HENAN XINXIANG 24MW BIOMASS BASED COGENERATION PROJECT

Document Prepared by Climate Bridge (Shanghai) Ltd.

Project Title	Henan Xinxiang 24MW Biomass based Cogeneration Project
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Project ID	VCS 1140
Monitoring Period	01-Jan-2013 to 31-Dec-2017 (both days included)
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the 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 doesn'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, the operation of the first turbine-generator was started on 28-Oct-2009 and the operation of the second turbine-generator was started on 17-Jan-2011. The project has been registered as a CDM project on 11-Jul-2011, the original registered PDD (version 09, dated 28-Feb-2011) has been revised on 05-Mar-2013 and approved on 24-May-2013. The project has been registered as a VCS project (VCS ID 1140) based on the current registered CDM PDD (version 10, dated 05- Mar-2013) on 11-Sep-2013, and the first monitoring report from 28-Oct-2009 to 10-Jul-2011 has been verified by TÜV Rheinland (China) Ltd. on 11-Sep-2013. And the current registered CDM PDD (version 10, dated 05- Mar-2013) and first monitoring report (version 02, dated 30- Aug-2013) are used as basic documents for this verification.

During current monitoring period (01-Jan-2013 to 31-Dec-2017), the project has achieved emission reductions of 454,707 tCO_2e.

1.2 Sectoral Scope and Project Type

Sectoral scope: 1. Energy (renewable/non-renewable);

Project type: Biomass power generation project;

The project is not a grouped project.

1.3 Project Proponent

Organization name	Xinxiang Tianjie Bio-Power Generation Co., Ltd.

Contact person	Qingjie Wang
Title	Project manager
Address	Huangli Village, Wucun Town, Huixian City, Henan Province, China
Telephone	+86 21 2301 9950
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1.4 Other Entities Involved in the Project

Organization name	Climate Bridge (Shanghai) Ltd.
Role in the Project	Consultancy
Contact person	Zhiwen Gao
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New District, Shanghai, 200120
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1.5 Project Start Date

28-Oct-2009 (Project operation date)

1.6 Project Crediting Period

There is a deviation for the crediting period. The project is registered under VCS standard Version 3.3 and completed validation before 19-Mar-2020. thus, as per VCS standard 4.1, registered projects and projects that complete validation on or before 19-Mar-2020 remain eligible to apply the crediting period requirements under VCS standard Version 3.3 which shall be a maximum of ten years and may be renewed at most twice. However, the project is also registered as a CDM project (UNFCCC Ref. 3054) and the crediting period under CDM is 21 years (7*3 renewable), therefore the total length of VCS crediting period should be no more than 21 years which is from 28-Oct-2009 to 27-Oct-2030 and the project is not eligible for VCU issuance beyond 27-Oct-2030. And the first renewable crediting period of the project have been updated to 28-Oct-2009 to 27-Oct-2019. This monitoring period belongs to the first crediting period.

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.

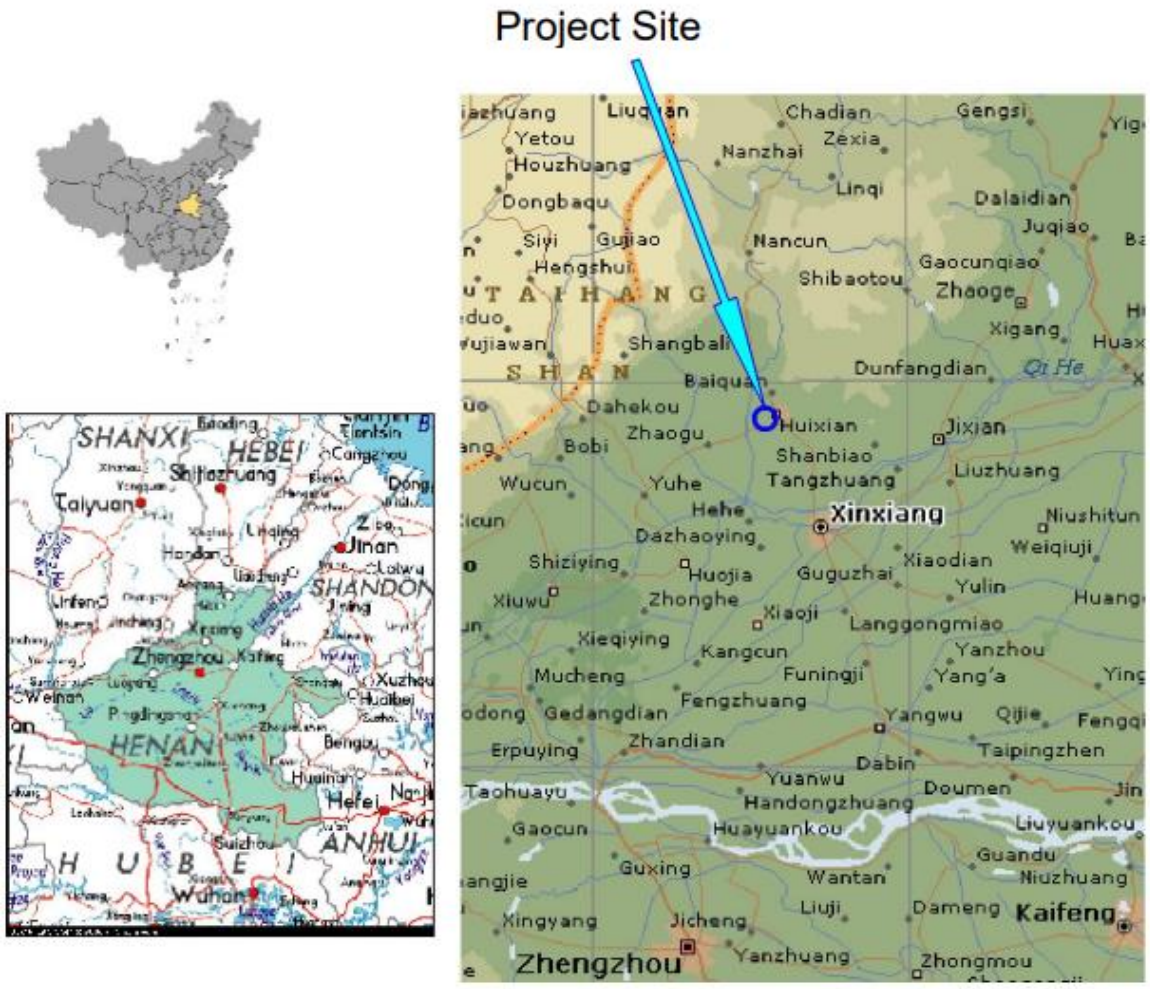

Figure 1 Location of the project

1.8 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied;

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

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 CO_2 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

1.9 Participation under other GHG Programs

The project has been registered as a Clean Development Mechanism (CDM) project in UNFCCC on 11-Jul-2011 (UNFCCC Ref. 3054), with the renewable 7 years crediting period started from 11-Jul-2011. Total GHG emission reductions of 186,473 tCO_2 generated from 11-Jul-2011 to 31-Dec-2012 (both first and last days included) by the project has been issued as CER under CDM program. Please refer to the following link for details.

https://cdm.unfccc.int/Projects/DB/RWTUV1256116990.83/view

The project has been registered as a VCS project (VCS ID 1140) on 11-Sep-2013, Total GHG emission reductions of 153,838 tCO_2 generated from 28-Oct-2009 to 10-Jul-2011 (both first and last days included) by the project has been issued as VCU under VCS program. Please refer to the following link for details.

https://registry.verra.org/app/projectDetail/VCS/1140

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits

China has a national emissions trading scheme only cover the high-emission industries, such as thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO_2e/year, not including renewable project[1]. And the project activity is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner

[1] http://www.mee.gov.cn/xxgk2018/xxgk/xxgk05/202103/t20210330_826728.html

according to the enforced company list[2] in public information. Hence, it is confirmed that the emission reductions will not be double counted.

