

**PROJECT DESIGN DOCUMENT FORM (CDM PDD)**

**CDM – Executive Board**

**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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**Project name: Hunan Yueyang Kaidi Biomass Power Project**

Version: 01

Date: 27/08/2008

##### A.2. Description of the project activity:

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Hunan Yueyang Kaidi Biomass Power Project (hereafter referred to as the proposed project) is a biomass utilization project developed by Yueyang Kaidi Green Energy Development Co., Ltd. (hereafter referred to as the Project Owner), which is located in Economic Management Area, Qu Yuan Management District, Yueyang City, Hunan Province, P.R. China.

The proposed project will process about 371,400 tonnes of biomass residues annually, of which rice husk is 175,800 tons and the straws (including cotton straw, rice straw and oil seed rape straw) is 195,600 tons, by installing of 4 sets of 65t/h Circulating Fluidized Bed (CFB) boilers and 4 sets of 12MW steam turbines generator units will be installed. Therefore, the total installed capacity of the Project is 48MW. The annual operation time is estimated to be 6000 hours with a net electricity of 253,440MWh and a net heat generation of 1,083,204GJ per year. It is estimated that the proposed project will generate GHG emission reductions 347,698tCO<sub>2</sub>e per year.

The electricity generated will be delivered to the grid via two 110kV outlet circuit, one of which is connected to Qu Yuan Substation and another of which is connected to Hongjiapo Substation and then supplied to Hunan power grid, which is a sub-grid of the Central China Power Grid (CCPG). The proposed project will therefore replace the capacity of power plants on the CCPG, which is predominantly made up of coal fired power plants. The heat generated will be supplied to in plants with heat demand in Industrial Area to replace heat from small coal-fired boilers.

Additionally, the proposed project will accomplish an extra benefit of greenhouse gas (GHG) mitigation derived from a reduction of methane emissions by utilizing a mix of rice husk, straws (including cotton straw, rice straw and oil seed rape straw) from the local area which would be dumped or left decay under mainly aerobic conditions and burned uncontrolled outside in the fields. It is estimated that the proposed project will generate GHG emission reductions 347,698tCO<sub>2</sub>e per year.

The baseline scenario of the proposed project is the generation of power in the grid, generation of heat in coal-fired boilers and the biomass residues are dumped or left to decay under mainly aerobic conditions. The latter applies to, for example, dumping and decay of biomass residues on fields or burnt in an uncontrolled manner without utilizing it for energy purposes.

The proposed project will not only supply renewable electricity to grid generating emission reductions, but it will also contribute to sustainable development of the local community and the host country by means of:

- Supply of clean renewable energy to CCPG with improvements to the local energy structure;
- Promoting the comprehensive utilization of resources and mitigating emissions caused by decay or uncontrolled fire of the biomass residues;
- Increasing local incomes and providing 113 job opportunities;

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- Decreasing the GHG emission from the fossil-fuel fired power plants as well as the emission of SO<sub>x</sub>, NO<sub>x</sub> and dust.

#### A.3. Project participants:

>>

| Name of Party involved (*)<br>((host) indicates a host<br>Party) | Private and/or public entity<br>(ies)<br>project participants (*)<br>(as applicable) | Kindly indicate if<br>the Party involved<br>wishes to be<br>considered as<br>project participant<br>(Yes/No) |
|--|--|--|
| Peoples' Republic of China<br>(host)                             | Yueyang Kaidi Green Energy<br>Development Co., Ltd                                   | No   |
| Netherlands  | Camco International Limited  | No   |

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See Annex 1 for details

#### 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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Hunan Province

