



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03-in effect as of: 28 July 2006**

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**SECTION A. General description of project activity****A.1. Title of the project activity:**

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Henan Xinxiang 24MW Biomass based Cogeneration Project

Version: 10

Date: 05/03/2013

A.2. Description of the project activity:

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

The existing scenario prior to the start of the implementation of the project activity is: the electricity estimated to be generated was obtained from Central China Power Grid (hereinafter as CCPG); the heat was generated by coal-fired boilers with low efficiency; and the biomass residues was dumped or left to decay without utilizing for energy purposes.

Purpose of this project is to generate electricity and heat by utilizing surplus stalks and waste wood in the project region. Installed capacity of this project is 24MW (2*12MW) and electricity generated will be supplied to the CCPG dominated by fossil fuel fired power plants (64.2% of installed capacity in 2006) to displace equivalent electricity from the grid, and the heat will be supplied into factories near the project site which will generate the equivalent heat by coal-fired boilers in the absence of this project. 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 CCPG; the generation of heat with 909,200GJ/yr; and the utilization of biomass residues for cogeneration of power and heat.

The baseline scenario of this project is the same as the scenario existing prior to the start of implementation of the project activity as mentioned above.

As the scenario of this project mentioned above, the emission sources and gases of the project activity includes CO₂ emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity; CO₂ emissions from off-site transportation of biomass residues that are combusted in the project plant; and CH₄ emissions from combustion of biomass residues for electricity and heat generation.

The emission sources and gases of the baseline scenario includes CO₂ emissions from fossil fuel fired power plants connected to CCPG; CO₂ emissions from fossil fuel based heat generation that is displaced through the project activity; and CH₄ emissions from decay of surplus biomass residues.

The proposed project will not claim the emission reductions due to displacement of heat that would be generated by coal-fired boilers, 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 CO₂ emission. In addition, CH₄ emissions will be reduced by avoiding dumping of biomass residues. As a result, 123,858 tCO₂e emission reductions will be generated annually.



The proposed biomass fired cogeneration project without utilization of fossil fuel has remarkable environmental and social benefits. 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 will mitigate environmental pollution and reduce the GHG emissions, because the pollution caused by biomass fired power plant is less than fossil fuel fired plant;
- This project will increase income of local farmers and accelerate economy development in rural areas through purchase of agricultural stalks. It will also reduce environmental pollution from dumping of biomass residues;
- Ash generated from the biomass burning will be used to produce fertilizer, which has remarkable environmental benefits;
- During construction and operation of this project, direct and indirect employment opportunities will be generated.

A.3. Project participants:

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Table 1: Project participants

Name of Party involved (*) (host) indicates a host Party)	Private and/or public entity(ies) project participants (*)(as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant(Yes/No)
People's Republic of China (host)	Xinxiang Tianjie Bio-Power Generation Co., Ltd	No
United Kingdom of Great Britain and Northern Ireland	Goldman Sachs International	No

(see **Annex 1** for detail)

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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People's Republic of China

A.4.1.2. Region/State/Province etc.:

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Henan Province

A.4.1.3. City/Town/Community etc:

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Huangli Village, Wucun Town, Huixian County

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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

The coordinates of the project site are:

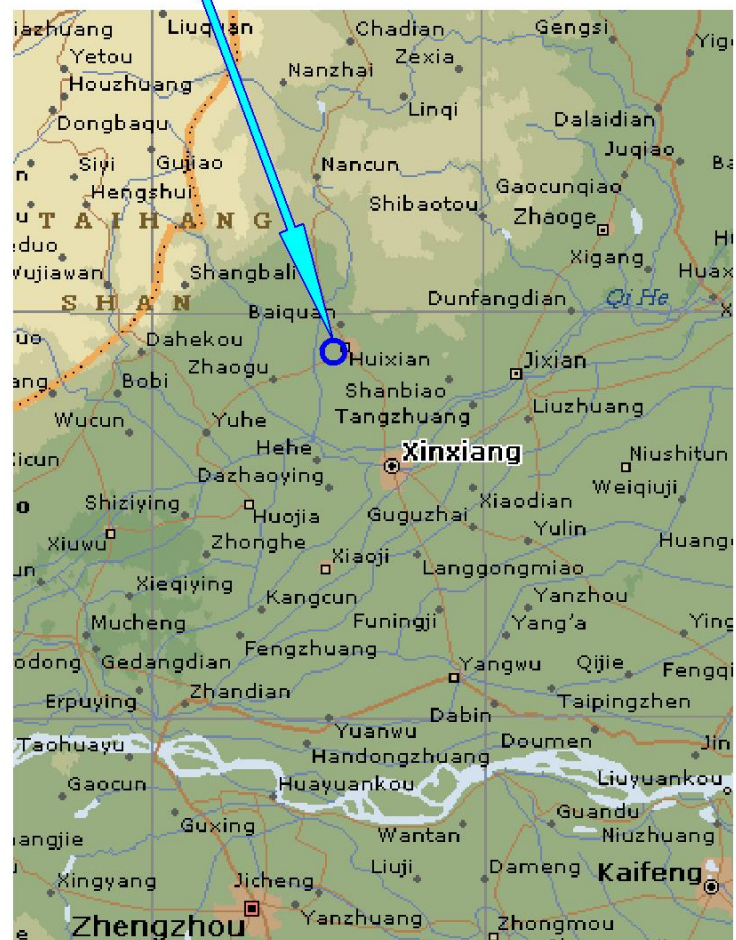
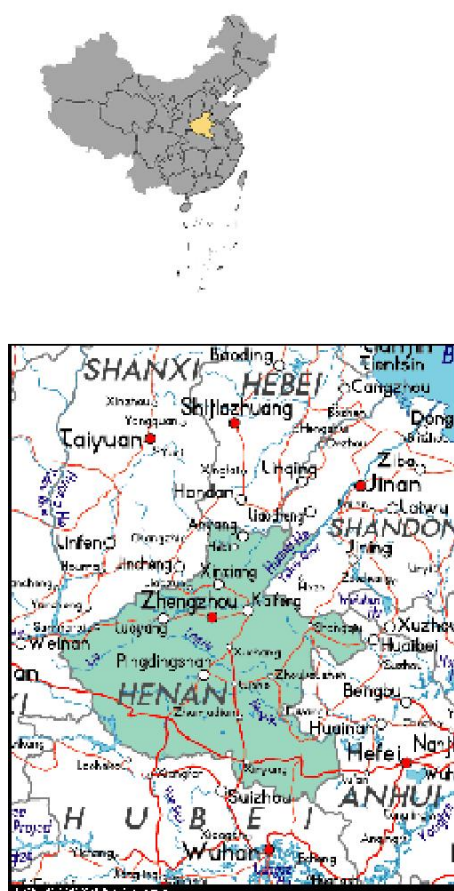
Longitude: 113°30'40" E

Latitude: 35°19'50" N

Geographical location of the project is shown in **Figure 1** below.

Figure1: Location of the Henan Xinxiang 24MW biomass based cogeneration project

Project Site



**A.4.2. Category(ies) of project activity:**

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The project activity falls under the following scope and category.

Sectoral Scope: 1 Energy Industries (renewable / non-renewable sources).

A.4.3. Technology to be employed by the project activity:

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Purpose of this project is to generate electricity and heat by utilizing surplus stalks and waste wood in the project region and achieve the GHG emission reductions by displacing the equivalent electricity.

Existing scenario

The existing scenario prior to the start of the implementation of the project activity is:

The electricity estimated to be generated was obtained from CCPG which includes provincial power grids of Jiangxi, Henan, Hubei, Hunan, Chongqing and Sichuan, and dominated by fossil fuel fired power plants;

The heat was generated by coal-fired boilers with low efficiency;

The biomass residues was dumped or left to decay without utilizing for energy purposes.

There are 7 existing coal-fired boilers which located in 7 local factories around the project site. In the absence of this project, these coal-fired boilers would continue to supply heat as their remaining lifetimes are covering at least the first crediting period, and they will be retired due to the installation of this project. According to the declaration of the owners of these 7 factories, these coal-fired boilers will be shut down once this project comes into operation. The parameters of these boilers are shown in **Table 2** and **Table 3**.

Table 2: Parameters of the existing coal-fired boilers for heat generation prior to the start of this project

	Position	Type	Capacity (t/h)	Lifetime (yr)	Year of starting operation	Expected year of retire	Efficiency	Load factor
1	Yanguang Hongtai Bio-product Co., Ltd.	SZL20-1.25-AII	20	20	2007	2027	80%	62%
2	Huixian Zhongzhou Textile Mill	SZH2-0.7	2	20	1998	2018	78%	24%
3	Huixian Xinyang Textile Mill	DZL2-1.25	2	20	1998	2018	78%	24%
4	Huixian Tengyuan Textile Mill	DZL1.5-1.25	1.5	20	1998	2018	78%	24%
5	Huixian Hengtai Building Material Factory	DZL4-1.25	4	20	2007	2027	80%	62%
6	Huixian Huayi Building Material Factory	DZL4-1.25	4	20	2007	2027	80%	62%
7	Huixian Hongchang	DZL4-1.25	4	20	2007	2027	80%	62%



Building Material Factory							
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Data sources: Technological Specification of 7 coal-fired boilers.

Table 3: Fuel consumption of the existing coal-fired boilers

	Position	Type	Fuels	Quantity of fuels (t)		
				2006	2007	2008
1	Yanguang Hongtai Bio-product Co., Ltd.	SZL20-1.25-AII	Anthracite	-	9258	21568
2	Huixian Zhongzhou Textile Mill	SZH2-0.7	Anthracite	861	863	941
3	Huixian Xinyang Textile Mill	DZL2-1.25	Anthracite	890	812	925
4	Huixian Tengyuan Textile Mill	DZL1.5-1.25	Anthracite	880	845	936
5	Huixian Hengtai Building Material Factory	DZL4-1.25	Anthracite	-	2752	6562
6	Huixian Huayi Building Material Factory	DZL4-1.25	Anthracite	-	2351	6858
7	Huixian Hongchang Building Material Factory	DZL4-1.25	Anthracite	-	3765	6568

Data sources: Operation Statements of 7 coal-fired boilers.

The emission sources and GHG gases of the existing scenario includes:

CO₂ emissions from fossil fuel fired power plants connected to the electricity system;

CO₂ emissions from fossil fuel based heat generation that is displaced through the project activity;

CH₄ emissions from decay of surplus biomass residues.

Baseline scenario

The baseline scenario of this project is the same as the scenario existing prior to the start of implementation of the project activity as mentioned above.

Project scenario

This project will install 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, parameters of the main facilities are estimated to be shown in **Table 4** below. Annual electricity output is estimated to be 126,709 MWh which will be supplied to the CCPG. Electricity generated from this project will be delivered to distribution equipment in the factory and then delivered to new Wucun electric transformer substation with 35kV or 110kV. The new Wucun electric transformer substation is connected to Xinxiang Power Grid which is ultimately connected to CCPG. The heat generated will be supplied to 7 factories around through steam pipe networks with the pressure of 0.98MPa, and the total quantity of heat supplied is estimated to be 909,200 GJ per year.



For the heat displacement, according to Operation Statements of the consumers, the 7 existing coal-fired boilers which belong to the consumers for heat generation will be shut down once the proposed project comes into operation, and their heat generation will be displaced by this project based on the *heat supply agreements* signed between the project owner and the consumers.

This project will not claim for emission reductions due to displacement of heat.

Therefore, the project scenario is:

The installation of 2*12MW cogeneration plants based on biomass residues;

The electricity of 126,709 MWh/yr supplied into CCPG;

The heat of 909,200 GJ/yr supplied to consumers;

The utilization of biomass residues with 176,160 t/yr for cogeneration of power and heat.

Table 4: Parameters of the main equipments estimated in this project

Boiler	
Type	YG-75/3.82-T
Quantity	2
Rated evaporative capacity	75t/h
Steam-gas pressure	3.821MPa
Steam-gas temperature	450°C
Water temperature	150°C
Air preheater temperature	150°C
Funnel temperature	140°C
Efficiency	83%
Turbine	
Type	C12-3.43/0.98
Quantity	2
Rated installed capacity	12MW
Inlet pressure	3.43MPa
Inlet temperature	435°C
Rated steam flow	75t/h
Rated revolution	3000r/min
Rated extraction pressure	0.98MPa
Rated extraction amount	25t/h
Maximal extraction amount	75t/h
Cooling water temperature	20°C
Rated back-pressure	0.0043MPa
Generator	
Type	QF-15-2
Quantity	2
Rated power	15MW
Rated voltage	6300V
Rated current	1617A



Rated power factor	0.8
Rated frequency	50Hz
Rated revolution	3000r/min

Data sources: Equipment Purchase Agreements of Xinxiang Tianjie Bio-Power Generation Project.

There are 26 towns and villages in Huixian County, and this project plans to build 25 stalk collecting sites respectively in each towns and villages except Wucun Town which could send stalks into the plant directly. Each collecting site can store about 4,000 tons of stalks which will be transported to project site by trucks, and the stalks will not be stored longer than one year.

All technologies are obtained within China and no technology is transferred for the proposed CDM project.

The emission sources and GHG gases of this project activity includes:

CO₂ emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity. This includes fossil fuels co-fired in the project plant, fossil fuels used for on-site transportation or fossil fuels or electricity used for the preparation of the biomass residues; and

CO₂ emissions from off-site transportation of biomass residues that are combusted in the project plant;

CH₄ emissions from combustion of biomass residues for electricity and heat generation

The monitoring equipments and their location used in this project are shown as **Table 5** below, for complete monitoring information, please refer to B.7 of the PDD.

Table 5: Main monitoring equipments used in this project

Equipments	Functions	Location
Electricity meters	Monitor the quantity of electricity generated in this project and delivered to the grid.	The outlet of the generator and the connection point with the power grid.
Weight meter	Monitor the quantity of the biomass residues transported to the project plant.	The gate of the project site.
Moisture analyzer	Monitor the moisture of the biomass residues used in this project.	The gate of the project site

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

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This project adopts renewable crediting periods of 7 years. The total GHG emissions reduction is estimated to be 867,006 tCO₂e in the first crediting period, as shown in **Table 6** below.

Table 6: Emission reductions in the first crediting period

Years	Annual estimation of emission reductions (tCO ₂ e)
2010	123,858
2011	123,858
2012	123,858
2013	123,858



2014	123,858
2015	123,858
2016	123,858
Total estimated reductions in the first crediting period(tCO₂e)	867,006
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tCO₂e)	123,858

A.4.5. Public funding of the project activity:

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No public funding from Annex I countries is involved in the project activity.

**SECTION B. Application of a baseline and monitoring methodology****B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

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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

Sources: <http://cdm.unfccc.int/methodologies/PAMethodologies/approved.html>

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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The methodology ACM0006 is applicable to biomass residue fired electricity generation project activities, including greenfield power projects, power capacity expansion projects, energy efficiency improvement projects and fuel switch projects, which may be based on the operation of a power plant located in an agro-industrial plant generating the biomass residues or as an independent plant supplied by biomass residues coming from the nearby area or a market.

This project is a greenfield power project (installation of a new biomass residue fired cogeneration plant) based on the operation of an cogeneration plant supplied by biomass residues coming from nearby area. The particular applicability conditions are list following:

Table 7: The applicable conditions of ACM0006

The applicable conditions of ACM0006	Description of this project activity
No other biomass types than biomass residues (defined as biomass that is a by-product, residue or waste stream from agriculture, forestry and related industries) are used	Fuel fired in this project plants is agricultural stalks and waste wood, no other biomass types are used; according to national regulation ¹ , the

¹ NDRC. Provisional Measures for the Price and Apportioned Cost Management for the Electricity Generation from Renewable Energy Resources. 2006



in the project plant and these biomass residues are the predominant fuel used in the project plant;	percent of co-fire fossil fuel in biomass power plants should not exceed 20%, for this project, these biomass residues mentioned above are the only fuel used in this project plant besides a little diesel used during start-up process;
For projects that use biomass residues from a production process, the implementation of the project should not result in an increase of the processing capacity of raw input or in other substantial changes in process;	The biomass residues used in this project are not from a production process;
The biomass residues used by project facility should not be stored for more than one year;	As the biomass residues used for this project are mainly crop stalks, their collecting frequency is planned to be twice a year for season factor, and the storage period is 4-6 months, less than one year;
No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion.	Except from transportation and process of the biomass compressing and fragmentation, there is no other biomass preparation process requiring significant energy quantities.