The project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading.

Other Forms of Environmental Credit

The project has not sought or received another form of GHG-related environmental credit, including renewable energy certificates, during this monitoring period.

1.11 Sustainable Development

The contributions of this project to sustainable development of the host country and project site are summarized as follows:

Being located in CCPG dominated by fossil fuel fired power plants, this project mitigates environmental pollution and reduces the GHG emissions, because the pollution caused by biomass fired power plant is less than fossil fuel fired plant. Ash generated from the biomass burning is used to produce fertilizer, which has remarkable environmental benefits;

During this monitoring period, 455,937.262 MWh of electricity from renewable sources has been supplied to the power grid. Thus, the project achieved SDG 7 Affordable and Clean Energy[3]. The project has achieved a GHG emission reduction of 454,707 tCO_2e during this monitoring period. Thus, the project achieved SDG 13 Climate Action[4].

This project increases income of local farmers and accelerate economy development in rural areas through purchase of agricultural stalks. It also reduces environmental pollution from dumping of biomass residues; During construction and operation of this project, direct and indirect employment opportunities are generated. Thus, the project achieved SDG 8 Decent Work and Economic Growth[5].

In view of the above, the PP has considered that the project activity profoundly contributes to the sustainable development.

2 SAFEGUARDS

[2] http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf

[3] https://sdgs.un.org/goals/goal7

[4] https://sdgs.un.org/goals/goal13

[5] https://sdgs.un.org/goals/goal8

2.1 No Net Harm

There are no negative environmental and/or socio-economic impacts due to the project. During this monitoring period, the project as a clean renewable energy project can reduce greenhouse gas emissions and the environmental pollution caused by fossil fuels consumption. Meanwhile, the implementation of the project improved local socio-economic development through creating career opportunities and paying taxes.

2.2 Local Stakeholder Consultation

Local Stakeholder Consultation during the project design stage:

A stakeholders meeting was held by the project owner on 03-Mar-2008 in order to collect the attitude and comments of the stakeholders in local area towards the construction and operation of this project. Before the meeting, the project owner informed the local government about the time and content of the meeting and asked the government to invite representatives of the stakeholders to attend this meeting.

Totally 51 stakeholder representatives participated the meeting, respectively from the local government, surrounding villages (Huangli Village, Xiedian Village, Guandian Village), Huangli Secondary School, and Yanguang Hongtai Bio-product Co., Ltd. (the primary heat consumer). The representatives were selected from different ages, different occupations and different education levels. At this meet, the project owner described this project activity to allow the local stakeholders to understand the project activity

Questionnaire survey: During the survey of stakeholders, the comments from the relevant stakeholders were collected. 51 copies questionnaires were distributed and all of them were collected. The recovery rate is 100%.

In summary, all stakeholders supported the project design and some of the stakeholders pointed out in the questionnaire that the project owner should strengthen the control about smoke, water and noise after this project activity put into production. The project owner has carried out measures in the EIA to reduce impact on the environment and pay attention to the follow-up solution control according to the comment of stakeholders, which solved possible noise pollution the stakeholders considered. Thus, there is no negative comments received during the project preparation stage.

Local Stakeholder Consultation during the project implementation stage:

Communications with Local stakeholders are being carried out at periodic intervals. In this monitoring period, the project owner carried out questionnaire survey for the local stakeholder to collect the relevant comments and suggestions.

Questionnaire was implemented by filling the stakeholder comments investigation. The comments, from the government, environmental protection bureau, local farmers, teachers and other relevant stakeholders, were collected. 30 copies questionnaires were distributed

respectively on 15-Jul-2013, 25-May-2015, 14-Sep-2017 and all of them were collected. The recovery rate is 100%. There are no negative comments received for the project according to every questionnaire survey.

The basic information about the interviewees in 2013, 2015, 2017 is described as following table:

Basic information	Classified items	Person number			Percentage（%）		
	Year	2013	2015	2017	2013	2015	2017
Age	Younger than 30	4	3	3	13	10	10
	30-40	11	13	12	37	43	40
	41-50	13	12	12	43	40	40
	Older than 50	2	2	3	7	7	10
Occupation	Officials	3	3	5	10	10	17
	Farmers	17	15	15	57	50	50
	Workers	5	8	7	17	27	23
	Staffs	3	2	2	10	7	7
	Others	2	2	1	6	6	3
Education	Elementary school and below	5	7	6	17	23	20
	Junior middle school	14	16	16	47	53	54
	Senior middle school	6	4	4	20	13	13
	College and above	5	3	4	16	11	13
Gender	Male	20	25	20	67	83	67
	Female	10	5	10	33	17	33

The questions in the questionnaire including:

Are you familiar with the project?

What is the effect of the project on local employment and social life?

What do you think the influence on the local economic development?

What is the effect of the project on local ecologic environment?

Do you support the construction of the project?

Do you have any suggestions for the project?

Among the total 90 interviewee in 2013, 2015 and 2019, 40% persons are familiar with the project totally, 60% know it partly about this project during operation phase. For the impacts on the local employment and social life, 90% think it's positive and 10% think no impact. For the impacts on the local ecologic environment, 50% think it's positive and 50% think no impact. 97% of them think the project have positive impacts on the local economic development, 3% think no impact, none of them think negative. 95% of them think the project has positive impacts on the local environmental development, 5% think no impact, none of them think negative.

In summary, all of them satisfied with the environment maintenance method for the project and there are no negative comments received for the project during this monitoring period. In line with VCS requirements all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project construction was commenced on 25-Jun-2008, the operation of the first turbine-generator was started on 28-Oct-2009 and the operation of the second turbine-generator was started on 17-Jan-2011. The project consists of one site only and the implementation is not phased. This project installs two biomass fired boilers of medium temperature and medium pressure with a capacity of 2×75t/h, and the system also includes the 2*12MW medium temperature and medium pressure turbines and generators for power generation resulting in a total Installed capacity of 24MW (2*12MW).

Please see Table 1 below for parameters of the main equipment of the Project.

Table 1 Parameters of the main equipments of the Project[6]

Boiler	
Manufacture: Jinan Boiler Group Co., Ltd.	
Type	YG-75/3.82-T
Quantity	2
Rated evaporative capacity	75t/h
Steam-gas pressure	3.821MPa
Water temperature	150°C
Efficiency	83%
Turbine	
Manufacture: China Changjiang Energy Corp (Group)	
Type	C12-3.43/0.98
Quantity	2
Rated installed capacity	12MW
Inlet pressure	3.43MPa
Inlet temperature	435°C

[6] Equipment Purchase Agreements of Xinxiang Tianjie Bio-Power Generation Project.

