's operation	17-01-2011

No events that may impact the GHG emission reductions or removals and monitoring occurred during the current monitoring period.

2.2 Project Description Deviations

N/A.

2.3 Grouped Project

N/A.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$EF_{electricity,y}$
Data unit:	tCO_2e/MWh
Description:	CO_2 emission factor for the electricity displaced due to the project during the year *y*
Source of data:	The registered PDD
Value applied:	0.9735
Purpose of the data:	Used for baseline emission calculations

Any comment:	N/A

Data Unit / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global warming potential for CH_4
Source of data:	The registered PDD
Value applied:	21
Purpose of the data:	Used for baseline emission calculations
Any comment:	N/A

Data Unit / Parameter:	$NCV_{k^*} EF_{burning,CH4,k,y}$
Data unit:	tCH_4/t
Description:	CH_4 emission factor for uncontrolled burning of the biomass residues type *k* to be used in the project during the year *y*
Source of data:	The registered PDD
Value applied:	0.001971
Purpose of the data:	Used for baseline emission calculations
Any comment:	N/A

Data Unit / Parameter:	$EF_{km,CO2}$
Data unit:	tCO_2e/km
Description:	Average CO_2 emission factor for transportation of biomass with trucks during the year *y*
Source of data:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (Table 1-32 on Page 1.75) of the Reference Manual (Estimated Emission Factors for US Heavy Duty Diesel Vehicles)
Value applied:	0.001097
Purpose of the data:	Used for project emission calculations
Any comment:	N/A

Data Unit / Parameter:	NCV_i
Data unit:	GJ/t
Description:	Net calorific value for fossil fuel type *i* (diesel)

Source of data:	China Energy Statistical Yearbook
Value applied:	42.652
Purpose of the data:	Used for project emission calculations
Any comment:	N/A

Data Unit / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2e/GJ
Description:	CO_2 emission factor for fossil fuel type *i* (diesel) during the year *y*
Source of data:	2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 2, P1.24)
Value applied:	0.0741
Purpose of the data:	Used for project emission calculations
Any comment:	N/A

Data Unit / Parameter:	$EF_{grid,y}$
Data unit:	tCO_2e/MWh
Description:	CO_2 emission factor of CCPG during the year *y*
Source of data:	The registered PDD
Value applied:	0.9735
Purpose of the data:	Used for project emission calculations
Any comment:	N/A

Data Unit / Parameter:	TDL_y
Data unit:	%
Description:	average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site
Source of data:	The registered PDD
Value applied:	20%
Purpose of the data:	Used for project emission calculations
Any comment:	N/A

Data Unit / Parameter:	$EF_{CH4,BF}$
Data unit:	tCH_4/GJ

Description:	CH_4 emission factor for the combustion of biomass residues in the project plant
Source of data:	The registered PDD
Value applied:	0.0000411
Purpose of the data:	Used for project emission calculations
Any comment:	N/A

3.2 Data and Parameters Monitored

Data Unit / Parameter:	$EG_{project\ plant,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated in the project plant during the year *y*
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Use electric meters
Frequency of monitoring/recording:	Measured continuously and recorded monthly
Value monitored:	156,699.13
Monitoring equipment:	Measure meter (M1) Type: DTSD188s Accuracy class: 0.5s Serial number: G014MS000391 Check meter (M1') Type: DTSD188s Accuracy class: 0.5s Serial number: G014MS000383
QA/QC procedures to be applied:	The consistency of metered net electricity generation is cross-checked with receipts from electricity sales and the quantity of fuels fired; Calibration frequency for electric meters: annually 1st date of calibration: 16/11/2009 2nd date of calibration:16/11/2010
Calculation method:	N/A
Any comment:	The starting date of this monitoring period is 28/10/2009, but the earliest calibration date of the monitoring meters is 16/11/2009 and the results of the delayed calibration do not show any errors,

	therefore the value of $EG_{project\ plant,y}$ during 28/10/2009 to 16/11/2009 have been adjusted by applying the max permissible error of the meters (0.5%).