According to Table2 in ACM0006, the baseline scenario of this project is Scenario 2, which means this project activity involves the installation of a new biomass residue fired power plant at a site and the power generated by the project plant is fed into the grid; the heat would in the absence of the project activity be generated in boilers fired with fossil fuels; and the biomass residues would in the absence of the project activity be dumped or left to decay without utilizing it for energy purposes.

Based on the above analysis, it can be concluded that the project meets all the requirements. Therefore ACM0006 is appropriate to this project.

B.3. Description of how the sources and gases included in the project boundary

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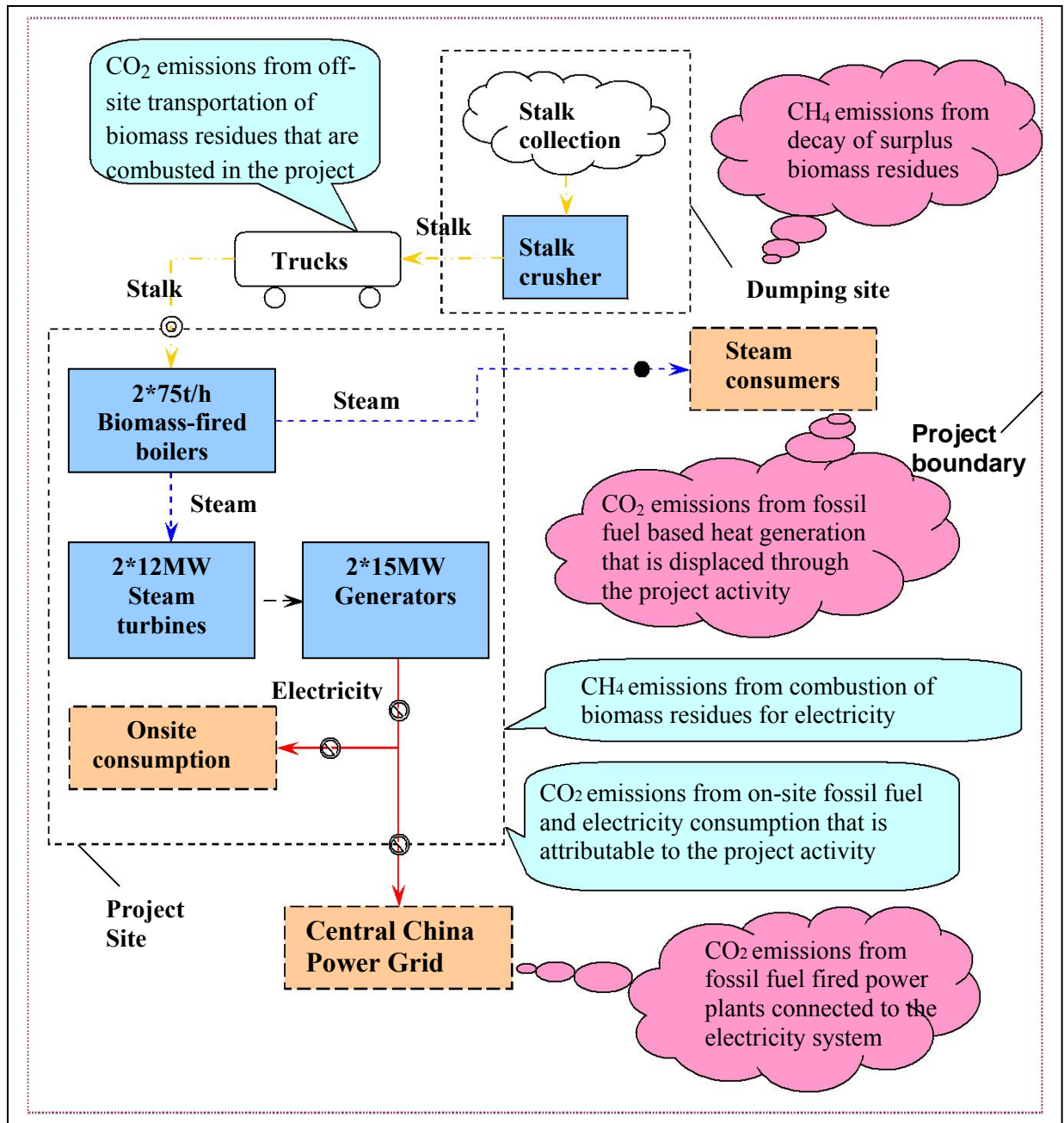
As the electricity generated by this project will be supplied to the CCPG, which includes provincial power grids of Jiangxi, Henan, Hubei, Hunan, Chongqing, Sichuan, according to ACM0006, the spatial extent of the project boundary encompasses:

- The power plants at the project site;
- The means for transportation of biomass residues;
- All power plants connected physically to the CCPG this project power plant is connected to;
- The site where the biomass residues would have been left for decay or dumped.

The project boundary is shown in **Figure 2** as below.

According to methodology, sources and gases included in the project boundary are shown in the **Table 8**.

Figure 2: Project Boundary



→ Flow of stalk
 → Flow of steam
 → Flow of electricity

⊙ Electricity meter ● Steam meter (one of the total seven) ⊙ Weighing machine

☁ Project emissions

☁ Baseline emissions

▭ Equipment

▭ Consumer

**Table 8:** The sources and gases included in the project boundary

	<u>Source</u>	<u>Gas</u>	<u>Included?</u>	<u>Justification/explanation</u>
Baseline	Electricity generation	CO ₂	Included	Main emission source
		CH ₄	Excluded	Excluded for simplification. This is conservative.
		N ₂ O	Excluded	Excluded for simplification. This is conservative
	Heat generation	CO ₂	Included	Main emission source
		CH ₄	Excluded	Excluded for simplification. This is conservative.
		N ₂ O	Excluded	Excluded for simplification. This is conservative
	Uncontrolled burning or decay of surplus biomass residues	CO ₂	Excluded	It is assumed that CO ₂ emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector.
		CH ₄	Included	This emission source is chosen to be included in the baseline.
		N ₂ O	Excluded	Excluded for simplification. This is conservative
Project activity	On-site fossil fuel and electricity consumption due to the project activity (stationary or mobile)	CO ₂	Included	Main emission source
		CH ₄	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N ₂ O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Off-site transportation of biomass residues	CO ₂	Included	Main emission source
		CH ₄	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N ₂ O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Combustion of biomass residues for electricity and / or heat generation	CO ₂	Excluded	It is assumed that CO ₂ emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector.
		CH ₄	Included	This emission source must be included because CH ₄ emissions from uncontrolled burning or decay of biomass in the baseline scenario are included.
		N ₂ O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Storage of biomass residues	CO ₂	Excluded	It is assumed that CO ₂ emissions from surplus biomass do not lead to changes of carbon pools in the LULUCF sector.
		CH ₄	Excluded	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be very small.
		N ₂ O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Waste water from the treatment of biomass residues	CO ₂	Excluded	It is assumed that CO ₂ emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH ₄	Excluded	There is no waste water treated under anaerobic conditions in this project activity.
		N ₂ O	Excluded	Excluded for simplification. This emissions source is assumed to be very small.



B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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According to methodology ACM0006, approved *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality* is used to identify the most plausible baseline scenario and demonstrate and assess the additionality of this project in the following four steps:

- STEP 1. Identification of alternative scenarios;
- STEP 2. Barrier analysis;
- STEP 3. Investment analysis;
- STEP 4. Common practice analysis.

Step 1. Identification of alternative scenarios

Sub-step 1a. Define alternative scenarios to the proposed CDM project

According to methodology ACM0006, realistic and credible alternatives should be separately determined regarding:

- How **power** would be generated in the absence of the CDM project activity;
- What would happen to the **biomass residues** in the absence of the project activity;
- In case of cogeneration projects: how the **heat** would be generated in the absence of the project activity.

According to *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality*, the analysis in this step should define a relevant geographical area. As the framework conditions vary significantly between each province of China, the Henan province where this project located is selected to be the relevant geographical area, and it is appropriate because there are far more than 10 cogeneration projects with the comparable quality, properties and application areas as the proposed CDM project in Henan province.

Alternatives for power generation:

Table 9: The applicable baseline alternatives for power generation

	Baseline alternatives for power generation	Applicability for this project activity
P1	This project activity not undertaken as a CDM project activity.	Construction of a new biomass fired power plant with the same capacity without registration of as a CDM project complies, P1 can be considered as a baseline scenario.
P2	The continuation of power generation in an existing biomass residue fired power plant at the project site, in the same configuration, without retrofitting and fired with the same type of biomass residues as (co-)fired in the project activity.	There are no existing biomass fired power plants at the project site, therefore, P2 cannot be even considered as a realistic baseline alternative.
P3	The generation of power in an existing captive power plant, using only fossil fuels.	There are no fossil fuel fired captive power plants around the project site, therefore, P3 cannot be even considered as a realistic baseline alternative.



P4	The generation of power in the grid.	Can be considered as a baseline alternative.
P5	The installation of a new biomass residue fired power plant, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	Can be considered as a plausible baseline alternative.
P6	The installation of a new biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity, therefore, the power output is the same as in the project case.	Can be considered as a plausible baseline alternative.
P7	The retrofitting of an existing biomass residue fired power, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	There are no existing biomass fired power plants around the project site, therefore, P7 cannot be even considered as a realistic baseline alternative.
P8	The retrofitting of an existing biomass residue fired power that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity.	There are no existing biomass fired power plants around the project site, therefore, P8 cannot be even considered as a realistic baseline alternative.
P9	The installation of a new fossil fuel fired captive power plant at the project site.	Can be considered as a baseline alternative.
P10	The installation of a new single- (using only biomass residues) or co-fired (using a mix of biomass residues and fossil fuels) cogeneration plant with the same rated power capacity as the project activity power and heat plant, but that is fired with a different type and/or quantity of fuels (biomass residues and/or fossil fuels). The annual amount of biomass residue used in the baseline scenario is lower than that used in the project activity.	Except maize stalk and waste wood which are used in this project, the other types of biomass residues available around the project site are wheat stalk, soybean stalk, oil plants stalk and other stalks. The amount of available soybean stalk, oil plants stalk and other stalks is very small which is completely insufficient for this project; the wheat stalk has lower net calorific value than maize stalk and waste wood, which means the annual amount of wheat stalk used should be higher than that used in the project activity. In



		addition, according to national regulation ² , the co-fired power plant (using a mix of biomass residues and fossil fuel) whose energy consumption from fossil fuel exceeds 20% should be considered as a normal fossil fuel fired power plant and cannot obtain the subsidy (0.25 CNY/kWh) for renewable energy sources, so it is economically unattractive for project owner to install a co-fired power plant. Therefore, P10 cannot be even considered as a realistic baseline alternative.
P11	The generation of power in an existing fossil fuel fired cogeneration plant co-fired with biomass residues, at the project site.	There is no existing fossil fuel fired cogeneration plant co-fired with biomass residues around the project site, therefore, P11 cannot be even considered as a realistic baseline alternative

Based on the analysis in **Table 9**, the only realistic and credible baseline scenario for power generation is **P1, P4, P5, P6 and P9**.

Alternatives for heat generation:

According to methodology ACM0006, the most plausible baseline scenario for the generation of heat should also be defined as this project activity is the cogeneration of power and heat.

Table 10: The applicable baseline alternatives for heat generation

	Baseline alternatives for heat generation	Application for this project activity
H1	The proposed project activity not undertaken as a CDM project activity.	Can be considered to be a baseline alternative.
H2	The proposed project activity (installation of a cogeneration power plant), fired with the same type of biomass residues but with a different efficiency of heat generation (e.g. an efficiency that is common practice in the relevant industry sector).	Can be considered as a plausible baseline alternative.
H3	The generation of heat in an existing captive cogeneration plant, using only fossil fuels.	There is no existing captive cogeneration plant at the project site, thus H3 can not be considered to be a realistic and credible baseline alternative.
H4	The generation of heat in boilers using the same type of biomass residues.	There is no other existing biomass-based boiler at the project site prior to this project, thus H4 can not be considered to be a realistic and credible baseline alternative.

² NDRC. Provisional Measures for the Price and Apportioned Cost Management for the Electricity Generation from Renewable Energy Resources. 2006



H5	The continuation of heat generation in an existing biomass residue fired cogeneration plant at the project site, in the same configuration, without retrofitting and fired with the same type of biomass residues as in the project activity.	There is no other existing biomass residue fired cogeneration plant at the project site, thus H5 can not be considered to be a realistic and credible baseline alternative.
H6	The generation of heat in boilers using fossil fuels.	There are 7 coal-fired boilers used for heat generation prior to the implementation of this project, in the absence of this project, these coal-fired boilers would continue to supply heat as their remaining lifetimes are covering at least the first crediting period; and it is unlikely that they will be replaced by other boilers fired with other type of fossil fuels because coal is the most cost-effective fossil fuel in China according to the price and thermal value ³ . Thus H6 can be considered to be a realistic alternative, and the fossil fuel type used for heat generation in the absence of the project activity is coal.
H7	The use of heat from external sources, such as district heat.	There is no other external sources existing near the project site, thus H7 can not be considered to be a realistic and credible baseline alternative.
H8	Other heat generation technologies (e.g. heat pumps or solar energy).	There is no other heat generation technologies or resources (e.g. heat pumps or solar energy) available near the project site that could supply equivalent amount of heat generated by this project, thus H8 can not even be considered to be a realistic and credible baseline alternative.
H9	The installation of a new single- (using only biomass residues) or co-fired (using a mix of biomass residues and fossil fuels) power and heat plant with the same rated power capacity as the project activity power and heat plant, but that is fired with a different type and/or quantity of fuels (biomass residues and/or fossil fuels). The annual amount of biomass residue used in the baseline scenario is lower than that used in the project activity.	Except maize stalk and waste wood which are used in this project, the other types of biomass residues available around the project site are wheat stalk, soybean stalk, oil plants stalk and other stalks. The amount of available soybean stalk, oil plants stalk and other stalks is very small which is completely insufficient for this project; the wheat stalk has lower net calorific value than maize stalk and waste wood, which means the annual amount of wheat stalk used should be higher than that used in the project activity. In addition, according to national regulation ⁴ , the co-fired power plant (using a mix of biomass

³<http://oil.nengyuan.net/ranliaoyou/>, <http://coal.nengyuan.net/mtjg/jghz/>, <http://oil.nengyuan.net/trqsc/hq/>
http://www.chinaprice.gov.cn/fgw/ProxyServlet?server=e450&urls_count=1&url=eneg/C_0_0_0.htm

⁴ NDRC. Provisional Measures for the Price and Apportioned Cost Management for the Electricity Generation from Renewable Energy Resources. 2006



		residues and fossil fuel) whose energy consumption from fossil fuel exceeds 20% should be considered as a normal fossil fuel fired power plant and cannot obtain the subsidy (0.25 CNY/kWh) for renewable energy sources, so it is economically unattractive for project owner to install a co-fired power plant. Therefore, H9 cannot be even considered as a realistic baseline alternative.
H10	The generation of power in an existing fossil fuel fired cogeneration plant co-fired with biomass residues, at the project site.	There is no existing fossil fuel fired cogeneration plant co-fired with biomass residues around the project site, therefore, P11 cannot be even considered as a realistic baseline alternative.

Based on the analysis in **Table 10**, the realistic and credible baseline scenarios for heat generation are the alternative **H1**, **H2** and **H6**.

Alternatives for the use of biomass residues

The biomass residues used in this project include maize stalks and waste wood, the estimated amount of utilization is list in Table 11:

Table 11: The estimated amount of biomass residues used in this project

Types of biomass residues	Estimated amount of utilization (t)	Percentage
Maize stalk	88080	50%
Waste wood	88080	50%
Total	176160	100%

As the sources of these two type of biomass residues are the same (purchased from local farmers) and the use of them in the absence of this project are the same too, the applicable baseline alternatives for them will be analyzed together.