Rated steam flow	75t/h
Rated revolution	3000r/min
Generator	
Manufacture: China Changjiang Energy Corp (Group)	
Type	QF-15-2
Quantity	2
Rated power	15MW
Rated voltage	6300V
Rated power factor	0.8
Rated revolution	3000r/min

Please refer to Figure 3 in section 4.3 of this report for the technical flow chart of the Project.

The project was shut down for 31 days in February 2014, 99 days in June, October, November and December of 2015, 175 days in January, February, March, April, May and August of 2016 and 30 days in July 2017, during this monitoring period, the total time of shutdown is 335 days.

The project was shut down for period from 24-Nov-2015 to 23-May-2016 (182 days), the main reason is that adjustment and implement of the company internal rules and regulations due to change of shareholding of Xinxiang Tianjie Bio-Power Generation Co., Ltd.. The remaining 153 days of the shutdown time due to normal overhaul and debugging. During this monitoring period, neither emergencies happened to the monitoring system, nor events or situations occurred, which may impact the applicability of the methodology.

3.2 Deviations

3.2.1 Methodology Deviations

There is no methodology deviation applied to this monitoring period.

3.2.2 Project Description Deviations

Crediting period

The project is registered under VCS standard Version 3.3 and completed validation before 19-Mar-2020. thus, as per VCS standard 4.1, registered projects and projects that complete validation on or before 19-Mar-2020 remain eligible to apply the crediting period requirements under VCS standard Version 3.3 which shall be a maximum of ten years and may be renewed at most twice. However, the project is also registered as a CDM project (UNFCCC Ref. 3054) and the crediting period under CDM is 21 years (7*3 renewable), therefore the total length of VCS crediting period should be no more than 21 years which is from 28-Oct-2009 to 27-Oct-2030 and the project is not eligible for VCU issuance beyond 27-Oct-2030. And the first renewable crediting

period of the project have been updated to 28-Oct-2009 to 27-Oct-2019. This monitoring period belongs to the first crediting period.

Monitoring plan

$EG_{projectplant,y}$, net quantity of electricity generated in the project plant during the year y , is the difference between export electricity ($EG_{export,y}$) and import electricity ($EG_{import,y}$) measured by two bi-directional electricity meters M1 (measure meter) and M1' (check meter) with an accuracy of 0.5s installed at import of the New Wucun Electric Transformer Substation. On 02-Jun-2015, the local grid company replaced the meters with two new bi-directional electricity meters with an accuracy of 0.2s which could be more fit for the remote monitoring, and according to the latest Power Purchase Agreement signed between the project owner and the grid company on 09-May-2016, the new gate meters have been installed at supply side of the project site due to the change of property rights of grid-connected line. Both of the old and new meters have been calibrated regularly in line with the relevant regulations, and the new meters have higher accuracy than the old ones, so there was no influence on the ER calculation due to the meter replacement.

$EC_{PJ,y}$, 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, which is measured by electricity meter (M2) installed at the stalk collection sites by power grid company with an accuracy of 1.0s. Only one stalk collection site was built to collect stalks since the start of the project. Since 10-March-2014, this stalk collection site has been closed and all biomass is transported directly to the project site. Therefore, M2 has been dismantled and the electricity consumed by the project activity is 0 from 10-March-2014 onward.

$FF_{project\ plant,diessl,y}$, quantity of fossil fuel type i (diesel) combusted in the project plant during the year y, is measured by flow meters (F1) with an accuracy of 0.5. However, during the actual operation of the project, no diesel is needed for the ignition as the biomass residues used in the project are easy to be burnt in the boiler. During the previous monitoring period from 28-Oct-2009 to 31- Dec-2012, the diesel consumption for ignition was 0, therefore the flow meter F1 has been dismantled on 02-Feb-2013 by the project owner in order to improve efficiency and save the maintenance expense. And for the diesel used in forklifts, the consumption was determined by the records of diesel purchase and remained, and the measurements were crosschecked by diesel purchase invoice.

Please refer to Section 4.3 for detailed monitoring plan.

As described before, these changes of deviation do not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario.

3.3 Grouped Projects

The Project is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

With consideration of the fact of the Project, the parameters ($FC_{i,y}$, NCV_i, $EF_{CO_2,i,y}$, EG_y, $EF_{Coal,Adv}$, $EF_{Oil,Adv}$,$EF_{Gas,Adv}$, CAP_{thermal}, CAP_{hydro},CAP_{other},$CAP_{\text{total},m}$ and CAP_{nuclear}) used for calculation of the baseline gird emission factor ($EF_{electricity,y}/EF_{grid,CM,_y}$) available at validation in the registered PDD are replaced by the parameter of $EF_{electricity,y}/EF_{grid,CM,_y}$ directly here. All data and parameters that are available at validation are summarized in below tables.

Data / Parameter	$EF_{electricity,y}/EF_{grid,CM,_y}$
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
Justification of choice of data or description of measurement methods and procedures applied	Calculated and sourced from China Electric Power Yearbook 2005~2007 according to the registered PDD.
Purpose of Data	Calculation of baseline emissions
Comments	This parameter is ex ante determined in PDD and fixed during the first crediting period.

Data / Parameter	GWP_{CH4}
Data unit	$t\ CO_2e/t\ CH_4$
Description	Global warming potential of CH_4
Source of data	IPCC
Value applied	28
Justification of choice of data or description of measurement methods and procedures applied	Default value of 28 from IPCC Fifth Assessment Report (AR5). Shall be updated according to any future VERRA decisions.
Purpose of Data	Calculation of baseline emissions

Comments	-

Data / Parameter	$EF_{km,CO2}$
Data unit	t CO_2e/t km
Description	Average CO_2 emission factor for the trucks during the year y
Source of data	The registered PDD
Value applied	0.001097
Justification of choice of data or description of measurement methods and procedures applied	According to methodology ACM0006, this data shall be determined by conducting sample measurements or choosing emission factors applicable for the truck types used from the literature in a conservative manner (i.e. the higher end within a plausible range). The latter option is taken in this project. This value used here is IPCC default value for the US heavy Duty Diesel Vehicle in uncontrolled condition (the highest emission level) which is conservative.
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	$NCV_{diesel,y}$
Data unit	GJ/t
Description	The net calorific value (energy content) of diesel
Source of data	The registered PDD
Value applied	42.652
Justification of choice of data or description of measurement methods and procedures applied	Country-specific value
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	$EF_{CO2,diesel,y}$
Data unit	tCO_2/GJ
Description	The CO_2 emission factor of diesel in year y
Source of data	The registered PDD
Value applied	0.0741

Justification of choice of data or description of measurement methods and procedures applied	IPCC default values
Purpose of Data	Calculation of project emissions
Comments	-

Data / 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
Justification of choice of data or description of measurement methods and procedures applied	As the on-site electricity consumption attributable to the project activity is obtained from grid (CCPG), according to Tool to Calculate Baseline, Project and/or Leakage Emissions from Electricity Consumption (Version 01), 20% can be used as default value for project or leakage electricity consumption sources.
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	$EF_{CH4,BF}$
Data unit	tCH_4/GJ
Description	The CH_4 emission factor for the combustion of biomass residues in the project plant in year y
Source of data	The registered PDD
Value applied	0.0000411
Justification of choice of data or description of measurement methods and procedures applied	Default values
Purpose of Data	Calculation of project emissions
Comments	-

Data / Parameter	$NCV_K \cdot EF_{burning,CH4,k,y}$

Data unit	tCH_4/t
Description	The CH_4 emission factor for the combustion of biomass residues in the project plant in year y
Source of data	The registered PDD
Value applied	0.001971
Justification of choice of data or description of measurement methods and procedures applied	Default values
Purpose of Data	Calculation of baseline emissions
Comments	-

4.2 Data and Parameters Monitored

With consideration of the fact of the Project, data and parameters monitored are summarized in below tables.