##### A.4.1.3. City/Town/Community etc:

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Yueyang County

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

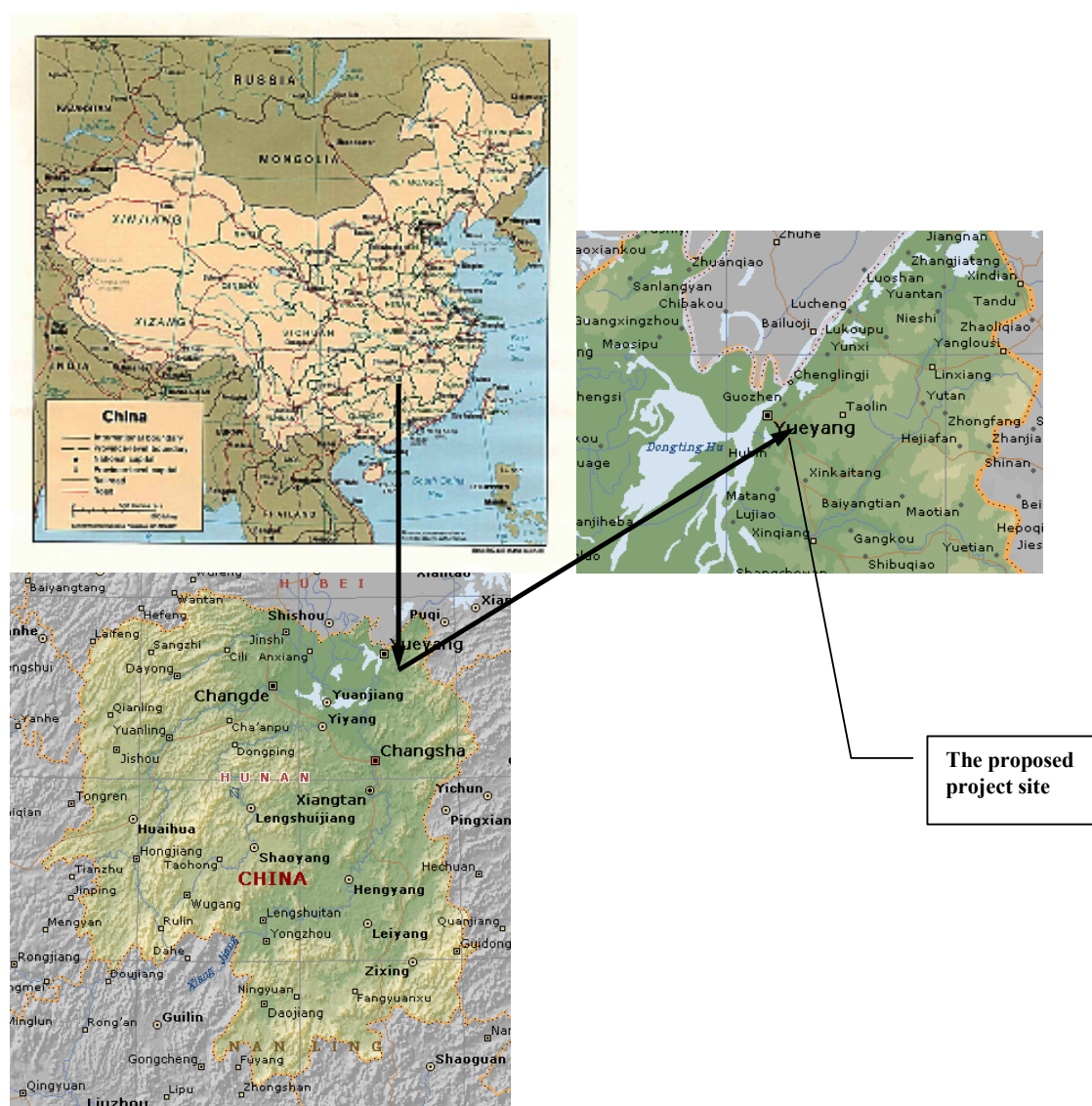
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The proposed project activity is located in the Economic Management Area, Qu Yuan Management District, Yueyang City, Hunan Province, which is west to Renhe Road, east to Tangliang Road and south to Yuefei Road.

The center of plant has geographical coordinates of 112°54'30" east longitude 28°51'18" north latitude. The figure A-1 shows the location of the proposed project.