Table 12: The applicable baseline alternatives for the use of biomass residues

	Baseline alternatives for the use of biomass residues	Application for this project activity
B1	The biomass residues are dumped or left to decay under mainly aerobic conditions, this applies, for example, to dumping and decay of biomass residues on fields.	The biomass residues used in this project are surplus, and the demand for these biomass residues is not expected to increase significantly by other sources in foreseeable future, so it is credible these biomass residues will be left unused (dumped or left to decay) around the project site without this project, therefore, B1 is a realistic baseline alternative for unused biomass.
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions, this applies, for example, to deep landfills with more than 5	If the biomass residues are dumped or left to decay under clearly anaerobic conditions, the biomass residues must be covered with sand or soil, and



	metres, and it does not apply to biomass residues that are stock-piled or left to decay on fields.	thus certain investment is unavoidable. As a result, alternative B2 is economically less attractive and not a realistic alternative compared with B1.
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.	The biomass residues used in this project are surplus, and the demand for these biomass residues is not expected to increase significantly by other sources in foreseeable future, so it is credible that these biomass residues will be burned in an uncontrolled manner without this project, so alternative B3 is a realistic baseline alternative for unused biomass.
B4	The biomass residues are used for heat and/or electricity generation at the project site.	Can be considered as a plausible baseline alternative.
B5	The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power plants.	There is no other power plant or cogeneration plant using biomass residues around the project site, and power plants at other sites are unlikely to use these surplus biomass residues considering transportation cost, therefore, alternative B5 is not a realistic baseline alternative for unused biomass.
B6	The biomass residues are used for heat generation in other existing or new boilers at other sites.	There are no existing boiler using biomass residues as fuel around the project site, and boilers at other sites are unlikely to use these surplus biomass residues considering transportation cost, therefore alternative B6 is not a realistic baseline alternative for unused biomass.
B7	The biomass residues are used for other energy purposes, such as the generation of biofuels.	Prior to this project, only small quantity of biomass residues are used for feedstock or fertilizer, leaving the remaining biomass residues dumped to decay (see Table 18 for details), the biomass residues used in this project are surplus, therefore B7 is not a realistic baseline alternative for unused biomass.
B8	The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes.	Prior to this project, only small quantity of biomass residues are used for feedstock or fertilizer, leaving the remaining biomass residues dumped to decay (see Table 18 for details), so the biomass residues utilized in this project will not be used for non-energy purposes in the absence of this project, so B8 is not a realistic baseline alternative for unused biomass.

As the analysis shown in **Table 12**, the realistic and credible baseline scenarios for unused biomass residues are the alternative **B1**, **B3** and **B4**.

Outcome of Step 1a: List of plausible alternative scenarios to the project activity

In conclusion, the possible baseline scenario of this project is: **P1**, **P4**, **P9**; **H1**, **H6**; **B1**, **B3** and **B4**.

***Sub-step 1b. Consistency with mandatory applicable laws and regulations*****1. Power generation**

1) **P1** This project activity not undertaken as a CDM project activity

P1 is in compliance with all laws and regulations.

2) **P4** The generation of power in the grid

P4 is in compliance with all regulations and laws in China.

3) **P5** The installation of a new biomass residue fired power plant, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation than the project plant and therefore with a lower power output than in the project case

P5 is in compliance with all regulations and laws in China.

4) **P6** The installation of a new biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation than the project activity, therefore, the power output is the same as in the project case.

P6 is in compliance with all regulations and laws in China.

5) **P9** The installation of a new fossil fuel fired captive power plant at the project site

According to *Strictly Prohibiting the Installation of Fossil Fuel-fired Generators with the Capacity of 135 MW or Below*⁵ issued by the General Office of the Chinese State Council on Apr 15th 2002, the construction of fossil fuel fired power plants with capacity of less than 135 MW are prohibited in the areas which can be covered by large grids such as provincial grids. As the project has a capacity of 24 MW, which is lower than 135MW, **P9** is not in compliance with all laws and regulations in China.

2. Heat generation

1) **H1** This project activity not undertaken as a CDM project activity

H1 is in compliance with all laws and regulations.

2) **H2** The proposed project activity fired with the same type of biomass residues but with a different efficiency of heat generation

H2 is in compliance with all regulations and laws in China.

2) **H6** The generation of heat in the boilers using fossil fuel.

It is a common practice to generate heat in boilers using fossil fuel in China, so **H6** is in compliance with all regulations and laws in China.

⁵ http://www.gdepb.gov.cn/wrfz/jsxmgl/cyjg/t20040707_16036.htm



3. Use of biomass residues

1) **B1** The biomass residues are dumped or left to decay under mainly aerobic conditions
B1 is in compliance with all laws and regulations.

2) **B3** The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.

The local government has published a regulation to prohibit the uncontrolled burning of crop stalks⁶, so **B3** is not in compliance with all laws and regulations in China.

3) **B4** The biomass residues are used for heat and/or electricity generation at the project site.

B4 is in compliance with all laws and regulations in China.

Outcome of Step 1b: List of plausible alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

In conclusion, baseline scenario alternatives to this project consistent with current laws and regulations are: **P1, P4, P5, P6; H1, H2, H6; B1, B4**

Step 2: Barrier analysis

Sub-step 2a. Identify barriers that would prevent the implementation of alternative scenarios

Establish a complete list of realistic and credible barriers that may prevent the alternative scenarios to occur. Such realistic and credible barriers may include:

- Investment barriers, other than insufficient financial returns as analyzed in Step3;
- Technological barriers;
- Lack of prevailing practice;
- Other barriers, preferably specified in the underlying methodology as examples

Sub-step 2b. Eliminate alternative scenarios which are prevented by the identified barriers

As the sector of power generation (including cogeneration) by using biomass residues is still an immature industry in China^{7,8,9}, so there is no other type of biomass power generation technologies at considerably different efficiency levels available for project developers, The technology adopted in this project using

⁶ People's Government of Wucun Town. The Notification about Delivering the Implement Measures for Comprehensive Utilization of Stalks and Prohibition of Stalk Hewing, Transporting, Burning in Autumn of 2008.

⁷ Jiang Dehou, Liu Kuiyu. The Analyzing of Operation Condition of the Biomass Fuel Fired Power Plants. Forum of Environmental Protection and Ecological Civilization Construction in 10th CAST Annual Conference. 2008

⁸ <http://www.china5e.com/newenergy/newenergynews.aspx?newsid=6591cb94-41f0-4f79-ba25-260ce9cbf411&classid=%u65b0%u80fd%u6e90&panelv=%u5206%u6790%u7efc%u8ff0>

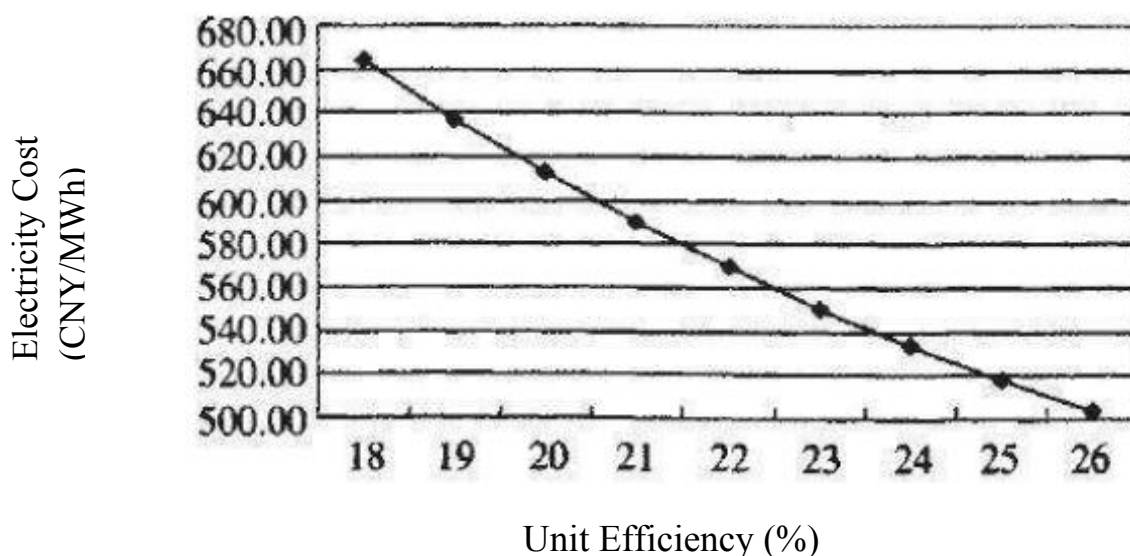
⁹ <http://www.newenergy.org.cn/html/0086/6260818446.html>



medium temperature and medium pressure boilers is common practice, and the efficiency of this project is a general level and also common practice in this sector (refer to **Table 16**).

In addition, installing a biomass power plant with a lower efficiency than the proposed project is more economically unattractive for the project owner. According to “Economic Evaluation and Influence Factors Analysis on Biomass Combustion for Power Generation” published on Renewable Energy Resources in April 2008¹⁰, lower efficiency technology results in higher electricity cost (see **Figure 3**) and less financially attraction for project owner.

Figure 3 Effect of unit efficiency on electricity cost



Therefore, the alternative **P5**, **P6** and **H2** will be prevented by technological barriers, and the rest alternatives can not be prevented by the same barrier.

Outcome of Step 2b: List of alternative scenarios to the project activity that are not prevented by any barrier.

Alternative 1: This project activity not undertaken as a CDM project activity (**P1**, **H1**, **B4**);

Alternative 2: The same electricity output from CCPG, the same heat output from boilers using fossil fuel, and biomass residues be dumped or left to decay under mainly aerobic conditions (**P4**, **H6**, **B1**).

And as analyzed in step3 (see **B.5**. for details), the baseline scenario of this project is Alternative 2 which is the Scenario 2 described in Methodology ACM0006, see **Table 13**:

Table 13: The baseline scenario of this project activity

Scenario	Baseline scenario	Description of the situation
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¹⁰ http://d.wanfangdata.com.cn/Periodical_ncny200802027.aspx



	Power	Biomass	Heat	
2	P4	B1	H6	The project activity involves the installation of a new biomass residue fired cogeneration plant at a site where no power was generated prior to the implementation of the project activity. The power generated by the project plant is fed into the grid. The heat would in the absence of the project activity be generated in boilers fired with fossil fuels. The biomass residues would in the absence of the project activity be dumped or left to decay under mainly aerobic conditions.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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According to methodology ACM0006, approved *Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality* is used to identify the most plausible baseline scenario and demonstrate and assess the additionality of this project:

Step 1. Identification of alternative scenarios

As analysed in section B.4., **outcome of Step 1** - List of plausible alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations - is: **P1, P4, P5, P6; H1, H2, H6; B1**

Step 2: Barrier analysis

As analysed in section B.4., **outcome of Step 2** - List of alternative scenarios to the project activity that are not prevented by any barrier - is:

Alternative 1: This project activity not undertaken as a CDM project activity (**P1, H1, B4**);

Alternative 2: The same electricity output from CCPG, the same heat output from boilers using fossil fuel, and biomass residues be dumped or left to decay under mainly aerobic conditions (**P4, H6, B1**).

As there are more than one alternative, one of which is the proposed project activity undertaken without being registered as a CDM project activity (Alternative 1). According to the tool, then proceed to Step 3.

Step3: Investment Analysis

As the financial benchmark rate of return (after tax) is 8% in Chinese power generation industry¹¹, and this project is to generate electricity based on biomass residues, so the benchmark IRR of this project is determined to be 8%.

The total investment of this project is about 189.92 million CNY. The main financial index and IRR of this

¹¹ Interim Regulation for Economic Evaluation on Electrical Power Project and Technical renovation Project. Chinese Electricity Press. 2003, page 2.



project are shown in **Table 14** below.

Table 14: Financial index

Index	Value
Total investment ¹²	187.29 million CNY
Total operating cost	65.58 million CNY/yr
including:	
Fuel (stalk) cost	54.62 million CNY/yr
Water cost	1.51 million CNY/yr
Material cost	0.89 million CNY/yr
Pollutant expenses	0.16 million CNY/yr
Repair expenses	4.08 million CNY/yr
Employee salary and welfare	2.04 million CNY/yr
Other expenses	2.28 million CNY/yr
Depreciation	10.56 million CNY/yr
Years of depreciation	15 years
Price of electricity for sale	0.586 CNY/kWh in former 15 years and 0.369 CNY/kWh in latter 5 years
Price of heat for sale	29.7 CNY/GJ
Quantity of the electricity for sale	126709 MWh/yr
Quantity of the heat for sale	909,200 GJ/yr
Quantity of the biomass residues utilized	17,616 t/yr
Price of biomass residues	310 CNY/t
VAT rate for electricity	17%
VAT rate for heat	13%
VAT rate for water	6%
Construction tax	5% of VAT
Educational surtax	3% of VAT
Income tax	25% (remitted in former 5 years)
IRR without CERs	5.98%
Price of CERs	€9/CER*
IRR with CERs	17.70%

Data sources: Feasibility Study Report of Xinxiang Tianjie Bio-Power Generation Project;

*: Obtained from Emission Reduction Purchase Agreement of Xinxiang Tianjie Bio-Power Generation Project.

As shown in the table, the IRR of this project is 5.98% without the revenue from the sale of CERs, which is lower than the benchmark IRR, so this project is unlikely to be financially attractive. The IRR with CERs is up to 17.70%.

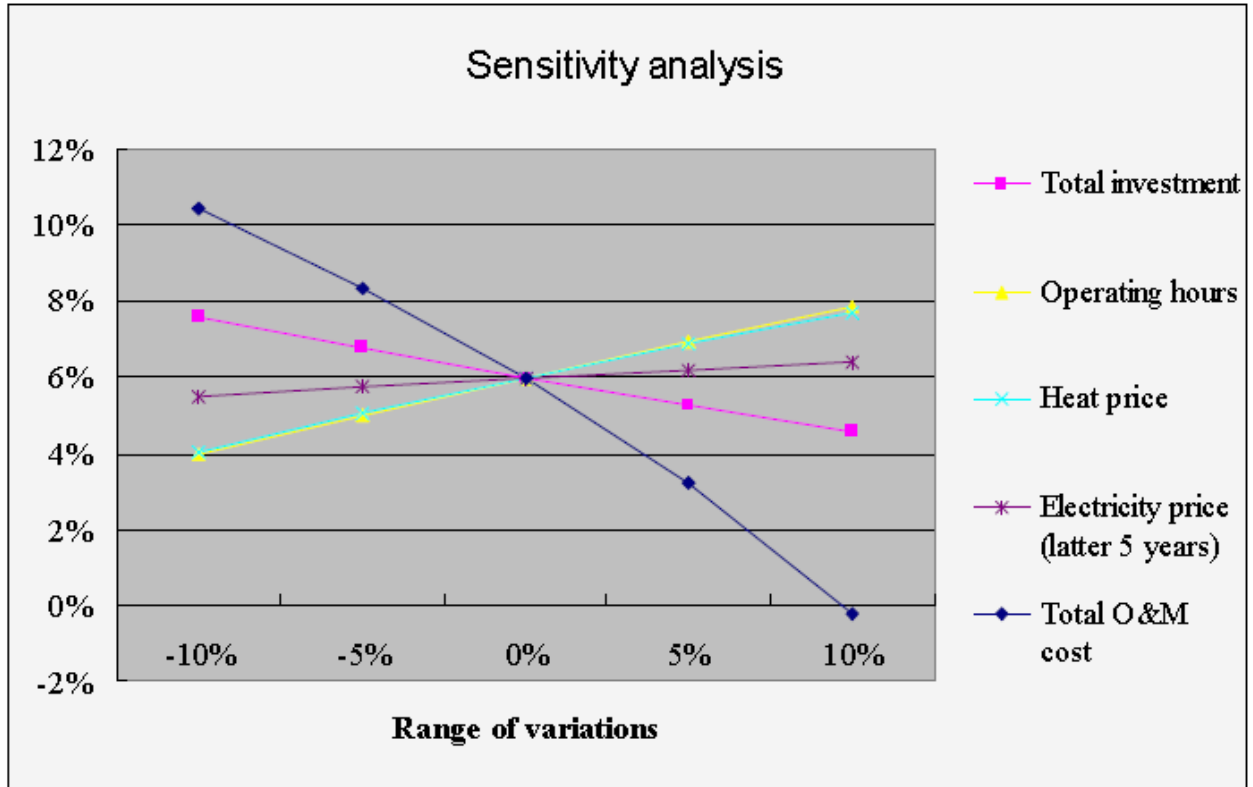
Sensitivity analysis

Considering the reasonable variations in the critical assumptions, the sensitivity analysis is made in allusion

¹² For conservativeness, the investment cost applied in the investment analysis excludes the cost of steam pipelines and the other associated costs due to transportation of the steam to the end users.

to the 5 factors including total investment, total O&M cost, electricity price (latter 5 years), heat price, and operating hours, as shown in **Figure 4**.