Data Unit / Parameter:	$BF_{k,y}$
Data unit:	Tons of dry matter
Description:	Quantity of biomass residue type *k* combusted in the project plant during the year *y*
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Use electronic belt weight. Adjust for the moisture content in order to determine the quantity of dry biomass.
Frequency of monitoring/recording:	Continuously, prepare annually an energy balance
Value monitored:	Maize stalk: 68,081 Waste wood: 115,982
Monitoring equipment:	Electronic belt weight (B1) Type: ICS-17B-1400 Accuracy class: 0.5 Serial number: 12060401
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes; the energy balance sheet of the project during this monitoring period has been incorporated in the ER calculation spreadsheets; Calibration frequency: annually 1st date of calibration: 15/06/2009 2nd date of calibration:15/06/2010 3rd date of calibration:15/06/2011
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	$BF_{T,k,y}$
Data unit:	Tons of dry matter
Description:	Quantity of biomass residue type *k* that has been transported to the project site during the year *y*
Source of data:	On-site measurement
Description of measurement methods and	Use weight meters. Adjust for the moisture

procedures to be applied:	content in order to determine the quantity of dry biomass.
Frequency of monitoring/recording:	Continuously, prepare annually an energy balance
Value monitored:	357,202
Monitoring equipment:	Weight meter (W1) Type: XK3190-A9(SCS-20) Accuracy class: III Serial number: 100900352 Weight meter (W2) Type: XK3190-A9(SCS-80) Accuracy class: III Serial number: 0710430
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes; the energy balance sheet of the project during this monitoring period has been incorporated in the ER calculation spreadsheets; Calibration frequency: every six months 1st date of calibration: 12/06/2009 2nd date of calibration: 12/12/2009 3rd date of calibration: 12/06/2010 4th date of calibration: 12/12/2010 5th date of calibration: 12/06/2011
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	Moisture content of the biomass residues
Data unit:	% water content
Description:	Moisture content of each biomass residue type *k*
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Use electronic balance and drying cabinet.
Frequency of monitoring/recording:	Continuously, mean values calculated monthly
Value monitored:	See ER spreadsheets for details
Monitoring equipment:	Moisture analyzer (Ma1) Type: Sh-10A Accuracy class: 0.2%

	Serial number: N/A
QA/QC procedures to be applied:	Calibration frequency: annually 1st date of calibration: 09/05/2009 2nd date of calibration: 09/05/2010 3rd date of calibration: 09/05/2011
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	TL_y
Data unit:	km
Description:	Average load of the trucks used in transportation of biomass during the year y
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Determined by averaging the weights of each truck carrying biomass to the project plant
Frequency of monitoring/recording:	Continuously, aggregated annually
Value monitored:	9
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	AVD_y
Data unit:	km
Description:	Average round trip distance (from and to) between biomass fuel supply sites and the project site during the year y
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Recorded in log books for each truck of biomass residues transported to the project plant
Frequency of monitoring/recording:	Continuously
Value monitored:	48.73
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Check consistency of the distance records provided by the truckers by comparing recorded distances with other information from other sources (e.g. maps);
Calculation method:	N/A

Any comment:	N/A

Data Unit / Parameter:	$FF_{project\ plant,i,y}$
Data unit:	t
Description:	Quantity of fossil fuel type *i* (diesel) combusted in the project plant during the year *y*
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Use flow meter
Frequency of monitoring/recording:	Continuously
Value monitored:	0
Monitoring equipment:	Flow meter (F1) Type: JYB-60 Accuracy class: 0.5 Serial number: 11L00621
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes; Calibration frequency: annually 1st date of calibration: 09/06/2009 2nd date of calibration: 09/06/2010 3rd date of calibration: 09/06/2011
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	$FF_{project\ site,i,y}$
Data unit:	t
Description:	Quantity of fossil fuel type i (diesel) combusted at the project site (including the collection sites) for other purposes that are attributable to the project activity during the year y
Source of data:	On-site purchase and consumption records maintained in the log books
Description of measurement methods and procedures to be applied:	Use flow meter
Frequency of monitoring/recording:	Continuously
Value monitored:	132.23
Monitoring equipment:	Flow meter (F1) Type: JYB-60

	Accuracy class: 0.5 Serial number: 11L00621
QA/QC procedures to be applied:	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes; Calibration frequency: annually 1st date of calibration: 09/06/2009 2nd date of calibration: 09/06/2010 3rd date of calibration: 09/06/2011
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	On-site electricity consumption (including the electricity consumption for the mechanical treatment of the biomass in the biomass collection sites and the project site) attributable to the project activity during the year *y*
Source of data:	On-site measurement
Description of measurement methods and procedures to be applied:	Use electric meters
Frequency of monitoring/recording:	Continuously
Value monitored:	1,011.28
Monitoring equipment:	Electric meter (M2) Type: DTS72 Accuracy class: 1.0s Serial number: KSE005040
QA/QC procedures to be applied:	Cross-check measurement results with invoices for purchased electricity if available; Calibration frequency for electric meters: annually 1st date of calibration: 17/10/2009 2nd date of calibration:17/10/2010
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	NCV_k
Data unit:	GJ/ton of dry matter
Description:	Net calorific value of biomass residue type *k*