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**Figure A-1. The location of Hunan Yueyang Kaidi Biomass Power Project**

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

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The proposed project falls into:

Sectoral Scope 1: energy industries (renewable - / non-renewable sources)

Project Activity: Grid-connected renewable power generation;

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

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**Scenario existing prior to the start of the implementation of the project activity:**

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The equivalent electricity is supplied from the CCPG, which is dominated by coal-fired power plants. The heat is supplied by small coal-fired boilers in the Economic Management Area. The new heat demand would also be met by the small coal-fired boilers in the absence of the proposed project activity. Existing small coal-fired boilers which would be replaced by the proposed project are traditional boilers, with low efficiency and high pollution to the surroundings. If the boiler is new, the lifetime is about 20 years and if they are operating well, the lifetime can last for about 25 years.

The biomass residues which are to be utilized in the proposed power plant are currently dumped or left decay under mainly aerobic conditions and burned uncontrolled outside in the fields.

#### **Baseline Activity Scenario:**

The baseline scenario is the scenario prior to the start of the implementation of the project activity as above. In the absence of the proposed project, the scenario will continue..

#### **Project Activity Scenario:**

The technology employed by the proposed project is advanced domestic technology. The proposed project will install 4 sets of 65t/h circulating fluid bed (CFB) boilers with medium temperature and medium pressure. At the same time, four 12MW steam turbines and two suited generators (C12-4.90/0.981-12/435℃) will be applied in the proposed project. The steam turbine employed is medium temperature and medium pressure condensing steam turbine. The total installed capacity of the proposed project is 48MW.

The key technical specifications of boiler, turbine and generator are listed in the table below.

TableA-1 Key Equipments Parameters:

| <b>STEAM TURBINE and GENERATOR</b> |   |
|------------------------------------|---|
| Manufacturer                       | NanJing Steam Turbine(Group) Co., Ltd                           |
| Model                              | C12-4.90/0.981-12/435℃  |
| Type                               | Medium temperature and medium pressure condensing steam turbine |
| Rated power                        | 12MW  |
| Rated voltage                      | 6.3KV   |
| Efficiency factor                  | 0.85  |
| Rated rotating speed               | 3000r/min   |
| Rated frequency                    | 50Hz  |
| Lifetime                           | 30years   |
| Quantity                           | 2   |
| <b>BOILER</b>                      |   |
| Manufacturer                       | Jiangxi Jianglian Energy and Environmental Protection Co., Ltd  |
| Model                              | KG65-450/5.29-FSWZ- I   |
| Type                               | Medium temperature and High pressure Circulating Fluidized Bed  |
| Rated steam pressure               | 5.29MPa   |

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|                       |         |
|-----------------------|---------|
| Rated steam temporary | 450℃    |
| Efficiency            | ≥86 %   |
| Lifetime              | 30years |
| Quantity              | 2       |

The biomass residues utilized in this proposed project will be mainly rice husk, but also some straws will also be used. The straws include rice straw, cotton straw and oil seed rape straw. The rice husk will be packed and stored temporarily at the rice mills. Some collection stations will be set up near to the resources for the straw to be processed and stored temporarily. From here the straws will be transported to the plant according to the dispatch schedule. The proposed radius for biomass collection is 50km<sup>2</sup> around the site of the power plant.

After the biomass residues are transported to the storehouse in the plant, they will be weighed by the weighbridge and then fed into fuel entering system to the boiler, and then sent to the boiler for combustion. All the steam entered into the turbine for power generation and some extracted for heat generation. The steam generated by the proposed project will be supply to the local industry users in the industrial park.

The boiler smoke will be treated by a high efficiency hop-pocket dust catcher and then carried to the ash storeroom. It is estimated that the annual ash generated from the power plant will be very limited. The ash is expected to be picked up by the local farmers and used as fertilizer.

All of the turbine and generator system will be supplied by Chinese domestic suppliers as well as the other auxiliary equipments installed in the power plant.