Figure4: Sensitivity analysis



It can be shown that the IRR is still below 8% in the variations of total investment, operating hours, electricity price (latter 5 years) and heat price with the range of $\pm 10\%$, and the total O&M cost will cause the most significant impact to the IRR of this project. More detailed results for critical range of variations are list in **Table 15**.

Table 15: Sensitivity analysis

Variations of total investment	-13%	-10%	-5%	0	+5%
IRR	8.14%	7.60%	6.76%	5.98%	5.26%
Variations of operating hours	-5%	0	+5%	+10%	+11%
IRR	5.00%	5.98%	6.93%	7.86%	8.04%
Variations of heat price	-5%	0	+5%	+10%	+12%
IRR	5.04%	5.98%	6.87%	7.71%	8.03%
Variations of electricity price (latter 5 years)	-5%	0	+5%	+10%	+70%
IRR	5.73%	5.98%	6.20%	6.38%	8.01%
Variations of total O&M cost	-4.5%	-2.5%	0	+2.5%	+5%
IRR	8.11%	7.20%	5.98%	4.67%	3.24%

The project IRR will reach the 8% benchmark when the total O&M cost decrease by 4.5%, however, this is unlikely to happen, because the stalk cost in this project accounts for about 83% of the total O&M cost,



and the price keeps increasing in recent years. According to the statistics and analysis made by Development and Reform Commission (DRC) of Huixian City¹³, the price of stalk was rising continuously since the technology of biomass-based generation has been applied in Henan province, the price was 150 CNY/t in 2005 which increased to 200 CNY/t in 2006, and increased to 300 CNY/t in 2007, and the trend of price rising will continue in the foreseeable future. Furthermore, it is reasonable to predict that the market-driven price of biomass fuels will increase once this project start to operate, which leads to a substantial increase in demand. Therefore, this project is financially unattractive in the reasonable variations of total O&M cost.

For electricity price, this price of this project is 0.586 CNY/kWh in former 15 years and 0.369 CNY/kWh in latter 5 years. The former price (0.586 CNY/kWh) is comprised of a benchmark price (0.336 CNY/kWh, the in-grid electricity price of local coal-fired plants in 2005) and a subsidy (0.25 CNY/kWh) for renewable energy sources, according to national regulation¹⁴, and this price will not change in the first 15 years of project operating life and the subsidy will be deducted in the rest years. The latter price (0.369 CNY/kWh) is based on the latest authorized in-grid electricity price of local coal-fired plants. As shown above, the project IRR will reach the 8% benchmark only if the latter price increased by 70% which is 0.628 CNY/kWh. This price is almost near the former price which is unlikely to happen. Actually, the authorized in-grid electricity price of Henan province was 0.336 CNY/kWh in 2005 and 0.369 CNY/kWh in 2008, which leads an average increase of 0.011 CNY/kWh per year. At this rate, the price would increase by 0.22 CNY/kWh in 20 years which is 0.589, lower than 0.628 CNY/kWh. Therefore, this project is financially unattractive in the reasonable variations of electricity price.

For heat price, the project IRR will reach the 8% benchmark only if the heat price increased by 12%. The heat price of this project was determined based on the local price analysis predicted by DRC of Huixian City¹⁵, and this price is strictly regulated by the government thus can not be changed easily and frequently. So, it is unlikely to happen that the heat price increase by 13% by the time this project start to operation. Therefore, this project is financially unattractive in the reasonable variations of heat price.

For total investment, the project IRR will reach the 8% benchmark only if the total investment decreased by 13%. As the installed capacity of this project is 24MW and the total investment is 187.29 million CNY, the total investment per unit capacity is about 7.8 million CNY/MW, and this parameter for similar projects are summarized in **Table 16**. All of the similar projects selected have been registered as CDM projects which could ensure the authenticity of the data value for these projects. It can be shown that the total investment per unit capacity of this project is the lowest one among the similar projects. So the value of total investment estimated in this project is conservative and it is unlikely to happen that the actual total investment decrease by 13% in future. Therefore, this project is financially unattractive in the reasonable variations of total investment.

¹³ DRC of Huixian City. Forecasting Analysis Report of Stalk Price in Huixian City. 2008

¹⁴ NDRC. Provisional Measures for the Price and Apportioned Cost Management for the Electricity Generation from Renewable Energy Resources. 2006

¹⁵ DRC of Huixian City. Assessment of Industrial Heat Price in Region of Huixian City. November of 2007

**Table 16** Statistic of total investment per unit capacity for registered biomass based power projects in China¹⁶

Project location	Registered date	Installed capacity (MW)	Total investment (million CNY)	Investment per unit capacity (million CNY/MW)
Jiangsu Rudong	4-Jun-09	25	281.20	11.25
Hebei Wei County	25-Jun-08	25	264.02	10.56
Jiangsu Sheyang	1-Apr-08	25	276.09	11.04
Shandong Gaotang	20-Mar-08	30	290.96	9.70
Heilongjiang Tangyuan	20-Dec-07	24	269.42	11.23
Shandong Wudi	19-Dec-07	24	247.74	10.32
Shandong Shanxian	17-Jun-07	25	294.18	11.77
Zhongjieneng Jurong	19-Mar-07	24	242.79	10.12
Zhongjieneng Suqian	18-Mar-07	24	241.34	10.06
Henan Luyi	16-Mar-07	25	244.87	9.79
Shandong Yuncheng	12-Mar-07	15	121.56	8.10
Hebei Jinzhou	4-Mar-07	24	259.42	10.81
Henan Xinxiang	-	24	187.29	7.80

For operating hours, the operating hours of this project is expected to be 5932 h/yr at full work load, and the project IRR will reach the 8% benchmark only if the operating hours increased by 11% which is 6585 h/yr. In 2006, the average operating hours for thermal power plants was 5331 h/yr in Henan province¹⁷, and was 5125 h/yr in 2007¹⁸, the national average operating hours was 4911 h/yr in 2008¹⁹, all of which are much lower than this project. The designed operating hours of other registered biomass projects in China are from 5500 to 6975 h/yr²⁰ with an average value of 5998 h/yr which is almost the same as this project. Among these projects, there is only one project (Jiangsu Rudong Biomass Power Generation Project) whose designed operating hour is higher than 6500 h/yr (6975 h/yr²¹), but its actual value is much lower according to the description of its PDD²². So the estimation of the operating hours for this project is conservative, and it is unlikely to happen that the actual operating hour would increase by 11% to reach 6585 h/yr, which is a technically unrealistic number for domestic biomass-fired power units. Therefore, this project is financially unattractive in the reasonable variations of operating hours.

So, the IRR of this project is below the benchmark IRR in the reasonable variations of the key factors, thus

¹⁶ <http://cdm.unfccc.int/Projects/projsearch.html>

¹⁷ China Electric Power Yearbook 2007

¹⁸ China Electric Power Yearbook 2008

¹⁹ <http://www.chppch.com/viewnews-17379.html>

²⁰ <http://cdm.unfccc.int/Projects/projsearch.html>

²¹ Page 16 of the PDD of Jiangsu Rudong Biomass Power Generation Project

<http://cdm.unfccc.int/UserManagement/FileStorage/DQR9FENVA65KZO1L2IT8JY3CUMWS47>

²² Page 17 of the PDD of Jiangsu Rudong Biomass Power Generation Project

<http://cdm.unfccc.int/UserManagement/FileStorage/DQR9FENVA65KZO1L2IT8JY3CUMWS47>



this project is unlikely to be financially attractive.

Outcome of Step 3: Ranking of the short list of alternative scenarios according to the most suitable financial indicator, taking into account the results of the sensitivity analysis.

As analyzed above, the baseline scenario of this project is Alternative 2: The same electricity output from CCPG, the same heat output from boilers using fossil fuel, and biomass residues be dumped or left to decay under mainly aerobic conditions (**P4, H6, B1**), which is not “the proposed project activity undertaken without being registered as a CDM project activity”. Then proceed to step 4.

Step 4: Common Practice analysis:

As described in Step 1 above, the relevant geographical area for this project is defined as Henan province, so the similar activities to this project activity are defined as biomass-based cogeneration projects that take place in a comparable environment in Henan province. So by the time of this project began to construct, the similar project activities are summarized as followed, see **Table 17**.

Table 17 Biomass-based power generation projects in Henan province

Project ²³	Installed capacity	Technology applied	Status ²⁴
Henan Luyi 25MW Biomass Cogeneration Project	25MW	Transferred from Denmark	Registered as a CDM project
Changge Hengguang Biomass Power Generation Project	24MW	Domestic technology (biomass fired boilers with medium temperature and medium pressure)	Applying for registration of CDM
Biomass generation project in Xun county, Henan province, P.R. China	25MW	Transferred from Denmark	Applying for registration of CDM
Henan Changyuan Biomass Power Project	36MW	Domestic technology (biomass fired boilers with medium temperature and medium pressure)	Applying for registration of CDM
Guoneng Fugou Biomass Power Project	24MW	Domestic technology (biomass fired boilers with medium temperature and medium pressure)	Applying for registration of CDM

As seen above, the biomass-based power generation project is not a business as usual (BAU) project in Henan province, and all of the similar projects are applying for registration of CDM to support the construction and operation.

Therefore, this project is not a common practice project and is in compliance with requirements of additionality.

The starting date of this project is June 18th 2008 when the contract for equipment purchase was signed,

²³ <http://www.ccchina.gov.cn/WebSite/CCChina/UpFile/2008/2008121111144663.pdf>

²⁴ <http://cdm.unfccc.int/Projects/Validation/index.html>



which is the earliest date of project implementation, before that, CDM was seriously considered by project owner in the decision to implement the project activity.

When the project owner first planned to construct this project, the relevant researches^{25,26,27} indicated that the sector of power generation (including cogeneration) by using biomass residues is still an immature industry in China. As there was no other biomass power generation project had been implemented in Henan province at that time, the project owner committed Zhengzhou Designing Institute of Coal Industry to pre-assess the feasibility of the proposed project before they prepare the construction. The preliminary investigation including installed capacity, type of equipments, fuel consumption, total investment and IRR of this project, and this information has been combined into the FSR published later, which shows that this kind of project is economically unattractive in general. On March 4th 2007, the first biomass power generation CDM project (Hebei Jinzhou 24MW Straw-fired Power Project) in China was registered, and then Henan Luyi 25MW Biomass Cogeneration Project has also successfully been registered as a CDM project on March 16th 2007²⁸. So the project owner thought there was a chance that this kind of project may have comparative advantages from CDM, and they has seriously considered CDM in board decision about the incentive from the revenue of CERs which is the key to profitability of this project and has signed Emission Reduction Purchase Agreement (ERPA) with Goldman Sachs International (GSI) on January 27th 2008.

The FSR of this project was finished in June 3rd of 2008, which has analyzed the feasibility of this project and clearly pointed that CDM was the key to profitability, so the project owner made the investment decision on June 18th 2008 based on the data of FSR and started to claim the CDM registration for this project in the meantime.

The particular timeline of this project activity is shown in **Table 18** as below:

Table 18: Timeline of this project activity

Date	Project Events and actions	CDM milestones
March 1 st 2007	Zhengzhou Designing Institute of Coal Industry was committed to pre-assess the feasibility of the proposed project	
September 20 th 2007		CDM decision was made by the Board of Shareholders
September 25 th 2007	Contract of services for Feasibility Study Report (FSR) was signed	
October 10 th 2007		Contract with consultant company for CDM services was signed

²⁵ Jiang Dehou, Liu Kuiyu. The Analyzing of Operation Condition of the Biomass Fuel Fired Power Plants. Forum of Environmental Protection and Ecological Civilization Construction in 10th CAST Annual Conference.

2008

²⁶ <http://www.china5e.com/newenergy/newenergynews.aspx?newsid=6591cb94-41f0-4f79-ba25-260ce9cbf411&classid=%u65b0%u80fd%u6e90&panelv=%u5206%u6790%u7efc%u8ff0>

²⁷ <http://www.newenergy.org.cn/html/0086/6260818446.html>

²⁸ <http://cdm.unfccc.int/Projects/projsearch.html>



October 20 th 2007	Contract of services for Environmental Impact Assessment (EIA) was signed	
January 27 th 2008		Emission Reduction Purchase Agreement (ERPA) was signed
June 3 rd 2008	FSR was finished	
June 12 th 2008	EIA was approved	
June 18 th 2008	The investment decision was made (contract for boiler purchase was signed)	Be considered as the starting date of this project
June 22 nd 2008	Contract for turbine and generator purchase was signed	
June 25 th 2008	Contract for construction service was signed	
August 13 th 2008	FSR was approved	
September 1 st 2008		Contract for validation was signed

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

As the baseline analysis described in Part B.4., the baseline scenario of this project activity is:

Scenario	Baseline scenario		
	Power	Biomass	Heat (if relevant)
2	P4	B1	H6

Thus, according to the methodology ACM0006, the emission reductions of this project during the year y will be calculated following:

$$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y$$

(1)

Where:

ER_y are emission reductions of project during the year y , tCO₂e;

$ER_{heat,y}$ are emission reductions due to displacement of heat during the year y , tCO₂e;

$ER_{electricity,y}$ are emission reductions due to displacement of electricity during the year y , tCO₂e;

$BE_{biomass,y}$ are emission reductions due to natural decay or burning of anthropogenic sources of biomass residues during the year y , tCO₂e;

PE_y are project emissions during the year y , tCO₂e;

L_y are leakage emissions during the year y , tCO₂e.

**1. Project emissions (PE_y)**

The project emissions include:

- CO₂ emissions from transportation of biomass residues to the project site (PET_y);
- CO₂ emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$);
- CO₂ emissions from consumption of electricity ($PE_{EC,y}$);
- CH₄ emissions from the combustion of biomass residues ($PE_{biomass,CH_4,y}$), as this emission source is included in the project boundary and relevant in this project.

$$PE_y = PET_y + PEEF_y + PE_{EC,y} + GWP_{CH_4} \cdot (PE_{biomass,CH_4,y} + PE_{WW,CH_4,y})$$

(2)

Where:

PET_y are CO₂ emissions during the year y due to transport of the biomass residues to the project plant, tCO₂e;

$PEFF_y$ are CO₂ emissions during the year y due to fossil fuels co-fired by the generation facility or other fossil fuel consumption at the project site that is attributable to the project activity, tCO₂e;

$PE_{EC,y}$ are CO₂ emissions during the year y due to electricity consumption at the project site that is attributable to the project activity, tCO₂e;

GWP_{CH_4} is Global Warming Potential for methane valid for the relevant commitment period;

$PE_{biomass,CH_4,y}$ are CH₄ emissions from the combustion of biomass residues during the year y, tCH₄.

$PE_{WW,CH_4,y}$ are CH₄ emissions from waste water generated from the treatment of biomass residues during the year y, tCH₄.

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

According to the methodology ACM0006, Option 1 has been chose, i.e. emissions are calculated on the basis of distance and the number of trips (or the average truck load):

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

(3)

Where:

$BF_{T,k,y}$ is quantity of biomass residue type k that has been transported to the project site during the year y (tons of dry matter or liter), t;

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



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;

$EF_{km,CO_2,y}$ is average CO₂ emission factor for the trucks measured during the year y , tCO₂e/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 .

b) Carbon dioxide emissions from on-site consumption of fossil fuels ($PEFF_y$)

The Carbon dioxide emissions from on-site consumption of fossil fuels ($PEFF_y$) are calculated using the latest approved version of the *Tool to Calculate Project or Leakage CO₂ Emissions from Fossil Fuel Combustion*, the formula is:

$$PEEF_y = \sum_i FC_{i,j,y} \cdot COEF_{i,y}$$

(4)

Where:

$FC_{i,j,y}$ is quantity of fuel type i combusted in process j during the year y , t;

$COEF_{i,y}$ is CO₂ emission coefficient of fuel type i in year y , tCO₂e/t;

i refers to the fuel types combusted in process j during the year y .