Source of data:	Sample measurement
Description of measurement methods and procedures to be applied:	The random sample of the biomass residues will be sent to local Quality Testing Bureau for analysis
Frequency of monitoring/recording:	Measured every six months, taking at least three samples for each measurement
Value monitored:	The max value for maize stalk: 17.64 The max value for waste wood: 15.65
Monitoring equipment:	N/A
QA/QC procedures to be applied:	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements. Ensure that the NCV is determined on the basis of dry biomass
Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	
Data unit:	t
Description:	Quantity of each biomass residues type *k* that are utilized in the defined geographical region
Source of data:	The local statistical data
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Annually
Value monitored:	Maize stalk: 181,888 (2009); 209,282 (2010); 223,510 (2011) Waste wood: 159,383 (2009); 176,908 (2010); 174303 (2011)
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
N/A Calculation method:	N/A
Any comment:	N/A

Data Unit / Parameter:	
Data unit:	t
Description:	Quantity of available biomass residues type *k* in the defined geographical region
Source of data:	The local statistical data
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Annually
Value monitored:	Maize stalk: 389,500 (2009); 378,300 (2010); 383,900 (2011) Waste wood: 240,000 (2009); 240,000 (2010); 247,800 (2011)
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	N/A

3.3 Description of the Monitoring Plan

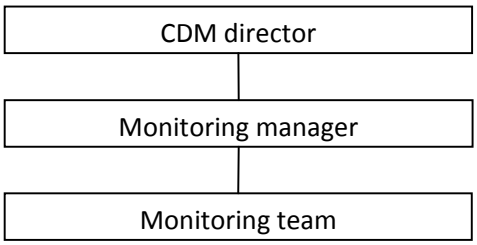
1) Organizational structure, responsibilities and competencies

The project owner has set up a specific CDM department for monitoring decisions and operation of the monitoring plan.

There is a CDM director as a leader of the CDM department, a monitoring manager for overall implementation and management of the monitoring plan, and a monitoring team for practical operation of the monitoring.

The management structure of the monitoring team is shown in **Figure 1**.

Figure 1: Management structure of the project monitoring plan



The CDM director is responsible for the general management of the CDM project, and takes charge of the communication and coordination with CDM related departments (DNA, stakeholders, CERs buyer and DOE, etc.).

The monitoring manager is responsible for the overall implementation and management of the monitoring plan for this project, including data collection, CERs calculation, preparing monitoring reports and cooperating with DOE for verification.

The monitoring team is responsible for the practical operation of the monitoring work, including monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the calibration and maintenance of the measuring equipment.

2) Monitoring system and procedures

Monitoring of biomass residues data

The biomass residues data of this project includes quantity, moisture content and net calorific value of used biomass residues.

Quantity of utilized biomass residues were measured by electronic belt weight installed at the feeding inlet of the boiler, and these data shall be crosschecked with the quantity of electricity and heat generated and any fuel purchase receipts (if available). The type of the electronic belt weight is ICS-17B-1400 with an accuracy of 0.5.

The moisture content of biomass residues were measured by moisture analyzer installed in gate of the project site for the random sample when they are transported into the project site each time, and calculate the mean values calculated annually. To ensure the authenticity of the value, the project owner will invite the technician of local Quality Testing Bureau to calibrate the moisture analyzer used for monitoring annually.

The net calorific value of biomass residues were measured by sending the random sample to local Quality Testing Bureau for analysis every six months, taking at least three samples for each measurement. The consistency of the measurements was checked by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements.

Monitoring of transport data

The transport data of this project includes quantity of biomass residues transported to the project site, average truck load and average round trip distance.

Quantity of biomass residues transported to the project site were measured by weighing the trucks twice when it goes in and out of the project site with electronic weight meter installed in the gate of the project site, and these data shall be crosschecked with the quantity of electricity and heat generated and any fuel purchase receipts (if available). The type of the weight meter is XK3190-A9 (SCS-20/SCS-80) with an accuracy of level III.