A flow diagram showing the power plant operation is provided as below. The monitoring equipments and their location are presented in section B.7.2. Figure B-4

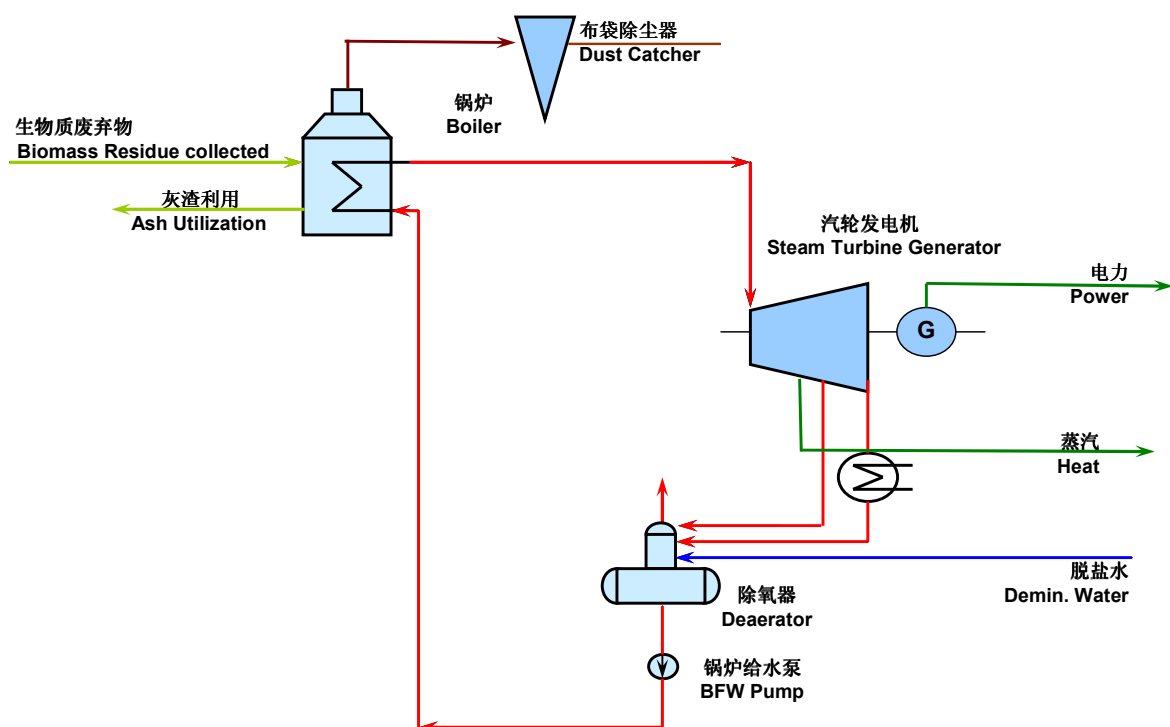


Figure A-2 Diagram of the plant

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

&gt;&gt;

A crediting period of 7 (seven) years (renewable twice) is selected for the project activity. During the first crediting period, 1<sup>st</sup> July 2009 to 30<sup>th</sup> June 2016, the proposed project is expected to lead to emission reductions of 347,698tCO<sub>2</sub>e. The estimated amount of emission reductions over the chosen crediting period is indicated below<sup>1</sup>.

| Years                 | Annual estimation of emission reductions in tones of CO <sub>2</sub> e |
|-----------------------|--|
| 01/07/2009-30/06/2010 | 296,462  |
| 01/07/2010-30/06/2011 | 347,698  |
| 01/07/2011-30/06/2012 | 347,698  |
| 01/07/2012-30/06/2013 | 347,698  |
| 01/07/2013-30/06/2014 | 347,698  |
| 01/07/2014-30/06/2015 | 347,698  |
| 01/07/2015-30/06/2016 | 347,698  |

<sup>1</sup> The proposed project will not supply heat in the first half year of delivery.

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|  |           |
|--|-----------|
| Total estimated reductions<br>(tones of CO <sub>2</sub> e)                                       | 2,382,650 |
| Total number of crediting years in 1 <sup>st</sup> crediting<br>period                           | 7         |
| Annual average over the crediting period of<br>estimated reductions (tones of CO <sub>2</sub> e) | 340,379   |

**A.4.5. Public funding of the project activity:**

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There is no public funding for this project.