Data / Parameter	$EG_{projectplant,y}$
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	The measure meter is 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. Data type: Measured Archiving procedure: Paper and Electronic Responsibility: The monitoring team was responsible for monitoring including monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the calibration and maintenance of the measuring equipment. Calibration Frequency: Once in one year
Frequency of monitoring/recording	Continuously measured by meter and monthly recorded

Value monitored

Please refer to ER spreadsheet for monthly data.

Period		Value
01-Jan-2013	31-Dec-2013	138,732.072
01-Jan-2014	31-Dec-2014	101,427.254
01-Jan-2015	31-Dec-2015	55,395.652
01-Jan-2016	31-Dec-2016	59,613.986
01-Jan-2017	31-Dec-2017	100,768.298
Total		455,937.262

Monitoring equipment

Bi-directional electric meter[7]

Type	Serial number	Accuracy class	Date of calibration	Validity
DTSD 188s (old measure meter M1)	G014MS000391	0.5s	10-Nov-2012 03-Nov-2013 01-Nov-2014	09-Nov-2013 02-Nov-2014 31-Oct-2015
DTSD 188s (old check meter M1')	G014MS000383	0.5s	10-Nov-2012 03-Nov-2013 01-Nov-2014	09-Nov-2013 02-Nov-2014 31-Oct-2015
DSZ188 (New	47304-2-	0.2S	07-May-2015 05-May-2016	06-May-2016 04-May-2017

[7]The old two electricity meters M1 and M1' (DTSD188s, G014MS000391 and G014MS000383) with an accuracy of 0.5s installed at the import of the new Wucun electric transformer were used as bi-directional electricity meters to monitor the exported and imported electricity. On 02-Jun-2015, the local grid company installed two new electricity meters with an accuracy of 0.2s (DSZ1884, 7304-2-11301669 and 47304-2-11301670) at supply side of the project site to monitor exported and imported electricity due to the change of property rights of grid-connected line.

	meas ure meter M1)	113016 69		06-Apr-2017	05-Apr-2018
	DSZ1 88 (New check meter M1')	47304-2-113016 70	0.2S	07-May-2015 05-May-2016 06-Apr-2017	06-May-2016 04-May-2017 05-Apr-2018
QA/QC procedures to be applied	The consistency of metered net electricity generation should be crosschecked with receipts from electricity sales and purchases, and the quantity of fuels fired. During the first VCS monitoring period, the power generation efficiency is 18.70%. Though power generation efficiency is the 22.52% in this monitoring period higher than previous years, the value is reasonable due to the unstable performance in the initial operation of the project and improvement of conversion efficiency in this monitoring period. The meters were installed and calibrated based on the national standard DL/T 448 and JJG596.				
Purpose of the data	Calculation of baseline emissions				
Calculation method	NA				
Comments	NA				

Data / 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 installed at the feeding inlet of the boiler to measure continuously the quantity of biomass residues combusted in the project plant. Data aggregated monthly was recorded in the monthly consumption statistics spreadsheet. Adjust for the moisture content in order to determine the quantity of dry biomass. And please refer to below parameter Moisture content of the biomass residues for relevant moisture content. Data type: Measured Archiving procedure: Paper and Electronic

<table>
<tr><td></td><td>Responsibility: The monitoring team was responsible for monitoring including monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the calibration and maintenance of the measuring equipment.

Calibration Frequency: once in one year</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Continuously, prepare annually an energy balance</td></tr>
<tr><td>Value monitored</td><td>Please refer to ER spreadsheet for monthly data.

Biomass residues during this monitoring period:
<table>
<tr><th colspan="2">Period</th><th>$BF_{Maizestalk,y}$</th><th>$BF_{Wastewood,y}$</th></tr>
<tr><td>01-Jan-2013</td><td>31-Dec-2013</td><td>95,156.09</td><td>87,058.35</td></tr>
<tr><td>01-Jan-2014</td><td>31-Dec-2014</td><td>44,260.02</td><td>71,934.61</td></tr>
<tr><td>01-Jan-2015</td><td>31-Dec-2015</td><td>19,460.51</td><td>46,494.39</td></tr>
<tr><td>01-Jan-2016</td><td>31-Dec-2016</td><td>15,895.65</td><td>28,075.39</td></tr>
<tr><td>01-Jan-2017</td><td>31-Dec-2017</td><td>26,403.57</td><td>97,317.69</td></tr>
<tr><td colspan="2">Total</td><td>201,175.84</td><td>330,880.43</td></tr>
</table></td></tr>
<tr><td>Monitoring equipment</td><td>Electronic belt weight:
<table>
<tr><th>Type</th><th>Serial number</th><th>Accuracy class</th><th>Date of calibration</th><th>Validity</th></tr>
<tr><td>ICS-17B-1400</td><td>12060401</td><td>0.5</td><td>11-Dec-2012
10-Dec-2013
09-Dec-2014
08-Dec-2015
07-Dec-2016
06-Dec-2017</td><td>10-Dec-2013
09-Dec-2014
08-Dec-2015
07-Dec-2016
06-Dec-2017
05-Dec-2018</td></tr>
</table></td></tr>
<tr><td>QA/QC procedures to be applied</td><td>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;</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Calculation method</td><td>-</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / Parameter	$BF_{T,k,y}$

<table>
<tr><td>Data unit</td><td>Tons of dry matter</td></tr>
<tr><td>Description</td><td>Quantity of biomass residue type k that has been transported to the project site during the year y</td></tr>
<tr><td>Source of data</td><td>On-site measurement</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Use weight meter installed in the gate of the project site to determine once for the mass of each freight transported. Then, the relevant staff records the type and mass of the biomass of each freight transported in the monthly fuel statistics spreadsheet.
Adjust for the moisture content in order to determine the quantity of dry biomass.
Data type: Measured
Archiving procedure: Electronic
Responsibility: The monitoring team was responsible for monitoring including monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the calibration and maintenance of the measuring equipment.
Calibration Frequency: once in one year</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Continuously, prepare annually an energy balance</td></tr>
<tr><td>Value monitored</td><td>Please refer to ER spreadsheet for monthly data.
Biomass residues during this monitoring period:
<table>
<tr><th colspan="2">Period</th><th>Value</th></tr>
<tr><td>01-Jan-2013</td><td>31-Dec-2013</td><td>277,836.30</td></tr>
<tr><td>01-Jan-2014</td><td>31-Dec-2014</td><td>208,117.35</td></tr>
<tr><td>01-Jan-2015</td><td>31-Dec-2015</td><td>101,722.50</td></tr>
<tr><td>01-Jan-2016</td><td>31-Dec-2016</td><td>62,087.37</td></tr>
<tr><td>01-Jan-2017</td><td>31-Dec-2017</td><td>205,755.34</td></tr>
<tr><td colspan="2">Total</td><td>855,518.86</td></tr>
</table></td></tr>
<tr><td>Monitoring equipment</td><td>Weight meter:
<table>
<tr><th>Type</th><th>Serial number</th><th>Accuracy class</th><th>Date of calibration</th><th>Validity</th></tr>
<tr><td>XK3190-A9 (SCS-80)</td><td>0710430</td><td>III</td><td>12-Dec-2012
08-Dec-2013
05-Dec-2014
03-Dec-2015
02-Dec-2016</td><td>11-Dec-2013
07- Dec-2014
04-Dec-2015
02-Dec-2016
01-Dec-2017</td></tr>
</table></td></tr>
</table>