The average truck load were determined by averaging the weights of each truck carrying biomass to the project plant which were measured continuously and aggregated annually.

The average round trip distance were obtained from the records by project participants on the origin of the biomass which were measured continuously and the consistency of distance records provided by the truckers was checked by comparing recorded distances with other information from other sources (e.g. maps).

Monitoring of fossil fuel data

The fossil fuel data of this project includes the diesel consumption in the ignition and for operation of forklifts at the project site. The diesel used for ignition was measured by flow meter with an accuracy of 0.5; the diesel used in forklifts were determined by the quantity of diesel purchase and remained, and the measurements were crosschecked by diesel purchase invoice.

Monitoring of electricity data

The electricity data of this project includes on-site electricity consumption and net electricity generation.

Two electricity meters were installed at the import of the new Wucun electric transformer according to “Technique Management Regulation of Power Measure Equipment” (DL/T448-2000, issued by State Economic and Trade Commission on Nov.03, 2000 and implemented on Jan.1, 2001) with an accuracy of 0.5s.

One of the meters (measure meter M1) was installed at the import of the new Wucun electric transformer substation to measure export ($EG_{export,y}$) and import ($EG_{import,y}$) electricity from the grid, the difference between export electricity and import electricity is the net electricity generation supplied by the project plant/unit to the grid ; another meter (check meter M1’) was also installed at the import of the new Wucun electric transformer substation next to the measure meter to measure export ($EG_{export,y}$) and import ($EG_{import,y}$) electricity from the grid. If reading of measure meter is not precision allowed error range at any month, electricity connected to grid should be confirmed as follow:

(1) Firstly, reading data from check meter, calculating electricity connected to grid of the project according to historical line lose rate, except anyone think that check ammeter is not precision after check;

(2) If check meter has not accepted precision or operation is not criterion, the project owner and power grid company should design a reasonable conservative method to estimate reading together, and explain that it’s reasonable and conservative at verification of DOE.

(3) If the project owner and power grid company can’t compass consistent idea about the method to estimate reading, it should be arbitrated according to conventional process to confirm consistency of reading estimated.

The on-site electricity consumption at the stalk collection sites was measured by electricity meters installed by power grid company with an accuracy of 1.0s. The data should be crosschecked with

receipts of electricity purchases (if available). Until now, only one stalk collecting site was built to collect stalks, and the on-site electricity consumption at the stalk collection site was measured by an electricity mete (M2) installed on this collecting site. If in the future, other stalk collecting sites will be built, the electricity meters will be installed as per the related standards and rules in China to measure the on-site electricity consumption at the stalk collection sites.

Monitoring of availability of biomass residues

The quantity of available and utilized biomass residues in the defined geographical region was monitored to check the leakage effect. These data were obtained from official statistical information on a yearly basis.

The detailed structure of the monitoring system can be found in **Figure 2** and **Table 2**.