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#### 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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1. ACM0006 (Version 06.2) – “*Consolidated methodology electricity generation from biomass residues*”
2. “*Combined tool to identify the baseline scenario and demonstrate additionality*”. (Version 02.1)
3. “*Tool for the demonstration and assessment of additionality*”(Version 05)
4. ACM0002 (Version 07) – “*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*”
5. “*Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion*” (Version 01)
6. “*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*” (Version 01)

For more information regarding the methodology, please refer to the link:

<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:

>>

The approved methodology ACM0006 is applied here to determine the baseline of the proposed project. The project activity is a newly installed biomass power plant in the Central China Power Grid (CCPG). The proposed project activity includes the installation of a new power generation plant at a site where currently no power generation occurs. Therefore, it is a “Greenfield” power project.

The proposed project meets all applicability conditions of methodology ACM0006 which are listed as follows:

- *No other biomass types than biomass residues, as defined in the methodology, are used in the project plant and these biomass residues are the predominant fuel used in the project plant (some fossil fuels may be co-fired);*  
Biomass from local rice husk in Yueyang City will be the predominant fuel in the proposed project. Straws (including cotton straw, rice straw and oil seed rape straw) will also be used as fuel in the proposed project. Only a very little amount of diesel will be used to help the start-ups of the boilers.
- *For projects that use biomass residues from a production process, the implementation of the project shall not result in an increase of the processing capacity of raw input or in other substantial changes in this process;*  
The straws and rice husk used by the proposed project are byproducts of agriculture crops, not from a production process.
- *The biomass residues used by the project facility should not be stored for more than one year;*  
The straws are directly bought from the farmers at the temporary storage stations at which the straws should not be stored for more than one year. The rice husks are directly bought from the rice mills and transported to the plant to use.

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- *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 (e.g. esterification of waste oils).*

There will be a small amount of energy consumption during the preparation of the biomass residues. This preparation includes mechanical treatment only, such as cutting and sheaving. There will also be fossil fuel consumption during transportation of the biomass residues. Except for these, the proposed project will not have significant consumption of fossil fuels.

Therefore, ACM0006 is applicable to the proposed project.

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

>>

#### Emission sources:

For the proposed project, the following emission sources shall be included:

- CO<sub>2</sub> emissions from on-site fossil fuel and electricity consumption that is attributable to the project activity. This includes fossil fuel co-fired in the project plant, fossil fuel used for on-site transportation of shredders or other equipment, as well as many other sources that are attributable to the project activity;
- CO<sub>2</sub> emissions from the electricity consumption in the biomass residues pretreatment
- CO<sub>2</sub> emissions from off-site transportation of biomass residues that are combusted in the project activity
- CH<sub>4</sub> emissions due to combustion of biomass residues for electricity and heat generation in the project activity

For the baseline emissions determination, following sources shall be included:

- CO<sub>2</sub> emissions from fossil fuel fired power plants at the electricity system, which is Center China Power Plant; and
- CO<sub>2</sub> emissions from fossil fuel based heat generation that is displaced through the Project.
- CH<sub>4</sub> emissions due to uncontrolled burning or decay of the biomass residue in the absence of the project activity.

According to the approved methodology ACM0006, the emission sources and GHGs in the project boundary are listed in the following table:

**Table B-1 GHGs source included or excluded from the project boundary**

|          | Source                           | Gas              | Included or not | Justification / Explanation   |
|----------|----------------------------------|------------------|-----------------|---|
| Baseline | Electricity generation           | CO <sub>2</sub>  | Yes             | Main emission source  |
|          |                                  | CH <sub>4</sub>  | No              | Excluded for simplification. This is conservative.  |
|          |                                  | N <sub>2</sub> O | No              | Excluded for simplification. This is conservative.  |
|          | Heat generation                  | CO <sub>2</sub>  | Yes             | Main emission source  |
|          |                                  | CH <sub>4</sub>  | No              | Excluded for simplification. This is conservative.  |
|          |                                  | N <sub>2</sub> O | No              | Excluded for simplification. This is conservative.  |
|          | Uncontrolled burning or decay of | CO <sub>2</sub>  | No              | It is assumed that CO <sub>2</sub> emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector. |