				01-Dec-2017	30-Nov-2018
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; It is conservative to use quantity of biomass residue based on wet basis for project emission calculation.				
Purpose of the data	Calculation of project emissions				
Calculation method	-				
Comments	-				

Data / Parameter	Moisture content of the biomass residues
Data unit	% Water content
Description	Moisture content of each biomass residues type k
Source of data	On-site measurements
Description of measurement methods and procedures to be applied	Use moisture analyzer installed in gate of the project site to determine once for the water content of the biomass of each freight transported. Then, the relevant staff records the water content of the biomass of each freight transported in the monthly fuel statistics spreadsheet. Adjust for the moisture content in order to determine the quantity of dry biomass. Data type: Measured Archiving procedure: Electronic Responsibility: The monitoring team was responsible for monitoring including monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the calibration and maintenance of the measuring equipment. Calibration Frequency: Once in one year
Frequency of monitoring/recording	Continuously, monthly mean values are calculated based on the water content of the biomass of each freight transported.
Value monitored	Please refer to ER spreadsheet for monthly data. The actual ER is calculated by the monthly data of moisture content. Annual average of biomass residues moisture during this monitoring period:

Period		Maizestalk (%)	Wastewood (%)
01-Jan-2013	31-Dec-2013	36.50%	40.42%
01-Jan-2014	31-Dec-2014	39.43%	40.82%
01-Jan-2015	31-Dec-2015	41.21%	48.45%
01-Jan-2016	31-Dec-2016	26.03%	29.19%
01-Jan-2017	31-Dec-2017	43.36%	34.88%

Monitoring equipment

Moisture analyzer (Ma1):

Type	Serial number	Accuracy class	Date of calibration	Validity
Sh-10A	-	0.2%	07-May-2012 25-Apr--2013 23-Apr-2014 21-Apr-2015 15-Apr-2016 13-Apr-2017	06-May-2013 24-Apr--2014 22-Apr-2015 20-Apr-2015 14-Apr-2017 12-Apr-2018

QA/QC procedures to be applied	The random sample of the biomass residues were monitored by moisture analyzer when the biomass residues are transported into the project site each time, and calculate the mean values calculated monthly used in ER calculation sheet. To ensure the authenticity of the value, the project owner invited the technician of local Quality Testing Bureau to calibrate the moisture analyzer used for monitoring annually.
Purpose of the data	Calculation of baseline and project emissions
Calculation method	-
Comments	-

Data / Parameter	TL_y
Data unit	t
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	Determined by averaging the weights of each truck carrying biomass to the project plant

<table>
<tr><td>procedures to be applied</td><td></td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Continuously, calculated by averaging the weights of each truck carrying biomass to the project plant annually</td></tr>
<tr><td>Value monitored</td><td>
<table>
<tr><th colspan="2">Period</th><th>Value</th></tr>
<tr><td>01-Jan-2013</td><td>31-Dec-2013</td><td>10.98</td></tr>
<tr><td>01-Jan-2014</td><td>31-Dec-2014</td><td>10.56</td></tr>
<tr><td>01-Jan-2015</td><td>31-Dec-2015</td><td>9.22</td></tr>
<tr><td>01-Jan-2016</td><td>31-Dec-2016</td><td>8.36</td></tr>
<tr><td>01-Jan-2017</td><td>31-Dec-2017</td><td>14.35</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>-</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>The average truck load was determined by averaging the weights of each truck carrying biomass to the project plant which were recorded continuously and calculated annually.</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of project emissions</td></tr>
<tr><td>Calculation method</td><td>-</td></tr>
<tr><td>Comments</td><td>-</td></tr>
</table>

Data / 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	50*2

Monitoring equipment	-
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); During this monitoring period, all the biomass residues supply sites are within 50 kilometers away around the site of the Project. Therefore, the 100 kilometers (AVD_y) is conservative for project emission calculation.
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	-

Data / Parameter	$FF_{project\ plant,diessl,y}$
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	/
Frequency of monitoring/recording	Continuously
Value monitored	0
Monitoring equipment	-
QA/QC procedures to be applied	Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	During the actual operation of the project, no diesel is needed for the ignition as the biomass residues used in the project are easy to be burnt in the boiler. During the previous monitoring period from 28-Oct-2009 to

	31- Dec-2012, the diesel consumption for ignition was 0, therefore the flow meter F1 has been dismantled in 02-Feb-2013 by the project owner.

Data / Parameter	$FF_{projectsite,diesel,y}$
Data unit	t
Description	Quantity of diesel combusted at the project site for other purposes that are attributable to the project activity during the year y
Source of data	On-site measurement by the records of diesel purchase and remained
Description of measurement methods and procedures to be applied	The fuel consumption quantities were from available purchase invoices from the financial records[8] which is conservative for project calculation.
Frequency of monitoring/recording	Continuously
Value monitored	
Monitoring equipment	-
QA/QC procedures to be applied	Cross-check the measurements with diesel purchase invoice.
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	For the diesel used in forklifts, the consumption was determined by the records of diesel purchase and remained, and the measurements were crosschecked by diesel purchase invoice.

Period		Value
01-Jan-2013	31-Dec-2013	92.08
01-Jan-2014	31-Dec-2014	88.965
01-Jan-2015	31-Dec-2015	43.77
01-Jan-2016	31-Dec-2016	33
01-Jan-2017	31-Dec-2017	95.92
Total		356.90

[8] The reason is that the project did not use flow meter to monitor the quantity of diesel fuel for the igniting and transporting during this monitoring period. And the relevant deviation has been described in the section 3.2.2 of this monitoring report.

<table>
<tr><td>Data / Parameter</td><td>$EC_{PJ,y}$</td></tr>
<tr><td>Data unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>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</td></tr>
<tr><td>Source of data</td><td>On-site measurement</td></tr>
<tr><td>Description of measurement methods and procedures to be applied</td><td>Use Electricity meter.
Data type: Measured
Archiving procedure: Paper and Electronic
Responsibility: The monitoring team was responsible for monitoring including monitoring, aggregating and processing original data, crosscheck and archiving of monitoring data, and the calibration and maintenance of the measuring equipment.