As the weighted average mass fraction of carbon in fuel type i in year y ($w_{c,i,y}$) can not be available, so Option B is chosen, i.e. the CO₂ emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO₂ emission factor of the fuel type i ,

$$COEF_{i,y} = NCV_{i,y} \cdot EF_{CO_2,i,y}$$

(5)

As the baseline scenario of this project is defined to be Scenario 2 in methodology ACM0006, the following two combustion process j should be considered:

- Fossil fuels combusted in the project plant during the year y ($FF_{project\ plant,i,y}$);
- Fossil fuels combusted at the project site for other purposes that are attributable to the project activity during year y ($FF_{project\ site,i,y}$).

For this project, the on-site fossil fuel consumed is diesel, so the formula used to calculate $PEEF_y$ is:

$$PEEF_y = (FF_{project\ plant,diesel,y} + FF_{project\ site,diesel,y}) \cdot NCV_{diesel} \cdot EF_{CO_2,FF,diesel}$$

(6)

Where:

$FF_{project\ plant,diesel,y}$ is quantity of diesel combusted in the project plant during the year y , t;



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

NCV_{diesel} is net calorific value of diesel, GJ/t;

$EF_{CO_2,diesel,y}$ is CO₂ emission factor for diesel during year y , tCO₂e/GJ.

c) CO₂ emissions from electricity consumption ($PE_{EC,y}$)

CO₂ emissions from on-site electricity consumption ($PE_{EC,y}$) should be calculated using the latest approved version of the *Tool to Calculate Baseline, Project and/or Leakage Emissions from Electricity Consumption*. The electricity consumption in this project is from the grid, and according to the tool, as Case A is chosen, $PE_{EC,y}$ is calculated based on the power consumed by the project activity and the emission factor of the grid, adjusted for transmission losses, using the following formula:

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

(7)

Where:

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

$EF_{grid,y}$ is CO₂ emission factor for CCPG electricity during the year y , as calculated in the following steps in this PDD, tCO₂e/MWh;

TDL_y are the 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, %.

d) Methane emissions from combustion of biomass residues ($PE_{biomass,CH_4,y}$)

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

(8)

Where:

$EF_{CH_4,BF}$ is CH₄ emission factor for the combustion of biomass residues in the project plant, tCH₄/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.

To determine the CH₄ emission factor, IPCC default values as provided in Table 4 and Table 5 of Methodology ACM0006 are used in this PDD. As the biomass residues used in this project are crop stalks and waste wood, 30kg CH₄/TJ with a conservativeness factor 1.37 are used as the value of $EF_{CH_4,BF}$.

e) Methane emissions from waste water treatment ($PE_{WW,CH_4,y}$)



As there is no waste water originating from the treatment of the biomass is treated under anaerobic conditions in this project, so $PE_{WW,CH_4,y} = 0$.

2. Emission reductions due to displacement of electricity ($ER_{electricity,y}$)

According to methodology ACM0006, emission reductions due to the displacement of electricity are relevant for all scenarios and are calculated by multiplying the net quantity of increased electricity generated with biomass residues as a result of the project activity (EG_y) with the CO₂ baseline emission factor for the electricity displaced due to the project ($EF_{electricity,y}$), as follows

$$ER_{electricity,y} = EG_y \cdot EF_{electricity,y}$$

(9)

Where:

EG_y is net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year y, MWh;

$EF_{electricity,y}$ is CO₂ emission factor for the electricity displaced due to the project activity during the year y, tCO₂e/MWh.

Step 1: Determination of $EF_{electricity,y}$

As the baseline scenario of this project is defined to be Scenario 2 in methodology ACM0006, the emission factor for the displacement of electricity should correspond to the grid emission factor ($EF_{electricity,y} = EF_{grid,y}$). And the capacity of the project plant is 24MW which is more than 15MW, thus $EF_{grid,y}$ should be calculated as a combined margin ($EF_{grid,CM,y}$), following the guidance in the section “Baselines” in the “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002). According to ACM0002, the *Tool to Calculate the Emission Factor for an Electricity System* is used here to calculate CM of the electric grid in this project.

Sub-step 1a. Identify the relevant electricity system

This project site is in Henan province of China, which belongs to CCPG according to the public delineation of DNA.

Sub-step 1b. Choose whether to include off-grid power plants in the project electricity system

There are two options to calculate the operating margin and build margin factors:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

For this project, **Option I** is chosen for calculation.

Sub-step 1c. Select an operating margin (OM) method

Calculation of Operating Margin should be based on one of the four following methods according to the tool:



- (a) Simple OM, or
- (b) Simple adjusted OM, or
- (c) Dispatch Data Analysis OM, or
- (d) Average OM.

As the low-cost / must-run resources constituted respectively 35.95% (2002), 34.43% (2003), 38.54% (2004), 38.18% (2005), 38.67% (2006) of total electricity generation of CCPG in recent five years²⁹, which are all less than 50% the Simple OM (a) method is selected and the emission factor is calculated using the following data vintage:

Ex ante option: the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available, without requirement to monitor and recalculate the emissions factor during the crediting period

Sub-step 1d. Calculate the operating margin emission factor according to the selected method

Simple OM is selected for calculation in this project.

The Simple OM emission factor ($EF_{OM,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO₂e /MWh) of all generating sources serving in the system, excluding low-operating cost and must-run power plants.

The simple OM may be calculated:

Option A: Based on the net electricity generation and a CO₂ emission factor of each power unit; or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

In this project, the particular data on fuel consumption, net electricity generation, and average efficiency of each power unit are not available; in addition, for CCPG only nuclear and renewable power generation are considered as low-cost / must-run power resources and the quantity of electricity supplied to CCPG by these sources is known; and off-grid power plants are not included in the calculation, so Option B was chosen.

Under this option, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run power plants/units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{EG_y}$$

(10)

²⁹ China Electric Power Yearbook (2003, 2004, 2005, 2006, 2007)



Where:

$EF_{grid,OMsimple,y}$ is simple operating margin CO₂ emission factor in year y , tCO₂e/MWh;

$FC_{i,y}$ is the amount of fossil fuel type i consumed in the project electricity system in year y , mass or volume unit;

$NCV_{i,y}$ is net calorific value (energy content) of fossil fuel type i in year y , GJ/mass or volume unit;

$EF_{CO2,i,y}$ is CO₂ emission factor of fossil fuel type i in year y , tCO₂e/GJ;

EG_y is net quantity of electricity delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y , MWh;

i refers to all fossil fuel types combusted in power sources in the project electricity system;

y refers to the relevant years as per the data vintage chosen in Sub-step 1c.

Sub-step 1e. Identify the cohort of power units to be included in the build margin (BM)

In this project, the sample group of power unit m used to calculate the build margin consists of the set of power capacity additions in the electricity system that comprise 20% of the electricity generation (MW) and that have been built most recently.

In term of the vintage data, according to the tool, there are two options can be chosen, and in this project, Option 1 is used to calculate the build margin emission factor, which is:

For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Sub-step 1f. Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO₂e/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

(11)

Where:



$EF_{grid,BM,y}$ is build margin CO₂ emission factor in year y , tCO₂e /MWh;

$EG_{m,y}$ is net quantity of electricity generated and delivered to the grid by power units m in year y , MWh;

$EF_{EL,m,y}$ is CO₂ emission factor of power unit m in year y , tCO₂e/MWh;

m refers to the power units included in the build margin;

y refers to most historical year for which power generation data is available.

Due to the unavailability of the relevant data, the following deviations from this calculation method which have been approved by CDM EB³⁰ are applied:

- 1) Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM);
- 2) Use of capacity additions during last 1 - 3 years for estimating the build margin emission factor for grid electricity;
- 3) Use of weights estimated using installed capacity in place of annual electricity generation.

The alternative method is used with the following steps:

Sub-step 1f.1: Calculate the proportion of the corresponding CO₂ emissions of solid, liquid and gas fuel in the total emissions of power generation, using the most recent one year fuel consumption information available at the time of PDD submission.

$$\lambda_{Coal} = \frac{\sum_{i \in Coal, m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}$$

(12)

$$\lambda_{Oil} = \frac{\sum_{i \in Oil, m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}$$

(13)

$$\lambda_{Gas} = \frac{\sum_{i \in Gas, m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO_2,i,y}}$$

(14)

³⁰http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ



Where:

$FC_{i,m,y}$ is amount of fuel i consumed by province m during the year y , mass or volume unit of the fuel;

$NCV_{i,y}$ is net calorific value (energy content) of fossil fuel type i in year y , GJ/mass or volume unit;

$EF_{CO_2,i,y}$ is CO₂ emission factor of fossil fuel type i in year y , tCO₂e/GJ;

Coal, Oil and Gas are the foot marks for solid, liquid and gas fuels, and see **Annex 3** for details.

Sub-step 1f.2: Calculate the emission factor of fossil-fuel fired power plants, using the efficiency level of the best technology commercially available:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$$

(15)

Where $EF_{Coal, Adv}$, $EF_{Oil, Adv}$ and $EF_{Gas, Adv}$ are corresponding emission factors of the best commercially available coal, oil and gas fired technologies.

Sub-step 1f.3: Calculate the BM:

$$EF_{BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$

(16)

Where:

CAP_{Total} is total newly added 20% installation capacity; and

$CAP_{Thermal}$ is fossil-fuel fired installed capacity in the newly added 20% capacity.

Sub-step 1g. Calculate the combined margin (CM) emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

(17)

Where:

$EF_{OM,y}$ is operating margin CO₂ emission factor in year y , tCO₂e/MWh;

$EF_{BM,y}$ is build margin CO₂ emission factor in year y , tCO₂e/MWh;

w_{OM} is the weight of operating margin emission factor, %;

w_{BM} is the weight of build margin emission factor, %.



According to the tool, in this project, $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period.

Step 2: Determination of EG_y

As the baseline scenario of this project is defined to be Scenario 2 in methodology ACM0006, EG_y should correspond to the net quantity of electricity generation in the project plant ($EG_y = EG_{project\ plant,y}$).

3. Emission reductions or increases due to displacement of heat ($ER_{heat,y}$)

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

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

Step 1. Determination of the quantity of biomass residues used as a result of the project activity ($BF_{PJ,k,y}$)

As the baseline scenario of this project is defined to be Scenario 2 in methodology ACM0006, the total quantity of biomass residues used in the project plant ($\sum BF_{k,y}$) is attributable to the project activity and hence $BF_{PJ,k,y} = BF_{k,y}$.

Step 2. Estimation of methane emissions, consistent with the baseline scenario for the use of biomass residues

As the baseline scenario for biomass in this project is identified to be B1, which means the biomass residues will be dumped or left to decay under mainly aerobic conditions without utilized for energy purposes in absence of proposed project. According to the methodology ACM0006, baseline emissions are calculated by multiplying the quantity of biomass residues that would not be used in the absence of the project activity with the net calorific value and an appropriate emission factor, as follows:

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

(18)

Where:

GWP_{CH_4} is Global Warming Potential of methane valid for the commitment period, tCO₂e/ tCH₄;

$BF_{PJ,k,y}$ 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;

$EF_{burning,CH_4,k,y}$ is CH₄ emission factor for uncontrolled burning of the biomass residue type k during the year y , tCH₄/GJ;

k refers to the types of biomass residues for which the identified baseline scenario is B1 or B3 and for which leakage effects could be ruled out with one of the approaches L₁, L₂ or L₃ described in the leakage section.



To determine the CH₄ emission factor, as in the absence of more accurate information, 0.0027 tCH₄ per ton of biomass with a conservativeness factor 0.73 is used in this project as default value for the product of NCV_k and $EF_{burning,CH_4,k,y}$ according to methodology ACM0006 which means 0.001971 tCH₄ per ton of biomass is used ultimately.

5. Leakage (L_y)

According to the methodology ACM0006, the option L₂ is used to demonstrate that the biomass residues used in the plant of this project will not increase fossil fuel consumption elsewhere and it is need to demonstrate that there is an abundant surplus of the biomass residue in the region of the project activity which is not utilized. For this purpose, demonstrate that the quantity of available biomass residue of type k in the region is at least 25% larger than the quantity of biomass residues of type k that are utilized (e.g. for energy generation or as feedstock), including the project plant.

For this project, the biomass residues used include maize stalks and waste wood which both come from the nearby area purchasing from local farmers, and have the same using way in the absence of this project activity.

According to the feasibility study report of this project, the usual transport distance of the biomass residue used in this project is less than 50km, so the geographical boundary of the region is defined to cover a radius of 50km around the project activity.

Table 19: Utilization circumstances of biomass residues in this project

Biomass residues	Quantity Of available (10kt/yr)	Quantity of utilized (10kt/yr)						Larger percentage than utilized
		Feedstuff	Compost	Returning field	Feed stock	For this project	Total	
Maize stalks	34.34	0.3434	6.868	10.302	0	8.81	26.32	30.45%
Waste wood	22.3	0	0	0	6.69	8.81	15.5	43.87%

Data source: Feasibility Study Report of Xinxiang Tianjie Bio-Power Generation Project.

Table 19 shows that the quantity of available maize stalks in the region is 30.45% larger than the stalks are utilized, and the quantity of available waste wood is 43.87% larger than that are utilized, which meet the requirement of L₂, so the leakage of this project is 0.

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	GWP_{CH_4}
Data unit:	tCO ₂ e/tCH ₄
Description:	Global warming potential for CH ₄
Source of data used:	IPCC 4 th Assessment Report “Climate Change 2007” Working Group I Report, Table 2.14, p212
Value applied:	21
Justification of the choice of data or description of	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions



measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{km,CO_2,y}$
Data unit:	tCO ₂ /km
Description:	Average CO ₂ emission factor for the trucks during the year y
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3, p1.75
Value applied:	0.001097
Justification of the choice of data or description of measurement methods and procedures actually 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.
Any comment:	The value should be updated according to latest IPCC version.

Data / Parameter:	$NCV_{diesel,y}$
Data unit:	GJ/t
Description:	The net calorific value (energy content) of diesel
Source of data used:	China Energy Statistical Yearbook 2006, p287
Value applied:	42.652
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	

Data / Parameter:	$EF_{CO_2,diesel,y}$
Data unit:	tCO ₂ /GJ
Description:	The CO ₂ emission factor of diesel in year y
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, p1.24
Value applied:	0.0741
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values
Any comment:	



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 used:	The default value in calculation tool
Value applied:	20%
Justification of the choice of data or description of measurement methods and procedures actually applied :	As the on-site electricity consumption attributable to the project activity is obtained from grid (CCPG), according to <i>Tool to Calculate Baseline, Project and/or Leakage Emissions from Electricity Consumption</i> , 20% can be used as default value for project or leakage electricity consumption sources.
Any comment:	

Data / Parameter:	$EF_{CH_4,BF}$
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 used:	Methodology ACM0006
Value applied:	0.0000411
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default values
Any comment:	

Data / Parameter:	$FC_{i,y}, FC_{i,m,y}$
Data unit:	t or m ³
Description:	The amount of fuel i consumed (by province m) in the grid in year y
Source of data used:	China Energy Statistical Yearbook 2005, 2006, 2007
Value applied:	A time series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	National statistic data value
Any comment:	This parameter is used to calculate OM.

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/t
Description:	The net calorific value (energy content) per mass or volume unit of a fuel i in



	year y
Source of data used:	China Energy Statistical Yearbook 2006, p287
Value applied:	A fuel series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate OM.

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO ₂ /GJ
Description:	The CO ₂ emission factor per unit of energy of the fuel i in year y
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Table 1.4, p1.23-1.24
Value applied:	A fuel series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values
Any comment:	This parameter is used to calculate OM.

Data / Parameter:	EG_y
Data unit:	MWh
Description:	The net quantity of electricity delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y
Source of data used:	China Electric Power Yearbook 2005, 2006, 2007
Value applied:	A time series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate OM.

Data / Parameter:	$EF_{Coal, Adv}$
Data unit:	tCO ₂ e/MWh
Description:	The emission factors of the best commercially available coal fired technology
Source of data used:	China DNA
Value applied:	0.9135
Justification of the	Country-specific value



choice of data or description of measurement methods and procedures actually applied :	
Any comment:	This parameter is used to calculate BM.

Data / Parameter:	$EF_{Oil, Adv}$
Data unit:	tCO ₂ e/MWh
Description:	The emission factors of the best commercially available oil fired technology
Source of data used:	China DNA
Value applied:	0.5706
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate BM.

Data / Parameter:	$EF_{Gas, Adv}$
Data unit:	tCO ₂ e/MWh
Description:	The emission factors of the best commercially available gas fired technology
Source of data used:	China DNA
Value applied:	0.4138
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate BM.