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|                         |   |                  |     |   |
|-------------------------|---|------------------|-----|---|
|                         | surplus biomass   | CH <sub>4</sub>  | Yes | Main emission source  |
|                         |   | N <sub>2</sub> O | No  | Excluded for simplification. This is conservative.  |
| <b>Project Activity</b> | On-site fossil fuel and electricity consumption due to the project activity | CO <sub>2</sub>  | Yes | May be an important emission source by the project activity   |
|                         |   | CH <sub>4</sub>  | No  | Excluded for simplification. This emission source is assumed to be very small.  |
|                         |   | N <sub>2</sub> O | No  | Excluded for simplification. This emission source is assumed to be very small.  |
|                         | Off-site transportation of biomass residues                                 | CO <sub>2</sub>  | Yes | May be an important emission source by the project activity   |
|                         |   | CH <sub>4</sub>  | No  | Excluded for simplification. This emission source is assumed to be very small.  |
|                         |   | N <sub>2</sub> O | No  | Excluded for simplification. This emission source is assumed to be very small.  |
|                         | Combustion of biomass residues for electricity and / or heat generation     | CO <sub>2</sub>  | No  | It is assumed that CO <sub>2</sub> emission from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.                        |
|                         |   | CH <sub>4</sub>  | Yes | Since the CH <sub>4</sub> emissions of biomass residue are included in baseline, according to the methodology, this emission is included in project scenario. |
|                         |   | N <sub>2</sub> O | No  | Excluded for simplification. This emission source is assumed to be very small.  |
|                         | Storage of biomass residues   | CO <sub>2</sub>  | No  | It is assumed that CO <sub>2</sub> emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.                       |
|                         |   | CH <sub>4</sub>  | No  | Excluded for simplification. Since biomass is stored for not longer than one year, this emission source is assumed to be small.                               |
|                         |   | N <sub>2</sub> O | No  | For simplification. This emission source is assumed to be very small.   |
|                         | Waste water from the treatment of biomass residues                          | CO <sub>2</sub>  | No  | It is assumed that CO <sub>2</sub> emission from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.                        |
|                         |   | CH <sub>4</sub>  | No  | No anaerobic treatment is involved in the proposed project.   |
|                         |   | N <sub>2</sub> O | No  | Excluded for simplification. This emission source is assumed to be very small.  |

### Spatial Extent of the Project Boundary:

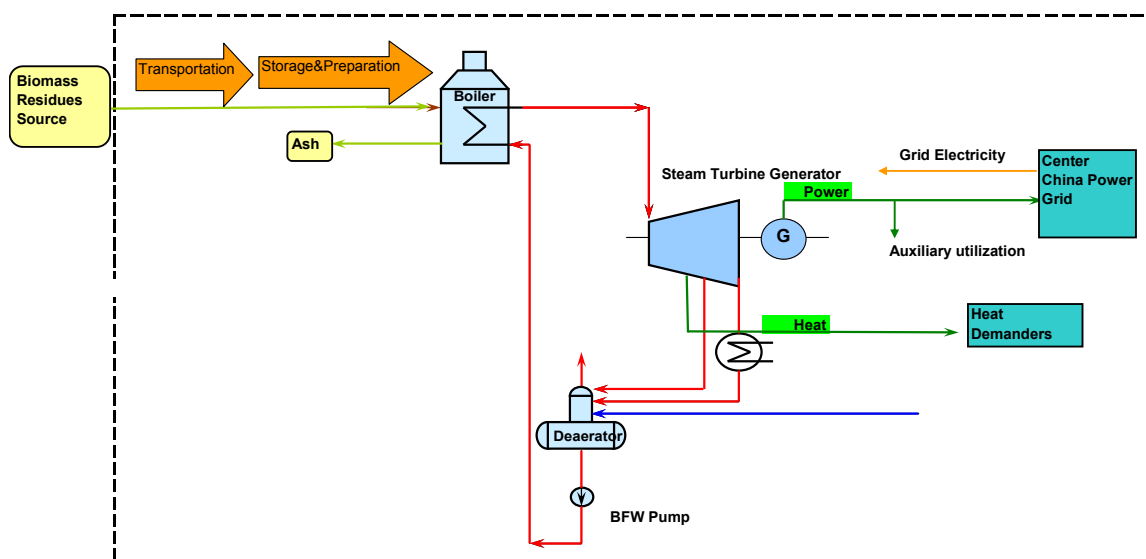
The spatial extent of the project boundary encompasses