Calibration Frequency: Once in one year</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Continuously</td></tr>
<tr><td>Value monitored</td><td>
<table>
<tr><td colspan="2">Period</td><td>Value</td></tr>
<tr><td>01-Jan-2013</td><td>31-Dec-2013</td><td>236.68</td></tr>
<tr><td>01-Jan-2014</td><td>31-Dec-2014</td><td>70.8</td></tr>
<tr><td>01-Jan-2015</td><td>31-Dec-2015</td><td>0</td></tr>
<tr><td>01-Jan-2016</td><td>31-Dec-2016</td><td>0</td></tr>
<tr><td>01-Jan-2017</td><td>31-Dec-2017</td><td>0</td></tr>
<tr><td colspan="2">Total</td><td>307.48</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>Electric meter (M2):
<table>
<tr><td>Type</td><td>Serial number</td><td>Accuracy class</td><td>Date of calibration</td><td>Validity</td></tr>
<tr><td>DTS72</td><td>KSE005040</td><td>1.0s</td><td>13-Oct-2012
11-Oct-2013</td><td>12-Oct-2013
10-Oct-2014</td></tr>
</table>
</td></tr>
<tr><td>QA/QC procedures to be applied</td><td>Cross-check measurement results with receipts for purchased electricity if available</td></tr>
<tr><td>Purpose of the data</td><td>Calculation of project emissions</td></tr>
<tr><td>Calculation method</td><td>-</td></tr>
<tr><td>Comments</td><td>Only one stalk collection site was built to collect stalks since the start of the project, and the on-site electricity consumption at the stalk</td></tr>
</table>

	collection site was measured by an electricity mete (M2) installed on this collecting site. Since 10-March-2014, this stalk collection site has been closed and all biomass is transported directly to the project site. Therefore M2 has been dismantled and the electricity consumed by the project activity is 0 from 10-March-2014 onward.

Data / 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 were sent to local Quality Testing Bureau every six months for analysis during this monitoring period.
Frequency of monitoring/recording	Measured every six months, taking at least three samples for each measurement
Value monitored	The annual net calorific value equals to the maximum of net calorific values of biomass residue measured every six months which are listed below table.
Monitoring equipment	-

Period		$NCV_{Maizestalk}$	$NCV_{Wastewood}$
01-Jan-2013	31-Dec-2013	14.96	13.52
		13.52	12.65
01-Jan-2014	31-Dec-2014	12.13	14.17
		8.24	12.96
01-Jan-2015	31-Dec-2015	13.73	13.29
		12.61	13.29
01-Jan-2016	31-Dec-2016	13.38	13.9
		11.64	13.44
01-Jan-2017	31-Dec-2017	13.64	13.99
		10.73	13.4

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. Ensured that the NCV is determined on the basis of dry biomass.
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	-

Data / 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	-
Frequency of monitoring/recording	Annually
Value monitored	
Monitoring equipment	-
QA/QC procedures to be applied	-

Period		Maizestalk	Wastewood
01-Jan-2013	31-Dec-2013	283,493	197,458
01-Jan-2014	31-Dec-2014	232,451	184,635
01-Jan-2015	31-Dec-2015	193,661	159,894
01-Jan-2016	31-Dec-2016	204,016	140,875
01-Jan-2017	31-Dec-2017	214,524	208,118

Purpose of the data	Calculation of leakage emissions
Calculation method	-
Comments	-

Data / 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	-
Frequency of monitoring/recording	Annually
Value monitored	
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of the data	Calculation of leakage emissions
Calculation method	-
Comments	-

Period		Maizestalk	Wastewood
01-Jan-2013	31-Dec-2013	383,900	257,900
01-Jan-2014	31-Dec-2014	384,100	247,800
01-Jan-2015	31-Dec-2015	379,300	240,000
01-Jan-2016	31-Dec-2016	383,900	247,800
01-Jan-2017	31-Dec-2017	384,000	268,700

4.3 Monitoring Plan

1. Organizational structure, responsibilities and competencies

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

There is a VCS director as a leader of the VCS 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 3.

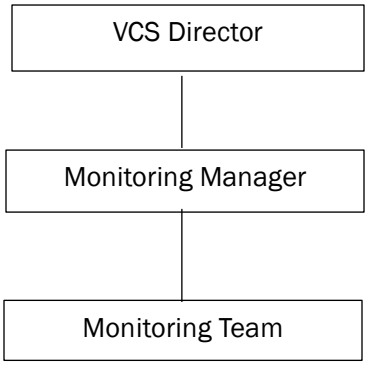

Figure 2 Monitoring structure of the Project

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

The monitoring manager is responsible for the overall implementation and management of the monitoring plan for this project, including data collection, ERs calculation, preparing monitoring reports and cooperating with VVB 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 or 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 was 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 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 was measured by sending the random sample to local Quality Testing Bureau for analysis every six months, taking at least three samples for each measurement and the mean values calculated annually. 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 was 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 was 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 for operation of forklifts at the project site which 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.

The two bi-directional electricity meters M1 (measure meter) and M1' (check meter) with an accuracy of 0.5s were used as gate-meters to monitor the exported and imported electricity since the project start operation. On 02-Jun-2015, the local grid company replaced the gate meters with two new bi-directional electricity meters with an accuracy of 0.2s which could be more fit for the remote monitoring, and according to the latest Power Purchase Agreement signed between the project owner and the grid company on 09-May-2016, the new gate meters have been installed at supply side of the project site due to the change of property rights of grid-connected line. Both of the old and new meters have been calibrated regularly in line with the relevant regulations, and the new meters have higher accuracy than the old ones, so there was no influence on the ER calculation due to the meter replacement. The monitoring team records the bidirectional electricity meter's readings and complete Meter Reading Records at 24:00 hr of the 23rd day of each month.

The difference between export ($EG_{export,y}$) and import ($EG_{import,y}$) electricity is the net electricity generation supplied by the project plant/unit to the grid ($EG_{projectplant,y}$).

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). Before 10-March-2014, 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. The monitoring team records the M2 electricity meter's readings and complete Meter Reading Records at 24:00 hr of the last day of each month. Since 10-March-2014, this stalk collection site has been closed and all biomass is transported directly to the project site. Therefore M2 has been dismantled and the electricity consumed by the project activity is 0 from 10-March-2014 onward. 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 4 and Table 2