Data / Parameter:	$CAP_{thermal}$
Data unit:	MW
Description:	The added installed capacity of thermal plants
Source of data used:	China Electric Power Yearbook 2003, 2004, 2005, 2006
Value applied:	A time series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate BM.



Data / Parameter:	CAP_{hydro}
Data unit:	MW
Description:	The added installed capacity of hydro plants
Source of data used:	China Electric Power Yearbook 2005, 2006, 2007
Value applied:	A time series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate BM.

Data / Parameter:	$CAP_{nuclear}$
Data unit:	MW
Description:	The added installed capacity of nuclear plants
Source of data used:	China Electric Power Yearbook 2005, 2006, 2007
Value applied:	A time series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate BM.

Data / Parameter:	CAP_{other}
Data unit:	MW
Description:	The added installed capacity of other plants
Source of data used:	China Electric Power Yearbook 2005, 2006, 2007
Value applied:	A time series of data is to be used, see Annex 3 for details
Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate BM.

Data / Parameter:	$CAP_{total, m}$
Data unit:	MW
Description:	The total added installed capacity by power unit m
Source of data used:	China Electric Power Yearbook 2005, 2006, 2007
Value applied:	A time series of data is to be used, see Annex 3 for details



Justification of the choice of data or description of measurement methods and procedures actually applied :	Country-specific value
Any comment:	This parameter is used to calculate BM.

Data / Parameter:	$NCV_k \cdot EF_{burning, CH_4, k, y}$
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 used:	Methodology ACM0006
Value applied:	0.001971
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default values
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

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1. Project emissions (PE_y)

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

As known in project feasibility study report, the average truck load TL_y is 7t; quantity of the dry matter of the maize stalk transported to the project site per year $BF_{T,maize\ stalk,y}$ is 93,902t, and $BF_{T,waste\ wood,y}$ is 99,189t; the average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant AVD_y is 50*2=100 km. And IPCC default value for the US heavy Duty Diesel Vehicle in uncontrolled condition is used in this project as average CO₂ emission factor for the trucks measured $EF_{km,CO_2,y}$ which is 0.001097 tCO₂/km. So

According to formula (3),

$$PET_y = \frac{\sum_k BF_{T,k,y}}{TL_y} \cdot AVD_y \cdot EF_{km,CO_2,y} = (93902 + 99189) / 7 \times 100 \times 0.001097 = 3026.0tCO_2e$$

b) Carbon dioxide emissions from on-site consumption of fossil fuels ($PEFF_y$)

The on-site consumption of fossil fuels is from two sources. The first one is the diesel used in the ignition whose annual amount is estimated to be 0.5t. The other source is diesel used for operation of forklifts at the



project site. It is estimated that the consumption rate of diesel for each forklift is 1.5L/hr and the density of diesel (#0) is about 0.84 kg/L. For totally 4 forklifts at all collecting stations, each of them works 8 hours per day, and 365 days per year, which conservatively gives the annual diesel consumption of about 15 tons. These data are estimated refer to registered project³¹, and the actual data values should be monitored during the operation of this project. And $NCV_{diesel,y}$ is 42.652 GJ/t, $EF_{CO_2,diesel,y}$ is 0.0741 tCO₂e/GJ, so

According to formula (6),

$$PEEF_y = (FF_{projectplant,diesel,y} + FF_{projectsite,diesel,y}) \cdot NCV_{diesel} \cdot EF_{CO_2,EF,diesel} = (0.5+15) \times 42.652 \times 0.0741 = 49.0 \text{ tCO}_2\text{e}$$

c) CO₂ emissions from electricity consumption ($PE_{EC,y}$)

The on-site electricity consumption of this project includes the electricity consumed by pressing and breaking up of crop stalks prior to combustion on stalk collection sites. It is estimated that the electricity consumption at each collection sites is 100 kWh per day, so the total electricity consumption $EC_{PJ,y}$ of the 25 collection sites within the project boundary is about 912.5 MWh (365 working days per year), for conservativeness and simple estimation, 1000 MWh is used here. These data are estimated refer to registered project³², and the actual data values should be monitored during the operation of this project; the average technical transmission and distribution losses in the local grid TDL_y are 20%; and the emission factor of Central China Grid $EF_{grid,y}$ is 0.9735 tCO₂/MWh as calculated in this project, so

According to formula (7),

$$PE_{EC,y} = EC_{PJ,y} \cdot EF_{grid,y} \cdot (1 + TDL_y) = 1000 \times 0.9735 \times (1 + 20\%) = 1168.2 \text{ tCO}_2\text{e}$$

d) Methane emissions from combustion of biomass residues ($PE_{biomass,CH_4,y}$)

According to methodology ACM0006, the default CH₄ emission factor of 30 kg/TJ is used for this project, and the uncertainty is estimated to be 300%, resulting in a conservativeness factor of 1.37. The net calorific value of the maize stalk combusted in this project $NCV_{maize\ stalk}$ is 17.79 GJ/t, and $NCV_{waste\ wood}$ is 15.64 GJ/t. The quantity of dry matter $BF_{maize\ stalk,y}$ is 88,080t, and $BF_{waste\ wood,y}$ is 88,080t, so

According to formula (8),

$$PE_{biomass,CH_4,y} = EF_{CH_4,BF} \cdot \sum_k BF_{k,y} \cdot NCV_k = 1.37 \times 0.00003 \times (88,080 \times 15.64 + 88,080 \times 17.79) =$$

121.0 tCH₄

In conclusion, as the Global Warming Potential for methane GWP_{CH_4} valid for the first commitment period is 21 tCO₂e/tCH₄ as described in the IPCC 4th Assessment Report, so

According to formula (2),

³¹ <http://cdm.unfccc.int/UserManagement/FileStorage/DQR9FENVA65KZO1L2IT8JY3CUMWS47>

³² <http://cdm.unfccc.int/UserManagement/FileStorage/DQR9FENVA65KZO1L2IT8JY3CUMWS47>



$$PE_y = PET_y + PEEF_y + PE_{EC, y} + GWP_{CH_4} \cdot PE_{biomass, CH_4, y}$$

$$\text{Project emissions } PE_y = 3026.0 + 49.0 + 1168.2 + 21 \times 121.0 = 6784.2 \text{ tCO}_2\text{e}$$

2. Emission reductions due to displacement of electricity ($ER_{electricity, y}$)

As described in B.6.1., the EF_{OM} of Central China Grid is calculated to be 1.2783 tCO₂e/MWh, and the EF_{BM} to be 0.6687 tCO₂e/MWh (see Annex 3 for details).

Where in the first crediting period, the weights $w_{OM} = w_{BM} = 50\%$,

According to formula (17),

$$EF_{grid, CM, y} = EF_{grid, OM, y} \times w_{OM} + EF_{grid, BM, y} \times w_{BM} = 1.2783 \times 50\% + 0.6687 \times 50\% = 0.9735$$

tCO₂e/MWh

Thus $EF_{electricity, y} = EF_{grid, CM, y} = 0.9735$ tCO₂e/MWh, and the total electrical generation of the project is estimated to be 142,370 MWh with a auxiliary consumption rate of 11%, the net electrical generation of the project $EG_{project plant, y}$ is estimated to be 126,709 MWh, thus $EG_y = EG_{project plant, y} = 126,709$ MWh;

According to formula (9),

$$ER_{electricity, y} = EG_y \cdot EF_{electricity, y} = 126709 \times 0.9735 = 123351.2 \text{ tCO}_2\text{e}$$

3. Emission reductions or increases due to displacement of heat ($ER_{heat, y}$)

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

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

As known from B.6.2., GWP_{CH_4} valid for the first commitment period is 21 tCO₂e/ tCH₄ as described in the IPCC 4th Assessment Report. Plus, it is recommended in methodology ACM0006 to use 0.0027 tCH₄/t as default value for the product of NCV_k and $EF_{burning, CH_4, k, y}$, and the uncertainty can be deemed to be greater than 100%, resulting in a conservativeness factor of 0.73, thus, in this case an emission factor of 0.001971 tCH₄/t biomass should be used. And the quantity of the dry matter of maize stalk $BF_{maize stalk, y}$ is 88,080t, and $BF_{waste wood, y}$ is 88,080t, so

According to formula (18),

$$BE_{biomass, y} = GWP_{CH_4} \cdot \sum_k BF_{PJ, k, y} \cdot NCV_k \cdot EF_{burning, CH_4, k, y} = 21 \times (88080 + 88080) \times 0.73 \times 0.0027 =$$

$$7291.4 \text{ tCO}_2\text{e}$$

5. Leakage (L_y)

As the description in part B.6.1., the leakage of this project $L_y = 0$

**6. Emission reductions (ER_y)**

According to formula (1), the annual emission reductions of this project is estimated to be

$$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y = 0 + 123351.2 + 7291.4 - 6784.2 = 123858.4 \text{ tCO}_2\text{e}$$

B.6.4 Summary of the ex-ante estimation of emission reductions:

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During the first 7-year crediting period from 2010 to 2016, the GHG emissions would be reduced by 867,006 tCO₂e.

Table 20: Summary of the ex-ante estimation of emission reductions

Years	Estimation of project activity emissions (tCO ₂ e)	Estimation of baseline emissions (tCO ₂ e)	Estimation of leakage (tCO ₂ e)	Estimation of overall emission reductions (tCO ₂ e)
2010	6,784	130,642	0	123,858
2011	6,784	130,642	0	123,858
2012	6,784	130,642	0	123,858
2013	6,784	130,642	0	123,858
2014	6,784	130,642	0	123,858
2015	6,784	130,642	0	123,858
2016	6,784	130,642	0	123,858
Total (tonnes of CO ₂ e)	47,488	914,494	0	867,006

B.7 Application of the monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**

(Copy this table for each data and parameter)

Data / Parameter:	$BF_{maizestalk,y}$
Data unit:	t dry matter
Description:	Quantity of maize stalk combusted in the project plant during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated to be 88080
Description of measurement methods	Use electronic belt weight with accuracy of 0.5. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity



and procedures to be applied:	shall be crosschecked with the quantity of electricity and heat generated and any fuel purchase receipts (if available).
Monitoring frequency	Continuously, prepare annually an energy balance
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes. The electronic belt weight will be calibrated based on the national standard JJG195-2002.
Any comment:	

Data / Parameter:	$BF_{wastewood,y}$
Data unit:	t dry matter
Description:	Quantity of waste wood combusted in the project plant during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated to be 88080
Description of measurement methods and procedures to be applied:	Use electronic belt weight with accuracy of 0.5. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be crosschecked with the quantity of electricity and heat generated and any fuel purchase receipts (if available).
Monitoring frequency	Continuously, prepare annually an energy balance
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes. The electronic belt weight will be calibrated based on the national standard JJG195-2002.
Any comment:	

Data / Parameter:	$BF_{T,maizestalk,y}$
Data unit:	t dry matter
Description:	Quantity of maize stalk that has been transported to the project site during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	$88080/(1-6.2\%)=93,902$ (estimated with the moisture content of 6.2%)
Description of measurement methods and procedures to be applied:	Use weight meters XK3190-A9(SCS-20/SCS-80) with accuracy of level III. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be crosschecked with the quantity of electricity and heat generated and any fuel purchase receipts (if available).
Monitoring frequency	Continuously, prepare annually an energy balance
QA/QC procedures to	Crosscheck the measurements with an annual energy balance that is based on



be applied:	purchased quantities and stock changes. The meters will be calibrated based on the national standard JJG907-2005.
Any comment:	

Data / Parameter:	$BF_{T,wastewood,y}$
Data unit:	t dry matter
Description:	Quantity of waste wood that has been transported to the project site during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	88080/(1-11.2%)=99,189 (estimated with the moisture content of 11.2%)
Description of measurement methods and procedures to be applied:	Use weight meters XK3190-A9(SCS-20/SCS-80) with accuracy of level III. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be crosschecked with the quantity of electricity and heat generated and any fuel purchase receipts (if available).
Monitoring frequency	Continuously, prepare annually an energy balance
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes. The meters will be calibrated based on the national standard JJG907-2005.
Any comment:	

Data / Parameter:	Moisture content of the biomass residues
Data unit:	% Water content
Description:	Moisture content of maize stalk
Source of data to be used:	Sample measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6.2% is used according to the sample analysis in the project feasibility study report.
Description of measurement methods and procedures to be applied:	The random sample of the biomass residues will be monitored by moisture analyzer when the biomass residues are transported into the project site each time.
Monitoring frequency	Continuously, mean values calculated at least annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Moisture content of the biomass residues
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Data unit:	% Water content
Description:	Moisture content of waste wood
Source of data to be used:	Sample measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	11.2% is used according to the sample analysis in the project feasibility study report.
Description of measurement methods and procedures to be applied:	The random sample of the biomass residues will be monitored by moisture analyzer when the biomass residues are transported into the project site each time.
Monitoring frequency	Continuously, mean values calculated at least annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	TL_y
Data unit:	t
Description:	Average truck load of the trucks used for transportation of biomass
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7
Description of measurement methods and procedures to be applied:	Determined by averaging the weights of each truck carrying biomass to the project plant.
Monitoring frequency	Continuously, aggregated annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	AVD_y
Data unit:	km
Description:	Average round trip distance (from and to) between biomass fuel supply sites and the project site
Source of data to be used:	Records by project participants on the origin of the biomass
Value of data applied for the purpose of	Estimated to be $50 \times 2 = 100$



calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	
Monitoring frequency	Continuously
QA/QC procedures to be applied:	Check consistency of distance records provided by the truckers by comparing recorded distances with other information from other sources (e.g. maps).
Any comment:	

Data / Parameter:	$FF_{projectplant,diesel,y}$
Data unit:	t
Description:	Quantity of diesel combusted in the project plant during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated to be 0.5
Description of measurement methods and procedures to be applied:	Use flow meters.
Monitoring frequency	Continuously
QA/QC procedures to be applied:	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes.
Any comment:	This should include fossil fuels co-fired in the project plant but not any other fuel consumption at the project site that is attributable to the project activity (e.g. for mechanical preparation of the biomass residues)

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 to be used:	On-site measurements by the records of diesel purchase and remained
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated to be 15
Description of	Use flow meters.



measurement methods and procedures to be applied:	
Monitoring frequency	Continuously
QA/QC procedures to be applied:	Crosscheck the measurements with diesel purchase invoice.
Any comment:	This should not include fossil fuels co-fired in the project plant but any other fuel consumption at the project site that is attributable to the project activity (e.g. for mechanical preparation of the biomass residues)

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	On-site electricity consumption attributable to the project activity during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated to be 1000 per year
Description of measurement methods and procedures to be applied:	Use electricity meters with accuracy of 1.0s.
Monitoring frequency	Continuously
QA/QC procedures to be applied:	Crosscheck the measurements with receipts of electricity purchases (if available).
Any comment:	

Data / Parameter:	$NCV_{maizestalk}$
Data unit:	GJ/t
Description:	The net calorific value of maize stalk
Source of data to be used:	Sample measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	17.79 was used according to the sample analysis in the project feasibility study report.
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.



Monitoring frequency	At least every six months, taking at least three samples for each measurement
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.
Any comment:	

Data / Parameter:	$NCV_{wastewood}$
Data unit:	GJ/t
Description:	The net calorific value of waste wood
Source of data to be used:	Sample measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	15.64 was used according to the sample analysis in the project feasibility study report.
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.
Monitoring frequency	At least every six months, taking at least three samples for each measurement
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.
Any comment:	

Data / Parameter:	$EG_{projectplant,y}$
Data unit:	MWh/yr
Description:	Net quantity of electricity generated in the project plant during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated to be 126,709
Description of measurement methods	Use electricity meters with accuracy of 0.5s.



and procedures to be applied:	
Monitoring frequency	Continuously
QA/QC procedures to be applied:	The consistency of metered net electricity generation should be crosschecked with receipts from electricity sales (if available) and the quantity of fuels fired (e.g. check whether the electricity generation divided by the quantity of fuels fired results in a reasonable efficiency that is comparable to previous years). The meters will be installed and calibrated based on the national standard DL/T 448-2000.
Any comment:	

Data / Parameter:	
Data unit:	10 ⁴ t
Description:	Quantity of available maize stalk in the defined geographical region
Source of data to be used:	The local statistical data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	34.34
Description of measurement methods and procedures to be applied:	
Monitoring frequency	Annually
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	
Data unit:	10 ⁴ t
Description:	Quantity of available waste wood in the defined geographical region
Source of data to be used:	The local statistical data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	22.3
Description of measurement methods and procedures to be applied:	
Monitoring frequency	Annually
QA/QC procedures to	



be applied:	
Any comment:	

Data / Parameter:	
Data unit:	10 ⁴ t
Description:	Quantity of maize stalk that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region
Source of data to be used:	The local statistical data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	26.32
Description of measurement methods and procedures to be applied:	
Monitoring frequency	Annually
QA/QC procedures to be applied:	The data will be kept at least 2 years after the last issuance of CERs.
Any comment:	

Data / Parameter:	
Data unit:	10 ⁴ t
Description:	Quantity of waste wood that are utilized (e.g. for energy generation or as feedstock) in the defined geographical region
Source of data to be used:	The local statistical data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	15.5
Description of measurement methods and procedures to be applied:	
Monitoring frequency	Annually
QA/QC procedures to be applied:	The data will be kept at least 2 years after the last issuance of CERs.
Any comment:	

B.7.2 Description of the monitoring plan:
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The monitoring plan of this project includes monitoring management, data management, quality control and assure measures and emergency measures etc. The project owner will implement the monitoring plan from the start of the operation of this project.