Figure 2: the monitoring diagram of the project

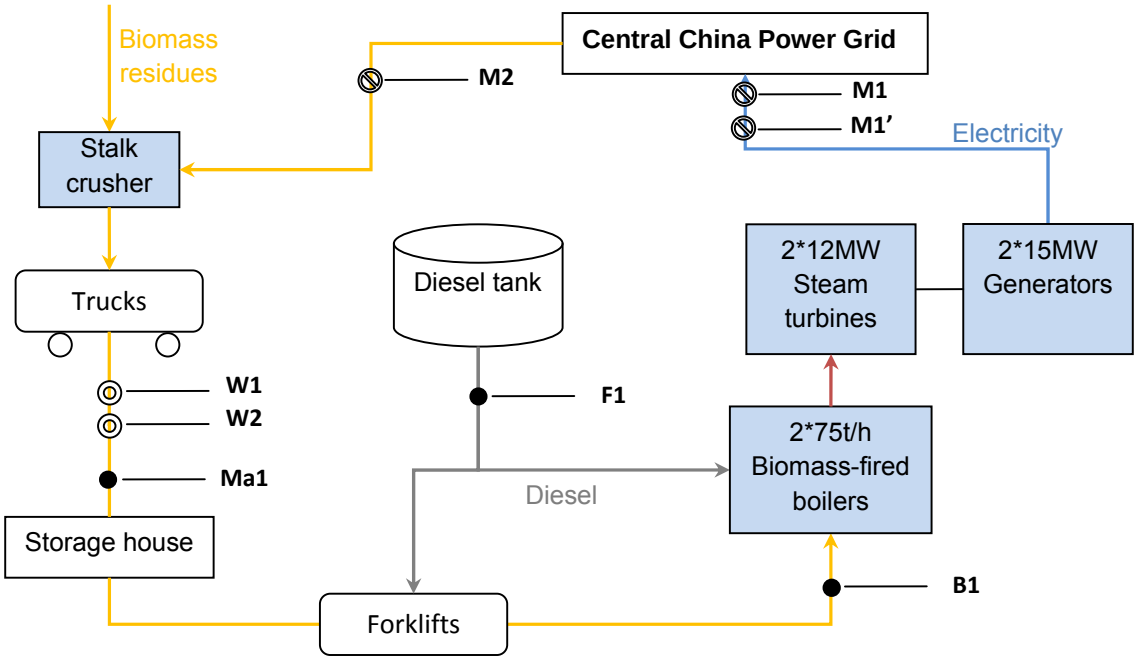


Table 2: Details of the monitoring equipment

Monitoring equipment	Description	Location
M1	Measure meter, measuring the net electricity generated by the project	Import of the New Wucun Electric Transformer Substation
M1'	Check meter, measuring the net electricity generated by the project	Import of the New Wucun Electric Transformer Substation
M2	Electricity meter, measuring the on-site electricity consumption attributable to the project activity	Stalk collection sites
W1	Weight meter, measuring the quantity of the biomass residues that has been transported to the project site	Gate of the project site

W2	Weight meter, measuring the quantity of the biomass residues that has been transported to the project site	Gate of the project site
B1	Electronic belt weight, measuring the quantity of biomass residues combusted in the project plant	Feeding inlet of the boiler
Ma1	Moisture analyzer, measuring the moisture content of the biomass residues	Gate of the project site
F1	Flow meter, measuring the quantity of diesel combusted (for ignition and operation of forklifts) in the project plant	Diesel tank

3) QA/QC procedures

Training programme

Before the operation of this project, monitoring personnel was trained for basic conception and management of the project activity, monitoring and archiving procedures of relevant data, and the requirement for data quality assurance etc.

Calibration of measuring equipment

In order to assure precision, the project owner invited the technician of local Quality Testing Bureau to calibrate all the monitoring equipment every year. The calibration of the equipment was implemented according to the relevant national standard. The calibration records were saved for verification, and the data inspectors of CDM monitoring team are in charge of daily maintenance of the equipment.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The baseline emissions are calculated as follow:

1) Baseline emissions due to displacement of electricity ($ER_{electricity,y}$)

$$ER_{electricity,y} = EG_{y} \cdot EF_{electricity,y} = EG_{projectplant,y} \cdot EF_{electriciy,y}$$

Where:

$EG_{project\ plant,y}$ is net quantity of electricity generated in the project plant during the year *y*, MWh;

$EF_{electricity,y}$ is CO_2 emission factor for the electricity displaced due to the project activity during the year *y*, tCO_2e/MWh.

During the current monitoring period, $EG_{project\ plant,y}$ = 156,699.13 MWh, and $EF_{electricity,y}$ = 0.9735 tCO_2e/MWh.,

So $ER_{electricity,y}$ = 156,699.13 × 0.9735 = 152,547 tCO_2e

2) Baseline emissions due to displacement of heat ($ER_{heat,y}$)

The project does not claim for the emission reductions due to displacement of heat, so $ER_{heat,y}$ = 0

3) Baseline emissions due to natural decay or uncontrolled burning of anthropogenic sources of biomass residues ($BE_{biomss,y}$)

$$BE_{biomass,y} = GWP_{CH_4} \cdot \sum_k BF_{PJ,k,y} \cdot NCV_k \cdot EF_{burning,CH_4,k,y}$$

Where:

GWP_{CH4} is Global Warming Potential of methane valid for the commitment period, tCO_2e/tCH_4;

$BF_{PJ,k,y}$ is incremental quantity of biomass residue type *k* used as a result of the project activity in the project plant during the year *y*, tons of dry matter;

NCV_k is net calorific value of the biomass residue type *k*, GJ/ tons of dry matter;

$EF_{burning,CH4,k}$ is CH_4 emission factor for uncontrolled burning of the biomass residue type *k* during the year *y*, tCH_4/GJ;