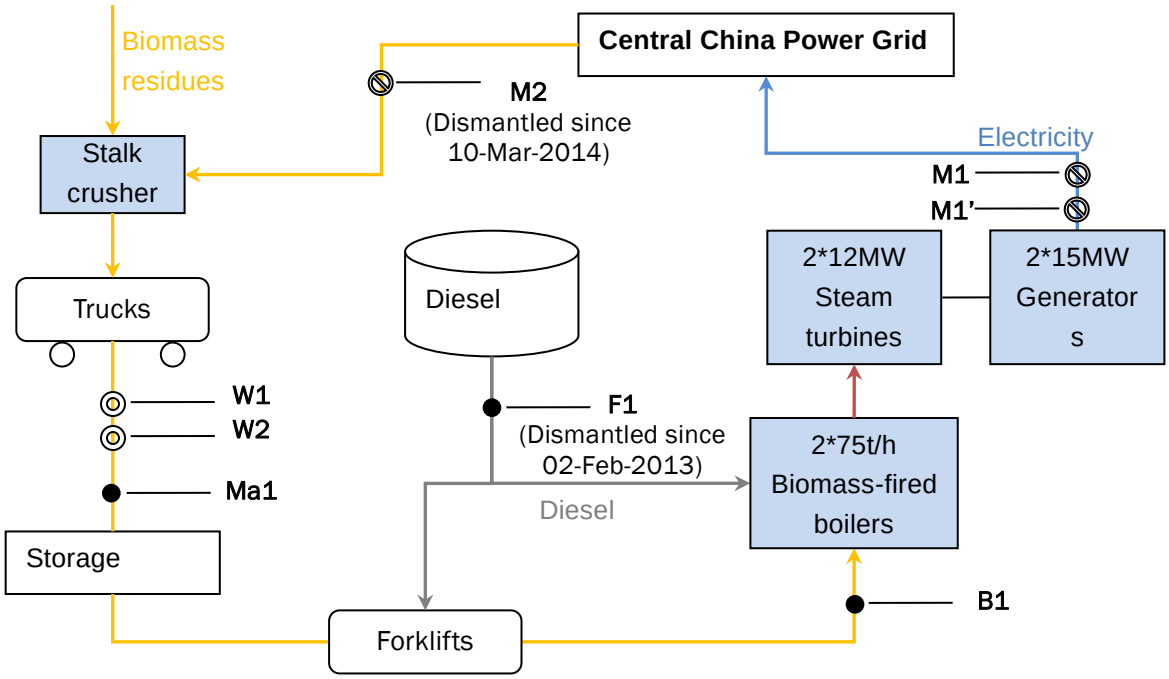

Figure 3: the monitoring diagram of the project

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 From 02-Jun-2015 onwards, the meter was installed on supply side of the project site
M1'	Check meter, measuring the net electricity generated by the project	Import of the New Wucun Electric Transformer Substation From 02-Jun-2015 onwards, the meter was installed on supply side of the project site
M2	Electricity meter, measuring the on-site electricity consumption attributable to the project activity	Stalk collection sites, dismantled since 10-March-2014

W1	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) in the project plant	Diesel tank, dismantled since 02-Feb-2013

4. QA/QC

Training program

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 VCS monitoring team are in charge of daily maintenance of the equipment.

5. Emergency procedure

Electricity meters

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 VVB.

(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.

Electronic belt weight

When the electronic belt weight is broken, the biomass consumption data could be calculated by energy balance based on purchased quantities and stock changes, the most conservative approach will be applied in ER calculation.

Weight meter

When malfunction of weight meter appears, the relevant monitoring data could be calculated by combusted quantities and stock changes, the most conservative approach will be applied in ER calculation.

Moisture analyzer

When malfunction of moisture analyzer appears, the historical data would be used by choosing the most conservative data.

If the failure of whole power generation system occurs, no VCUs should be claimed until it has been recovered.

During this monitoring period, there is no emergency happened.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

According to the methodology ACM0006, the emission reductions of this project are calculated following formula (1) in the registered PDD and the baseline emissions are not defined directly. As per the baseline scenario of this project defined in registered PDD, the baseline emissions are calculated as follows:

1. Emission reductions 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, $EG_{project\ plant,y}$ = 455,937.262 MWh, and $EF_{electricity,y}$ = 0.9735 tCO_2e/MWh.

So $\boldsymbol{ER_{electricity,y}}$ = 455,937.262 MWh × 0.9735 tCO_2e/MWh = 443,854.92 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 $\boldsymbol{ER_{heat,y}}$ = 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} = 28 tCO_2e/tCH_4, $BF_{PJ,k,y} = \sum BF_{k,y}$ = (201,175.84 + 330,880.43) = 532,056.27 t, and $NCV_k * EF_{burning,CH4,k,y}$ = 0.001971 tCH_4/t,

So $\boldsymbol{BE_{biomss,y}}$ = 28 tCO_2e/tCH_4 ×532,056.27t × 0.001971 tCH_4/t = 29,363.12 tCO_2e

Therefore,

Baseline emission ($\boldsymbol{BE_y}$) = $\boldsymbol{ER_{electricity,y}}$ + $\boldsymbol{BE_{biomss,y}}$ =443,854.92 tCO_2e+ 29,363.12 tCO_2e = 473,214 tCO_2e

In summary, during this monitoring period, the annual baseline emission is listed as below.

Period	$EG_{projectplant,y}$	$ER_{electricity,y}$	$BF_{maizestalk,y}$	$BF_{wastewood,y}$	$BE_{biomass,y}$	BE_y
	MWh	tCO_2e	t	t	tCO_2e	tCO_2e
01-Jan-2013~31-Dec-2013	138,732.072	135,055.67	95,156.09	87,058.35	10,056.05	145,111
01-Jan-2014~31-Dec-2014	101,427.254	98,729.16	44,260.02	71,934.61	6,412.55	105,151
01-Jan-2015~31-Dec-2015	55,395.652	53,737.92	19,460.51	46,494.39	3,639.92	57,567
01-Jan-2016~31-Dec-2016	59,613.986	57,448.88	15,895.65	28,075.39	2,426.67	60,460
01-Jan-2017~31-Dec-2017	100,768.298	97,180.13	26,403.57	97,317.69	6,827.93	104,925
Total	**455,937.262**	**443,854.92**	**201,175.84**	**330,880.43**	**29,363.12**	**473,214**

5.2 Project Emissions

The project emissions are calculated as follow:

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;

k refers to the types of biomass residues used in the project plant and that have been transported to the project plant in year y.

During the current monitoring period, according to above equation, the annual ***PET$_y$*** was listed in below table.

Period	$BF_{T,maizestalk,y}$	TL_y	AVD_y	$EF_{km,CO2,y}$	PET_y
	t	t	km	tCO_2/km	tCO_2e
	A	B	C	D	E=A/B*C*D
01-Jan-2013~31-Dec-2013	277,836.30	10.98	100	0.001097	2,776
01-Jan-2014~31-Dec-2014	208,117.35	10.56	100	0.001097	2,162
01-Jan-2015~31-Dec-2015	101,722.50	9.22	100	0.001097	1,211
01-Jan-2016~31-Dec-2016	62,087.37	8.36	100	0.001097	815
01-Jan-2017~31-Dec-2017	205,755.34	14.35	100	0.001097	1,573
Total	**855,518.86**				**8,537**

So ***PET$_y$*** = 2,776 tCO_2e +2,162 tCO_2e +1,211 tCO_2e +815 tCO_2e +1,573 tCO_2e =8,537 tCO_2e

Carbon dioxide emissions from on-site consumption of fossil fuels (*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, *$FF_{project\ site,i,y}$* = 356.90 t, according to above equation, the annual ***PEFF$_y$*** was listed in below table.