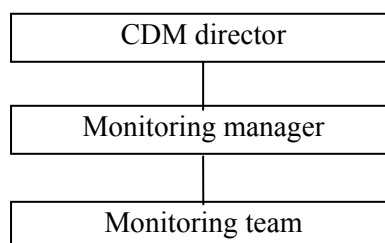
1. Operational and management structure of the monitoring plan

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

There will be 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 5**.

Figure 5: 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 equipments.

2. Procedures of the monitoring

2.1 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 will be measured by electronic belt weight installed at the feeding inlet of the boilers, 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 will be 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 will be 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 shall be 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.

2.2 Monitoring of transport data

The transportation 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 will be 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 will be determined by averaging the weights of each truck carrying biomass to the project plant which shall be measured continuously and aggregated annually.

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

2.3 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 will be measured by flow meters with an accuracy of 0.5; the diesel used in forklifts will be determined by the quantity of diesel purchase and remained, and the measurements shall be crosschecked by diesel purchase invoice.

2.4 Monitoring of electricity data

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

Two electricity meters should be 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) will be 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)³¹ will also be 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 any one 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 will be 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).

2.5 Monitoring of availability of biomass residues

The quantity of available and utilized biomass residues in the defined geographical region will be monitored to check the leakage effect. These data will be obtained from official statistical information on a yearly basis. If it is not available, the data will be calculated or estimated annually based on a survey conducted by a qualified third-party, e.g., a consulting agency.

The detail structure of the monitoring is shown in **Figure 6**.

³¹ As per the updated PPA signed on 28/06/2011, it was stipulated that, the measure meter and the check meter should be installed at the import of the new Wucun electric transformer substation, which leads to the location of the check meter change from the export of the project transformer to the import of the new Wucun electric transformer substation.

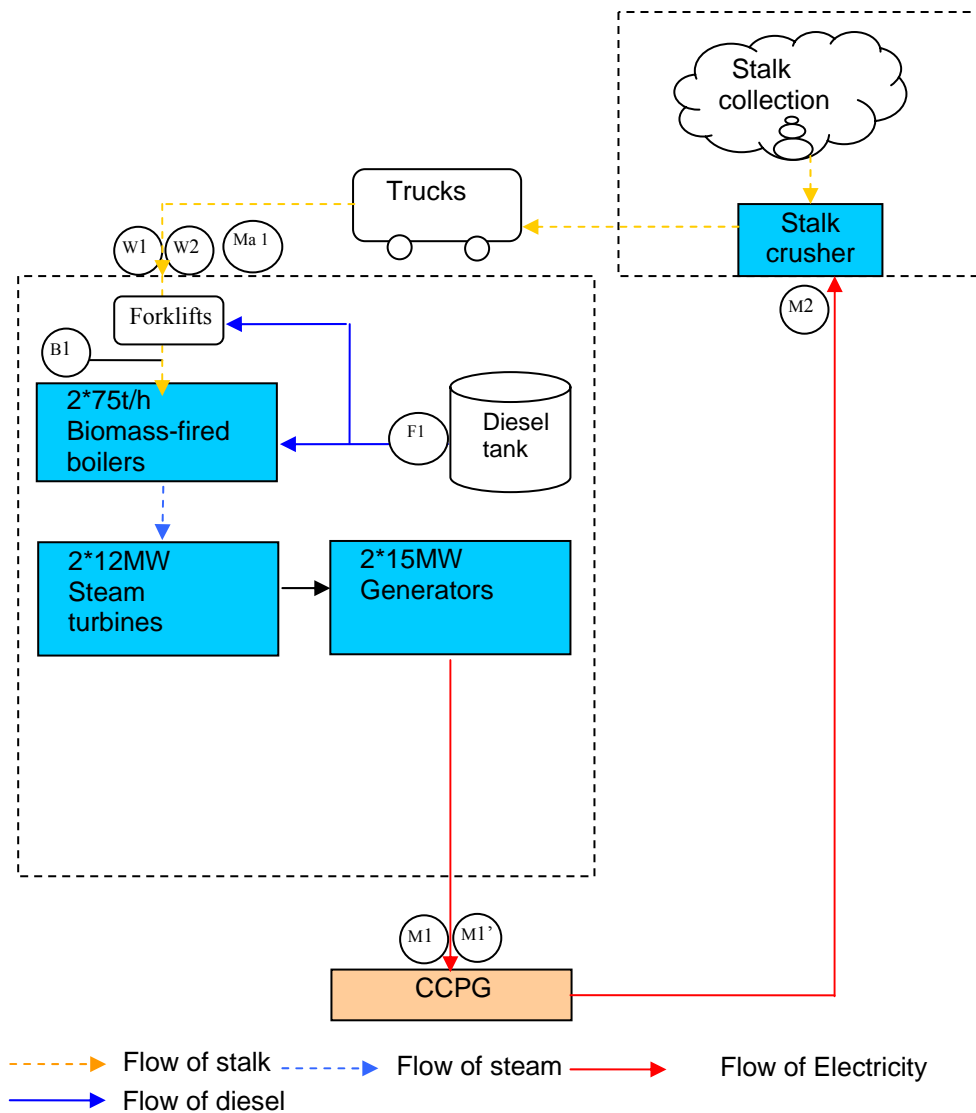


Figure 6. The detail structure of the monitoring

Measure equipment	Location	Description	Accuracy Class
M1	Import of the new Wucun electric transformer substation	Measure meter to measure the net quantity of electricity generated in the project plant	0.5s
M1'	Import of the new Wucun electric transformer substation	Check meter to measure the net quantity of electricity generated in the project plant	0.5s
B1	Feeding inlet of the boiler	Electronic belt weight to measure the quantity of maize stalk and waste wood combusted in the project plant	0.5
W1	Gate of the project site	Weight meter to measure the quantity of maize stalk and waste wood that has	level III



		been transported to the project site	
W2	Gate of the project site	Weight meter to measure the quantity of maize stalk and waste wood that has been transported to the project site	level III
Ma 1	Gate of the project site	Moisture analyzer to measure the Moisture content of maize stalk and waste wood	0.2%
F1	Diesel tank	Flow meter to measure the quantity of diesel combusted(for ignition and operation of forklifts) in the project plant	0.5
M2	Stalk collection sites	Electricity meter to measure the on-site electricity consumption attributable to the project activity	1.0s

3. Quality assurance and quality control

3.1 Training programme

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

3.2 Calibration of measuring equipments

In order to assure precision, the project owner will invite the technician of local Quality Testing Bureau to calibrate electricity meter, weighing meter and steam meters every year. The calibration of these meters will be implemented according to the relevant national standard as shown in B.7.1. The calibration records will be saved for verification, and the data inspectors of CDM monitoring team will be in charge of daily maintenance of the equipments.

3.3 Data checking

Data inspectors will also take charge for data checking and take corrective actions as soon as possible if abnormal data appears. The power (including electricity and heat) sales and stalk purchase invoice can be used for the crosscheck of the power sales amount and stalk purchase amount.

3.4 Emergency measures

The monitoring personnel will check the measuring equipments regularly to make sure their normal operation.

When malfunction of weighing meter appears, the relevant monitoring data would be substituted by data from stalk purchase invoice.

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

When malfunction of steam meters appears, the relevant monitoring data would be substituted based on historical records and heat sales invoice by choosing the most conservative data.

If one of the following things happened, the installed electricity meters should be tested by measure



inspection institution entrusted by the project owner and power grid company together within 10 days:

- (1) Measure error of measure meter and check meter is bigger than accepted error;
- (2) Meter has been repaired as component failure.

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

4 Data management

The two monitoring managers of the CDM Monitoring Team are responsible for data management, including data on project site and stalk collection site respectively. The monitoring vice director should prepare a monthly monitoring report based on the data provided by managers, which details the operational situation of the project plant, all parameters necessary for the calculation of CERs of the project, and other important relevant information, and report it to the director.

All data collected as part of the monitoring will be archived electronically and be kept for at least 2 years after the end of the last crediting period.

5. Verification of monitoring results

The project owner will invite DOE to verify monitoring reports and all the monitoring results annually during the following crediting period. The project owner should provide all the original records about the data collected as part of monitoring together with monitoring time and frequency, and relevant proof documents if necessary. The calibration records of the measure equipments and emergency records of the whole monitoring system should also be provided to DOE for verification.

During the verification the project owner will fully cooperate with the DOE by providing the DOE with all required necessary information in the event of queries and responding honestly to all questions from the DOE.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

The baseline study of this project was completed on 28/02/2011.

Name of the responsible person/entity:

Shanfeng Huang

Shenzhen Lingquexian Management Consulting Co., Ltd

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Tel: +86 755 25331841

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E-mail: fall_ren_ren@yahoo.com.cn

The entity who undertook the baseline study is not a project participant of this project.

**SECTION C. Duration of the project activity / crediting period****C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**

>>

18/06/2008

The starting date of this project activity is determined as the contract date of the boiler purchase which is the earliest date of contracts signed for equipments or construction service (see **Table 18** for details).

C.1.2. Expected operational lifetime of the project activity:

>>

20 years

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period**

3*7 years

C.2.1.1. Starting date of the first crediting period:

>>

01/01/2010³³**C.2.1.2. Length of the first crediting period:**

>>

7 years

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

>>

Not applicable.

C.2.2.2. Length:

>>

Not applicable.

³³ Or the date of registration whichever is later.

**SECTION D. Environmental impacts****D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

>>

The Environmental Impact Assessment (EIA) of this project completed by Beijing Xinguohuan Environmental Technical Development Co., Ltd. has been examined and approved by Henan Environmental Protection Bureau in June of 2008 (YuHuanShen [2008]128). This project will not cause significant impact on the environment as to the conclusion of the EIA. The conclusions of EIA are summarized below:

1. Air environment

When a gas-contamination happens, the maximum concentration of SO₂ and NO₂ is at the distance of 1993m; from the influence of the concern point, Yangqi battalion is about 2070m far from the chimney. Gas-contamination severely affected the battalion, but not exceeds the second class standard of *Environmental Air Quality Standard*, and the impact of concern point is still acceptable. The concentration of SO₂, NO₂ and PM₁₀ can still meet the standard. The daily average concentrations of SO₂, NO₂, PM₁₀ in all the concern points are not beyond the standard. It shows that this project has a very small impact on the quality of the local environment. The annual maximum concentrations of SO₂, NO₂ and PM₁₀ in this project are in the position of the chimney WSW 3231m; annual average concentrations in each concern points of SO₂, NO₂ and PM₁₀ can meet the evaluation criteria requirements, and have a smaller proportion. This project will replace the coal-fire boilers in 7 companies including Yanguang hongtai biological Co., Ltd., Huixian zhongzhou textile Co., Ltd., and Huixian Hengtai Building Material Co., Ltd. and etc. After the implementation of this project, the contamination concentration of each concern points showed a downward trend, and this project clearly demonstrated the positive effects of the environment.

2. Water environment

The emission of wastewater in this project is 30t/h (21t/h in winter), which is mainly concentrated wastewater produced by the chemical water treatment station, sewage water in recycling systems and boiler sewage water etc. Wastewater of this project is discharged by sewage pipe network into Dasha River.

The mine underground drainage water in Chengcun village was used as cooling water, which could mitigate the impact of mine drainage for surface water, and also saved the water resources. And it is a better use of wastewater.

The amount of wastewater emitted is small, and the drainage water is clean, which would not cause negative impact on Dasha River.

3. Noise environment

The status quo added by the contribution to this project of sound environment around plant boundary without the steam discharge of boilers will reach 48.7-61.5dB (A), and the noise around plant boundary can meet the requirement of type II in *Urban Regional Environmental Noise Standards* (GB3096-93) with the prevention measures.



In the situation with steam discharge of boilers, the noise of steam discharge will increase noise assessment by 5 dB (A) in the region around 50m after setting muffler, which had a greater impact on a wider scope. However, steam discharge of boilers is sporadic, small probability (less than 6 times per year), and the time is short (under normal circumstances not more than one minute), thus the external environmental impact is acceptable.

4. Solid waste

The solid waste of this plant is mainly slag and flying ash whose amount is about 6480t/a, including ash with 4560 t/a and slag with 1920t/a. Ash residues are rich in potassium carbonate and the SSP, which can be used for fertilizer directly or as deep processing of compound fertilizers. The ash residue positions can be use for temporary storage of fly ash and bottom ash. Remove ash by dry-method to keep activity of the ash. The scrappy ash under the bag filter ash bucket will be delivered into ash storeroom after pump gasification, and the ash exported from the ash storeroom will be returned to farmers for fertilizer by direct bagging. Ash bagging transport will not cause many dust, and the air will not have an impact on the environment along the way.

The project of the solid waste can be utilized, solid waste in the storage and transportation process will not have an impact on the surrounding environment.

5. Overall conclusions

Henan Huixian 2×12MW biomass power project accords with the state industrial policies. The construction of the project is conducive to optimizing the energy structure, to reduce environmental pollution and to mitigate the energy shortage, to improve the ecological environment, so that the national economy and people's living standards could going on a virtuous cycle of sustainable development path. The site of the project is reasonable, with various favorable conditions. Advanced equipment and technology had been adopt in this project, which have sound pollution prevention and control system. The contamination discharged from this project will not beyond the standard requirements, can meet the requirements of overall control. The environmental impact is small. Under Strict implementation of various measures and the conditions of governance, from the environmental point of view, this construction project is feasible.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

This project will not have significant impacts on the local environment.



**SECTION E. Stakeholders' comments****E.1. Brief description how comments by local stakeholders have been invited and compiled:**

>>

The following people are considered as the stakeholders of this project:

- Residents of the nearby village;
- Staff of certain seven factories (heat consumers of this project described in A.4.3.);
- Relevant administrative staff of the local government.

A stakeholders meeting was held by the project owner on March 3rd 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, the introduction includes:

- Difference between biomass based power plant and fossil fuel fired power plant;
- Construction schedule of this project;
- Possible influence on the local social and economic development of this project;
- The concept of CDM

To know more details about the comments of stakeholders, a questionnaire was surveyed for each representative after the meeting. The one page questionnaire was designed with the following sections:

- 1) Brief introduction of the project
- 2) Basic information of respondent
- 3) Major question issues
 - How do you know about the project?
 - How will the project influence environment, positive or negative?
 - What are the impacts of this project on the local economy and sustainable development?
 - How will this project affect your life?
 - Could this project improve the sustainable development of local economy and society?
 - What is your attitude towards construction of the project?