During the current monitoring period, GWP_{CH4} = 21, $BF_{PJ,k,y} = \sum BF_{k,y}$ = (68,081+115,982) = 184,063 t184,063, and $NCV_k * EF_{burning,CH4,k,y}$ = 0.001971 tCH_4/t,

So $BE_{biomss,y}$ = 21 ×184,063 × 0.001971 = 7,619 tCO_2e

Therefore,

Baseline emission (BE_y) = $ER_{electricity,y}$ + $BE_{biomss,y}$ = 152,547 +7,619 = 160,165 tCO_2e

4.2 Project Emissions

The project emissions are calculated as follow:

1) Carbon dioxide emissions from combustion of fossil fuels for transportation of biomass residues to the project plant (PET_y)

$$PET_y = \frac{\sum_k BF_{T,k,y}}{TL_y} \cdot AVD_y \cdot EF_{km,CO_2,y}$$

Where:

$BF_{T,k,y}$ is quantity of biomass residue type *k* that has been transported to the project site during the year *y*;

TL_y is average truck load of the trucks used during the year *y*;

AVD_y is average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during the year *y*, km;

$EF_{km,CO2}$ is average CO_2 emission factor for the trucks measured during the year *y*, tCO_2e/km;

During the current monitoring period, $\sum BF_{T,k,y}$ = 359,702 t, TL_y = 9 t, AVD_y = 48.73 km, and $EF_{km,CO2}$ = 0.001097 tCO_2e/km,

So $\boldsymbol{PET_y}$ = 359,702 / 9 × 48.73 × 0.001097 = 2,124 tCO_2e

2) Carbon dioxide emissions from on-site consumption of fossil fuels ($\boldsymbol{PEFF_y}$)

$$PEEF_y = \sum_i (FF_{projectplant,i,y} + FF_{projectsite,i,y}) \cdot NCV_i \cdot EF_{CO_2,i,y}$$

Where:

$FF_{project\ plant,i,y}$ is quantity of the fossil fuel *i* (diesel) combusted in the project plant during the year *y*, t;

$FF_{project\ site,i,y}$ is quantity of the fossil fuel *i* (diesel) combusted at the project site for other purposes that are attributable to the project activity during the year *y*, t;

NCV_i is net calorific value of the fossil fuel *i* (diesel), GJ/t;

$EF_{CO2,i,y}$ is CO_2 emission factor for the fossil fuel *i* (diesel) during year *y*, tCO_2e/GJ.

During the current monitoring period, $FF_{project\ plant,i,y}$ = 0 t, $FF_{project\ site,i,y}$ = 132.23 t, NCV_i = 42.652 GJ/t, and $EF_{CO2,i,y}$ = 0.0741 tCO_2e/GJ,

So $\boldsymbol{PEFF_y}$ = (0+132.23) × 42.652 × 0.0741 = 418 tCO_2e

3) CO_2 emissions from electricity consumption ($\boldsymbol{PE_{EC,y}}$)

$$PE_{EC,y} = EC_{PJ,y} \cdot EF_{grid,y} \cdot (1 + TDL_y)$$

Where:

$EC_{PJ,y}$ is quantity of electricity consumed by the project activity during the year *y*, MWh;

$EF_{grid,y}$ is CO_2 emission factor of CCPG during the year *y*, tCO_2e/MWh;

TDL_y are average technical transmission and distribution losses in the grid in year *y* for the voltage level at which electricity is obtained from the grid at the project site, %.

During the current monitoring period, $EC_{PJ,j,y}$ = 1,011.28 MWh, $EF_{EL,j,y}$ = 0.9735 tCO_2e/MWh, TDL_y = 20%,

So $\boldsymbol{PE_{EC,y}}$ = 1,011.28 × 0.9735 × (1+20%) = 1,181 tCO_2e

4) Methane emissions from combustion of biomass residues ($\boldsymbol{PE_{biomass,CH4,y}}$)

$$PE_{biomass,CH_4,y} = EF_{CH_4,BF} \cdot \sum_k BF_{k,y} \cdot NCV_k$$

Where:

$EF_{CH4,BF}$ is CH_4 emission factor for the combustion of biomass residues in the project plant, tCH_4/GJ;

$BF_{k,y}$ is quantity of biomass residue type *k* combusted in the project plant during the year *y*, t;

NCV_k is net calorific value of the biomass residue type *k*, GJ/t.