- The power plant at the project site;
- Heat users supplied by the proposed project
- Transportation of biomass residues to the project site;

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- All power plants connected physically to the Central China Power Grid(CCPG) connected to. The CCPG includes Henan Province, Hubei Province, Hunan Province, Jiangxi Province, Sichuan Province and Chongqing
- The sites where the biomass residues would have been left for decay or dumped.



FigureB-1 Project Boundary

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

>>

According to the latest methodology ACM0006, “Combined Tool to identify the baseline scenario and demonstrate additionality”(Version02.1) should be used to identify the most plausible baseline scenario and demonstrate additionality.

This tool applies the following four steps:

- STEP 1 Identification of alternative scenarios
- STEP 2 Barrier analysis
- STEP 3 Investment analysis(If applicable)
- STEP 4 Common practice analysis

#### STEP 1. Identification of alternative scenarios

This step serves to identify all alternative scenarios to the proposed CDM project activity(s) that can be the baseline scenario through the following sub-steps:

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

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;

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- How the heat would be generated in the absence of the project activity.

For **power generation**, the realistic and credible alternatives may include, inter alia:

- P1 The Project not undertaken as a CDM project activity.
- 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.
- P3 The generation of power in an existing captive power plant, using only fossil fuels.
- P4 The generation of power in the grid.
- 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, 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.
- 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 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. Therefore, the power output is the same as in the Project.
- 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, 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.
- 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 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.
- P9 The installation of a **new** fossil fuel fired captive power plant at the project site.

P2, P7 and P8 are excluded because the proposed project is a Greenfield project; therefore no continuation or retrofitting is plausible. P3 can also be excluded since there is no existing captive power plant, using fossil fuels near the project site.

P5 and P6 are excluded for a number of reasons. Firstly, biomass power plants are not common practice in the local area. Secondly, the installation of a new biomass residue fired power plant that is fired with the same type but with a lower efficiency of electricity generation is not feasible. A lower efficiency technology results in a less financially attractive project than the proposed project not undertaken as a CDM project activity. Also a low efficiency power plant is not encouraged by Chinese government<sup>2</sup>.

Scenarios P2, P5, P6, P7 and P8 are therefore eliminated and scenarios **P1, P4 and P9** need further discussion.

For **heat generation**, the realistic and credible alternatives may include, inter alia:

- H1 The Project not undertaken as a CDM project activity.
- H2 The Project (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).
- H3 The generation of heat in an existing captive cogeneration plant, using only fossil fuels.
- H4 The generation of heat in boilers using the same type of biomass residues.

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<sup>2</sup>Energy development 11<sup>th</sup> five year plan, Page 17, NDRC, April, 2007

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- 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.
- H6 The generation of heat in boilers using fossil fuels.
- H7 The use of heat from external sources, such as district heat.
- H8 Other heat generation technologies (e.g. heat pumps or solar energy).

H2 is excluded for a number of reasons; firstly, at present the technology of biomass cogeneration in China is just started, even if the biomass power plants with lower heat supply efficiency are not common practice in China. Secondly, the installation of a new biomass residue fired power plant that is fired with the same type but with a lower efficiency of heat generation is not feasible. A lower efficiency technology results in a less financially attractive project than the proposed project not undertaken as a CDM project activity. Also a low efficiency power plant is not encouraged by Chinese government<sup>3</sup>.

H3 and H5 are excluded because there is no fossil fuel fired cogeneration plant or any other cogeneration plant at or around the project site,

H4 is excluded as there is no heat boiler using biomass residues in the local area and using small coal-fired boiler is common practice in the local area for heating.