Period	$FF_{projectsite,diesel,y}$+ $FF_{projectplant,diesel,y}$	$NCV_{diesel,y}$	$EF_{CO2,diesel,y}$	$PEFF_y$
	t	GJ/t	tCO_2/GJ	tCO_2e
	A	B	C	D=A*B*C
01-Jan-2013~31-Dec-2013	92.08	42.652	0.0741	291
01-Jan-2014~31-Dec-2014	88.965	42.652	0.0741	281
01-Jan-2015~31-Dec-2015	43.77	42.652	0.0741	138
01-Jan-2016~31-Dec-2016	33	42.652	0.0741	104
01-Jan-2017~31-Dec-2017	99.08	42.652	0.0741	313
Total	356.90			1,127

So ***PEFF$_y$*** =291 tCO_2e +281 tCO_2e +138 tCO_2e +104 tCO_2e +313 tCO_2e = 1,127 tCO_2e

CO_2 emissions from electricity consumption (*$PE_{EC,y}$*)

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

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, according to above equation, the annual ***$PE_{EC,y}$*** was listed in below table.

Period	$EC_{PJ,y}$	TDL_y	*$EF_{EL,j,y}$*	$PE_{EC,y}$
	MWh	%	tCO_2e/MWh	tCO_2e
	A	B	C	D=A*(1+B) *C
01-Jan-2013~31-Dec-2013	236.68	20%	0.9735	276
01-Jan-2014~31-Dec-2014	70.8	20%	0.9735	83
01-Jan-2015~31-Dec-2015	0	20%	0.9735	0

01-Jan-2016~31-Dec-2016	0	20%	0.9735	0
01-Jan-2017~31-Dec-2017	0	20%	0.9735	0
Total	**307.48**			**359**

So $PE_{EC,y}$ =276 tCO_2e+83 tCO_2e = 359 tCO_2e.

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

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

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, according to above equation, the annual $PE_{biomass,CH4,y}$ was listed in below table.

Period	$BF_{maizestalk,y}$	$BF_{wastewood,y}$	$NCV_{maizestalk}$	$NCV_{wastewood}$	$EF_{CH4,BF}$	$PE_{biomass,CH4,y}$
	t	t	GJ/t	GJ/t	tCH_4/GJ	tCH_4
	A	B	C	D	E	=(A*C+B*D)*E
01-Jan-2013~31-Dec-2013	95,156.09	87,058.35	14.96	13.52	0.0000411	107
01-Jan-2014~31-Dec-2014	44,260.02	71,934.61	12.13	14.17	0.0000411	64
01-Jan-2015~31-Dec-2015	19,460.51	46,494.39	13.73	13.29	0.0000411	36
01-Jan-2016~31-Dec-2016	15,895.65	28,075.39	13.38	13.9	0.0000411	25

01-Jan-2017~31-Dec-2017	26,403.57	97,317.69	13.64	13.99	0.0000411	71
Total	**201,175.84**	**330,880.43**	-	-		**303**

So $PE_{biomass,CH4,y}$ = 107 tCH_4+64 tCH_4+36 tCH_4+25 tCH_4+71 tCH_4= 303 tCH_4

Therefore,

Project emissions (PE_y) = $PET_y + PEEF_y + PE_{EC,y} + GWP_{CH4} \times PE_{biomass,CH4,y}$ = 8,537 tCO_2e + 1,127 tCO_2e + 359 tCO_2e + 28 tCO_2e/ tCH_4 × 303 tCO_2e = 18,507 tCO_2e

In summary, during this monitoring period, the annual project emission is listed as below.

Period	PET_y	$PEFF_y$	$PE_{EC,y}$	$GWP_{CH4}*PE_{biomass,CH4,y}$	PE_y
	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
	A	B	C	D	E=A+B+C+D
01-Jan-2013~31-Dec-2013	2,776	291	276	2,996	6,339
01-Jan-2014~31-Dec-2014	2,162	281	83	1,792	4,318
01-Jan-2015~31-Dec-2015	1,211	138	0	1,008	2,357
01-Jan-2016~31-Dec-2016	815	104	0	700	1,619
01-Jan-2017~31-Dec-2017	1,573	313	0	1,988	3,874
Total	**8,537**	**1,127**	**359**	**8,484**	**18,507**

5.3 Leakage

Estimated project leakage emissions:

Based on the analysis below, 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 (LE_y) = 0.

Category	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	
2013	Maize stalk	383,900	3,932	76,873	107,532	0	95,156	**283,493**	35.42%
	Waste wood	257,900	0	0	0	110,400	87,058	**197,458**	30.61%
	Total	641,800	3,932	76,873	107,532	110,400	182,214	**480,951**	33.44%
2014	Maize stalk	384,100	3,910	76,784	107,497	0	44,260	**232,451**	65.24%
	Waste wood	247,800	0	0	0	112,700	71,935	**184,635**	34.21%
	Total	631,900	3,910	76,784	107,497	112,700	116,195	**417,086**	51.50%
2015	Maize stalk	379,300	3,839	73,246	97,115	0	19,461	**193,661**	95.86%
	Waste wood	240,000	0	0	0	113,400	46,494	**159,894**	50.10%
	Total	619,300	3,839	73,246	97,115	113,400	65,955	**353,555**	75.16%
2016	Maize stalk	383,900	3,839	76,784	107,497	0	15,896	**204,016**	88.17%
	Waste wood	247,800	0	0	0	112,800	28,075	**140,875**	75.90%
	Total	631,700	3,839	76,784	107,497	112,800	43,971	**344,891**	83.16%
2017	Maize stalk	384,000	3,839	76,784	107,497	0	26,404	**214,524**	79.00%
	Waste wood	268,700	0	0	0	110,800	97,318	**208,118**	29.11%
	Total	652,700	3,839	76,784	107,497	110,800	123,721	**422,641**	54.43%

Data source: Special Report of Biomass Fuel in Huixian City (2013, 2014, 2015, 2016 and 2017).

5.4 Net GHG Emission Reductions and Removals

According to the Section 5.1, 5.2 and 5.3 above,

BE_y = 473,214 tCO_2e;

PE_y = 18,507 tCO_2e;

LE_y = 0 tCO_2e;

Therefore, $ER_y = BE_y - PE_y - LE_y$ = 473,214 tCO_2e -18,507 tCO_2e -0 tCO_2e =454,707 tCO_2e

This monitoring period started from 01-Jan-2013 to 31-Dec-2017, with totally 1,826 days. Based on the annual estimated emission reductions from the registered VCS PD, the amount of emission reductions for this monitoring period would be 123,858 tCO_2e/ 365 d×1,826d=619,629 tCO_2e. The actual emission reductions in this monitoring period (1,826 days) are 454,707 tCO_2e, which is 26.62 % less than the estimation in the registered PDD.

As per section 3.1 in this report, during this monitoring period, the total shutdown time is 335 days. The project was shut down for period from 24-Nov-2015 to 23-May-2016 (182 days), the main reason is that adjustment and implement of the company internal rules and regulations due to change of shareholding of Xinxiang Tianjie Bio-Power Generation Co., Ltd.. The remaining 153 days of the shutdown time due to normal overhaul and debugging. Thus, the actual operation days of the project are 1,491 days which is 18.35% lower than 1,826 days. Thus, the fluctuation is at normal level.

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
01-Jan-2013~31-Dec-2013	145,111	6,339	0	138,772
01-Jan-2014~31-Dec-2014	105,151	4,318	0	100,833
01-Jan-2015~31-Dec-2015	57,567	2,357	0	55,210
01-Jan-2016~31-Dec-2016	60,460	1,619	0	58,841
01-Jan-2017~31-Dec-2017	104,925	3,874	0	101,051
Total	473,214	18,507	0	454,707