E.2. Summary of the comments received:

>>

There are 51 valid questionnaires been taken back, comments of the respondents are shown in **Table 21** as below:

**Table 21:** The statistical table of stakeholders' comments

	Item	Options	Results	Percentage
Basic information	Age	18-25	8	15.7%
		26-35	11	21.6%
		36-45	22	43.1%
		46-60	10	19.6%
	Education	Higher	4	7.8%
		Junior	9	17.6%
		Secondary	15	29.4%
		Elementary	23	45.1%
	Occupation	Manager	7	13.7%
		Worker	10	19.6%
		Farmer	18	35.3%
		Self-employed	8	15.7%
		Teacher or researcher	5	9.8%
Student		3	5.9%	
Major questions	How do you know about the project?	Deeply knowing	19	37.3%
		knowing a little	31	60.8%
		Never heard	1	2.0%
	How will the project influence local environment?	Positive	49	96.1%
		Negative	1	2.0%
		No influence	1	2.0%
	What are the impacts of this project on the local economy and sustainable development?	Improve economic development	29	56.9%
		Increase income of farmers	21	41.2%
		Supply more job opportunities	41	80.4%
	How will this project affect your life?	Improve the living level	47	92.2%
		Bring inconvenience	0	0.0%
		No affection	4	7.8%
	Could this project improve the sustainable development of local economy and society?	Yes	51	100.0%
		No	0	0.0%
	What is your attitude towards construction of the project?	Agree	32	62.7%
Disagree		0	0.0%	
Never mind		19	37.3%	

In addition, 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 survey forms are available from the project owner.

E.3. Report on how due account was taken of any comments received:

>>

As described above, most of the stakeholders interviewed expressed the project will benefit the environment, only one stakeholder thought this project may bring negative environment effect by causing noise pollution.

The project owner will carry 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 will solve possible noise pollution the stakeholders considered.

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Xinxiang Tianjie Bio-Power Generation Co., Ltd
Street/P.O.Box:	Huangli Village, Wucun Town, Huixian County
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FAX:	
E-Mail:	shangweihong@126.com
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Represented by:	Yulin Li
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Salutation:	Mr.
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Represented by:	Magid Shenouda
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Countries involved in the project activity.

Annex 3

BASELINE INFORMATION

Table A3-1 Fuel consumption and emission of CCPG in 2004

Fuel type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	$EF_{CO_2,i}$	$OXID_i$	NCV_i	CO ₂ Emission (tCO ₂ e)
									tCO ₂ /T J	%	MJ/t, km ³	K=G*H*I*J/100 (mass)
		A*	B*	C*	D*	E*	F*	G=A+B+C+ D+E+F	H**	I**	J*	K=G*H*I*J/10 (volume)
Raw coal	10 ⁴ t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	17144.1	94.6	100%	20908	339092605.3
Clean coal	10 ⁴ t		2.34					2.34	94.6	100%	26344	58316.1
Other washed coal	10 ⁴ t t	48.93	104.22			89.72		242.87	94.6	100%	8363	1921441.2
Coke	10 ⁴ t		109.61					109.61	107	100%	28435	3334933.6
Coke oven gas	10 ⁸ m ³			1.68		0.34		2.02	44.4	100%	16726	150012.1
Other gas	10 ⁸ m ³					2.61		2.61	44.4	100%	5227	60572.6
Crude oil	10 ⁴ t		0.86	0.22				1.08	73.3	100%	41816	33103.2
Gasoline	10 ⁴ t		0.06			0.01		0.07	69.3	100%	43070	2089.3
Diesel oil	10 ⁴ t	0.02	3.86	1.7	1.72	1.14		8.44	74.1	100%	42652	266747.3
Fuel oil	10 ⁴ t	1.09	0.19	9.55	1.38	0.48	1.68	14.37	77.4	100%	41816	465093.4
LPG	10 ⁴ t							0	63.1	100%	50179	0.0
Refinery gas	10 ⁴ t	3.52	2.27					5.79	57.6	100%	46055	153595.3
Natural gas	10 ⁸ m ³						2.27	2.27	56.1	100%	38931	495774.6
Other petro products	10 ⁴ t							0	73.3	100%	38369	0.0
Other coking products	10 ⁴ t							0	94.6	100%	28435	0.0
Other energy	10 ⁴ tsc		16.92		15.2	20.95		53.07	0	100%	0	0.0
											Total	346034284.1

Data Source: *: China Energy Statistical Yearbook 2005;

**: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.4, p.1.23-1.24



Table A3-2 Fuel consumption and emission of CCPG in 2005

Fuel type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	$EF_{CO_2,i}$	$OXID_i$	NCV_i	CO ₂ Emission (tCO _{2e})
									tCO ₂ /T J	%	MJ/t, km ³	K=G*H*I*J/100 (mass)
		A*	B*	C*	D*	E*	F*	G=A+B+C +D+E+F	H**	I**	J*	K=G*H*I*J/10 (volume)
Raw coal	10 ⁴ t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.75	94.6	100%	20908	352614496.8
Clean coal	10 ⁴ t	0.02						0.02	94.6	100%	26344	498.4
Other washed coal	10 ⁴ t		138.12			89.99		228.11	94.6	100%	8363	1804669.0
Coke	10 ⁴ t		25.95		105			130.95	107	100%	28435	3984212.7
Coke oven gas	10 ⁸ m ³			1.15		0.36		1.51	44.4	100%	16726	112137.8
Other gas	10 ⁸ m ³		10.2			3.12		13.32	44.4	100%	5227	309129.0
Crude oil	10 ⁴ t		0.82	0.36				1.18	73.3	100%	41816	36168.3
Gasoline	10 ⁴ t		0.02			0.02		0.04	69.3	100%	43070	1193.9
Diesel oil	10 ⁴ t	1.3	3.03	2.39	1.39	1.38		9.49	74.1	100%	42652	299932.7
Fuel oil	10 ⁴ t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	77.4	100%	41816	287082.7
LPG	10 ⁴ t							0	63.1	100%	50179	0.0
Refinery gas	10 ⁴ t	0.71	3.41	1.76	0.78			6.66	57.6	100%	46055	176674.3
Natural gas	10 ⁸ m ³						3	3	56.1	100%	38931	655208.7
Other petro products	10 ⁴ t							0	73.3	100%	38369	0.0
Other coking products	10 ⁴ t				1.5			1.5	94.6	100%	28435	40349.3
Other energy	10 ⁴ tsc		2.88		1.74	32.8		37.42	0	100%	0	0.0
											Total	360321753.6

Data Source: *: China Energy Statistical Yearbook 2006;

** : 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.4, p1.23-1.24



Table A3-3 Fuel consumption and emission of CCPG in 2006

Fuel type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	$EF_{CO_2,i}$	$OXID_i$	NCV_i	CO ₂ Emission (tCO ₂ e)
									tCO ₂ /T J	%	MJ/t, km ³	K=G*H*I*J/100 (mass)
		A*	B*	C*	D*	E*	F*	G=A+B+C +D+E+F	H**	I**	J*	K=G*H*I*J/10 (volume)
Raw coal	10 ⁴ t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	20127.82	94.6	100%	20908	398107507.7
Clean coal	10 ⁴ t					5.79		5.79	94.6	100%	26344	144295.0
Other washed coal	10 ⁴ t	4.51	104.12		8.59	79.21		196.43	94.6	100%	8363	1554035.9
Coal briquettes							0.01	0.01	97.5	100%	20908	203.9
Coke	10 ⁴ t		17.23		0.32			17.55	107	100%	28435	533966.6
Coke oven gas	10 ⁸ m ³		0.52	1.07	4.24	0.38	0.01	6.22	44.4	100%	16726	461918.6
Other gas	10 ⁸ m ³	12.69	3.95		1.7	4.36	0.01	22.71	44.4	100%	5227	527051.0
Crude oil	10 ⁴ t		0.49					0.49	73.3	100%	41816	15019.1
Gasoline	10 ⁴ t		0.01					0.01	69.3	100%	43070	298.5
Diesel oil	10 ⁴ t	0.91	2.23	1.41	1.78	0.96		7.29	74.1	100%	42652	230401.4
Fuel oil	10 ⁴ t	0.51	1.26	1.31	0.8	0.57	3.49	7.94	77.4	100%	41816	256982.7
LPG	10 ⁴ t							0	63.1	100%	50179	0.0
Refinery gas	10 ⁴ t	0.86	8.1	1	0.97			10.93	57.6	100%	46055	289947.5
Natural gas	10 ⁸ m ³			0.28		0.16	18.63	19.07	56.1	100%	38931	4164943.5
Other petro products	10 ⁴ t							0	73.3	100%	38369	0.0
Other coking products	10 ⁴ t						0.01	0.01	94.6	100%	28435	269.0
Other energy	10 ⁴ tsc	17.45	37.36	31.55	18.29	29.35		134	0	100%	0	0.0
											Total	406286840.4

Data Source: *: China Energy Statistical Yearbook 2007;

** : 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.4, p1.23-1.24

**Table A3-4** Power supply of fossil-fuel fired power plants in CCPG in 2004

Province	Power generation	Auxiliary consumption rate	Power supplied
	(MWh)	(%)	(MWh)
Jiangxi	30,127,000	7.04	28,006,059
Henna	109,352,000	8.19	100,396,071
Hubei	43,034,000	6.58	40,202,363
Hunan	37,186,000	7.47	34,408,206
Chongqing	16,520,000	11.06	14,692,888
Sichuan	34,627,000	9.41	31,368,599
Total			249,074,186
Data source: China Electric Power Yearbook 2005			

Table A3-5 Power supply of fossil-fuel fired power plants in CCPG in 2005

Province	Power generation	Auxiliary consumption rate	Power supplied
	(MWh)	(%)	(MWh)
Jiangxi	30,000,000	6.48	28,056,000
Henna	131,590,000	7.32	121,957,612
Hubei	47,700,000	2.51	46,502,730
Hunan	39,900,000	5.00	37,905,000
Chongqing	17,584,000	8.05	16,168,488
Sichuan	37,202,000	4.27	35,613,475
Total			286,203,305
Data source: China Electric Power Yearbook 2006			

Table A3-6 Power supply of fossil-fuel fired power plants in CCPG in 2006

Province	Power generation	Auxiliary consumption rate	Power supplied
	(MWh)	(%)	(MWh)
Jiangxi	34,449,000	6.17	32,323,497
Henna	151,235,000	7.06	140,557,809
Hubei	54,841,000	2.75	53,332,873
Hunan	46,408,000	4.95	44,110,804
Chongqing	23,487,000	8.45	21,502,349
Sichuan	44,193,000	4.51	42,199,896
Total			334,027,226
Data source: China Electric Power Yearbook 2007			
Net imported from Northwest Power Grid in 2006(MWh)			3,028,950
CO ₂ emission factor for net electricity imports $EF_{grid,import,y}$			0.82214
Data source: Statistic Abstract of Electric Industry 2006			



$$EF_{OM} = (3460346034284.1 + 360321753.6 + 406286840.4 + 3028950 \times 0.82214) / (249074186 + 286203305 + 34027226 + 3028950) = \mathbf{1.2783 \text{ tCO}_2/\text{MWh}}$$



Table A3-7 Percentage of emissions from Coal, Oil and Gas power plants in the total emission of CCPG in 2006

Fuel type	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	$EF_{CO_2,i}$	$OXID_i$	NCV_i	CO ₂ Emission	λ
		A*	B*	C*	D*	E*	F*	G=A+B+C +D+E+F	tCO ₂ /T J	%	MJ/t, km ³	tCO ₂ e	%
									H**	I**	J*	K=G*H*I*J/ 100	L
Raw coal	10 ⁴ t	1926.02	8098.01	3179.79	2454.48	1184.3	3285.22	20127.82	94.6	100%	20908	398107507.7	
Clean coal	10 ⁴ t					5.79		5.79	94.6	100%	26344	144295.0	
Other washed coal	10 ⁴ t	4.51	104.12		8.59	79.21		196.43	94.6	100%	8363	1554035.9	
Coal briquettes	10 ⁴ t						0.01	0.01	97.5	100%	20908	203.9	
Coke	10 ⁴ t		17.23		0.32			17.55	107	100%	28435	533966.6	
Subtotal of coal												400340009.1	98.54
Crude oil	10 ⁴ t		0.49					0.49	73.3	100%	41816	15019.1	
Gasoline	10 ⁴ t		0.01					0.01	69.3	100%	43070	298.5	
Diesel oil	10 ⁴ t	0.91	2.23	1.41	1.78	0.96		7.29	74.1	100%	42652	230401.4	
Fuel oil	10 ⁴ t	0.51	1.26	1.31	0.8	0.57	3.49	7.94	77.4	100%	41816	256982.7	
Other coking products	10 ⁴ t						0.01	0.01	94.6	100%	28435	269.0	
Other petro products	10 ⁴ t							0	73.3	100%	38369	0.0	
Subtotal of oil												502970.7	0.12
LPG	10 ⁴ t							0	63.1	100%	50179	0.0	
Refinery gas	10 ⁴ t	0.86	8.1	1	0.97			10.93	57.6	100%	46055	289947.5	
Natural gas	10 ⁷ m ³			2.8		1.6	186.3	190.7	56.1	100%	38931	4164943.5	
Coke oven gas	10 ⁷ m ³		5.2	10.7	42.4	3.8	0.1	62.2	44.4	100%	16726	461918.6	
Other gas	10 ⁷ m ³	126.9	39.5		17	43.6	0.1	227.1	44.4	100%	5227	527051.0	
Subtotal of gas												5443860.6	1.34
Total												406286840.4	100

Data Source: *: China Energy Statistical Yearbook 2007;

**: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Chapter 1, Table 1.4, p.1.23-1.24

**Table A3-8** Calculation of the emission factors of the best technologies commercially available

	Parameter	Efficiency	Carbon emission factor	Oxidation factor	Emission factor	Parameter
		%	tC/TJ	%	kJ/kWh	tCO ₂ /MWh
		A	B*	C*	D**	E=D/A*B*C*44/12/10 ⁶
Coal fired power plant	$EF_{Coal, Adv}$	37.28	25.8	100	3600	0.9135
Gas fired power plant	$EF_{Oil, Adv}$	48.81	21.1	100	3600	0.5706
Oil fired power plant	$EF_{Gas, Adv}$	48.81	15.3	100	3600	0.4138

Data Source: *: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, p1.23;
**: China Energy Statistical Yearbook 2006, p287

Based on the above calculation, the emission factor of thermal power plants can be calculated as:

$$\begin{aligned}
 EF_{Thermal,y} &= \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \\
 &= 98.54\% \times 0.9135 + 0.12\% \times 0.5706 + 1.34\% \times 0.4138 \\
 &= 0.9064 \text{ tCO}_2/\text{MWh}
 \end{aligned}$$

Table A3-9 Installed capacity of CCPG in 2006

Installed capacity	Unit	Jiangxi	Henna	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal	MW	6568	32603	11623	10715	5594	9555	76658
Hydro	MW	3288	2553	8521	8648	1979	17730	42719
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	0	17	24	0	41
Total	MW	9856	35156	20144	19380	7597	27285	119418

Data source: China Electric Power Yearbook 2007

Table A3-10 Installed capacity of CCPG in 2005

Installed capacity	Unit	Jiangxi	Henna	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal	MW	5906.0	26267.8	9526.3	7211.6	3759.5	7496.0	60167.2
Hydro	MW	3019.0	2539.9	8088.9	7905.1	1892.7	14959.6	38405.2
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	0	0	24	0	0
Total	MW	8925.0	28807.7	17615.2	15116.7	5676.2	22455.6	98596.4

Data source: China Electric Power Yearbook 2006

**Table A3-11** Installed capacity of CCPG in 2004

Installed capacity	Unit	Jiangxi	Henna	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal	MW	5496	21788.5	9590.3	6779.5	3271.1	6900.3	53825.7
Hydro	MW	2549.9	2438	7415.1	7448.2	1407.9	13382.9	34642
Nuclear	MW	0	0	0	0	0	0	0
Wind and others	MW	0	0	0	0	0	0	0
Total	MW	8045.9	24226.5	17005.4	14227.7	4679	20283.2	88467.7

Data source: China Electric Power Yearbook 2005

Table A3-12 Calculation of the BM of CCPG in 2006

	Installed capacity in 2004	Installed capacity in 2005	Installed capacity in 2006	2004-2006 new installed capacity	New installed percentage
	MW	MW	MW	MW	%
	A	B	C	D=C-A	E
Thermal	53825.7	60167.2	76658	22832.3	73.77
Hydro	34642	38405.2	42719	8077	26.10
Nuclear	0	0	0	0	0
Wind and others	0	24	41	41	0.13
Total	88467.7	98596.4	119418	30950.3	1
Percentage in 2006 capacity	74.08%	82.56%	100.00%	25.92%	

The BM emission factor of CCPG is then calculated as:

$$EF_{BM} = 0.9064 \times 73.77\% = \mathbf{0.6687 \text{ tCO}_2/\text{MWh}}$$



Annex 4

MONITORING INFORMATION