During the current monitoring period, $EF_{CH4,BF}$ = 0.0000411 tCH_4/GJ, $BF_{maize\ stalk,y}$ = 68,081 t, $BF_{waste\ wood,y}$ = 115,982 t, and $NCV_{maize\ stalk,y}$ = 17.64 GJ/t, $NCV_{waste\ wood,y}$ = 15.65 GJ/t,

So $\boldsymbol{PE_{biomass,CH4,y}}$ = 0.0000411 × (68,081 × 17.64 +115,982 × 15.65) = 124 tCH_4

Therefore,

Project emissions ($\boldsymbol{PE_y}$) = $\boldsymbol{PET_y + PEEF_y + PE_{EC,y} + GWP_{CH4} \times PE_{biomass,CH4,y}}$ = 2,124 + 418 + 1,181 + 21 × 124 = **6,327 tCO_2e**

4.3 Leakage

Table 3: Leakage analysis of the project

Type	Quantity of available (t/yr)	Quantity of utilized (t/yr)						Larger percentage than utilized
		Feedstuff	Compost	Return to field	Processing	For this project	Total	
Year 2009								
Maize stalk	**389,500**	3,839	79,785	90,576	0	7,688	**181,888**	**114.14%**
Waste wood	**240,000**	0	0	0	144,700	14,683	**159,383**	**50.58%**
Total	**629,500**	3,839	79,785	90,576	144,700	22,371	**341,271**	**84.46%**
Year 2010								

Maize stalk	**378,300**	3,839	73,246	97,115	0	35,082	**209,282**	**80.76%**
Waste wood	**240,000**	0	0	0	112,800	64,108	**176,908**	**35.66%**
Total	**618,300**	3,839	73,246	97,115	112,800	99,190	**386,190**	**60.10%**
Year 2011								
Maize stalk	**383,900**	3,839	76,784	107,497	0	35,390	**223,510**	**71.76%**
Waste wood	**247,800**	0	0	0	112,800	61,503	**174,303**	**42.17%**
Total	**631,700**	3,839	76,784	107,497	112,800	96,892	**397,812**	**58.79%**

Data source: Special Report of Biomass Fuel in Huixian City (2009, 2010 and 2011)

Based on the analysis above, we can find out that the quantity of available biomass residues in the defined geographical boundary are far larger than 25% the quantity of biomass residues utilized in the project. Thus the utilization of the biomass residues by the project plant is considered to have no influence on the current biomass usage, and therefore the leakage of proposed project is considered to be 0.

Therefore, Leakage emissions ($\boldsymbol{LE_y}$) = 0

4.4 Summary of GHG Emission Reductions and Removals

According to the description above, for this project, the total emission reductions during current monitoring period are summarized in **Table 4** as below, as well as the vintage breakdown:

Table 4: Emission reductions of the project during the monitoring period

Item	Unit	Value			
			Vintage		
		Total	2009	2010	2011
Baseline emissions (BE_y)	tCO_2e	160,165	9,447	74,538	76,179
Project emissions (PE_y)	tCO_2e	6,327	345	2,836	3,145
Leakage emissions (LE_y)	tCO_2e	0	0	0	0
Emission reductions (ER_y)	**tCO_2e**	**153,838**	**9,102**	**71,702**	**73,034**

5 ADDITIONAL INFORMATION

Comparison of actual emission reductions with estimates during validation:

This project has been registered as a CDM project, according to the registered CDM PDD, the estimated annual emission reductions are 123,858 tCO_2e, and for this monitoring period (1 year and 256 days) the estimated emission reductions should be 210,728 tCO_2e. But the actual emission reductions are 153,838 tCO_2e as calculated before, much lower than the estimation. It is mainly because of the unstable performance due to the initial operation of the project.

Energy balance during the monitoring period:

The total inputs of all types of fuels combusted and useful output of electricity from the project are presented below. From this data the conversion efficiency of the project in this monitoring period is calculated as 18.70%.

Table 5: Energy balance of the project during the monitoring period

			Quantity	NCV	Energy
Input	Biomass residues	Maize stalk	68,081 t	17.64 GJ/t	1,200,946.87 GJ
		Waste wood	115,982 t	15.65 GJ/t	1,815,122.74 GJ
	Fossil fuel		0 t	42.65 GJ/t	0 GJ
	Total				3,016,069.61 GJ
Output	Electricity		156,699.13 MWh	3.6 GJ/MWh	564,116.86 GJ
Efficiency					**18.70%**