H7 is excluded since there is no district heat supply in the local area, heat sources from external sources such as district heating do not exist.

H8 is excluded due to lack of other heat generation resources such as heat pumps or solar energy in and around the project site, The Hubei province where the proposed project located has no identified commercial geothermal resource that could be utilized for heat pump to supply heat. The local region lacks sufficient solar resources, hence, solar energy to heat is not feasible heat supply alternative in the region.

Therefore, scenarios **H1 and H6** need further discussion.

For **the use of biomass residues**, the realistic and credible alternatives may include, inter alia:

- 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.
- 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 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields.
- B3 The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.
- B4 The biomass residues are used for heat and/or electricity generation at the Project site
- B5 The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power plants
- B6 The biomass residues are used for heat generation in other existing or new boilers at other sites.
- B7 The biomass residues are used for other energy purposes, such as the generation of biofuels
- B8 The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry)

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<sup>3</sup>Energy development 11<sup>th</sup> five year plan, Page 17, NDRC, April, 2007

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The biomass residues which are to be utilized in the proposed power plant are currently dumped or left to decay under mainly aerobic conditions and burned in an uncontrolled way outside in the fields. For straws, local farmers have to get rid of a huge amount of straw in order to keep the land free for the next season's planting. For the rice husks the rice mills have limited room for the rice husk and they have to burn it or dumped it to leave room for the rice.

B2 is excluded, since there is no deep landfill with more than 5 meters around the site of the proposed project. Moreover, a landfill would result in a large investment and ongoing operation costs and this is therefore unlikely to occur given the current situation of decay and burning.

B5 and B6 can be excluded because using biomass to generate electricity or heat is not common practice in this region. Moreover, near the project site, there are no existing (grid connected) power plants or boilers which can use biomass residues to generate energy.

B7 is excluded, because the biomass residues used in the proposed project cannot be used to produce biofuels.

According to the FSR and biomass availability report, the rice husk consumed by the proposed project are about 175,800 tons, only accounting for 65% of total practical and economical available rice husk (270,000 tons within 50 kilometers), and the straws (including cotton straw, rice straw and oil seed rape straw) consumed by the proposed project are about 195,600 tons, only accounting for 31% of total practical and economical available quantity (630,000 tons within 50 kilometers) of the biomass dumped or left to decay or burned in an uncontrolled manner.

Alternative B8 is excluded because the proposed project will not change the use of biomass as fertilizer. Currently, there is no company using biomass residues for non-energy purpose such as fertilizer or as feedstock in processes around the project site.

Therefore, scenario **B1, B3 and B4** need further discussion.

**Outcome of Step 1a:**

As described above, the plausible alternative scenarios for the proposed project are **P1, P4 and P9** for power generation, **H1 and H6** for heat generation and **B1, B3 and B4** for the biomass residues.

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

In this sub step, alternative which is not compliance with laws and regulations will be eliminated:

Scenario P9 is not consistent with mandatory applicable laws and regulations. In 2006, the average annual utilization hours of Chinese fuel-fired power equipments are 5612 hours<sup>4</sup>. Considering the same annual electricity generation, the alternative baseline scenario for the proposed project should be a fuel-fired power plant with installed capacity of 52 MW. Furthermore, given that the proposed project is a grid-connected project, the alternative baseline scenario must be a grid-connected fuel-fired power project.

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<sup>4</sup> China Electric Power Yearbook 2007

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According to Chinese power regulations, fuel-fired power plants of less than 135MW<sup>5</sup> are prohibited to construct in the areas covered by large grids. The alternative of building a fossil fuel-fired power plant with installed capacity of 52MW conflicts with Chinese regulations. Therefore, P9 is excluded.

#### Outcome of Step 1b:

The plausible alternative scenarios are compliance with laws and regulations: P1, P4, H1, H6, and B1, B3. In conclusion, the credible combinations baseline scenarios are as follows:

| Combined Scenarios | Baseline alternatives  |                 |                          | Descriptions  |
|--------------------|------------------------|-----------------|--------------------------|---|
|                    | Electricity generation | Heat generation | Uses of biomass residues |   |
| a                  | P1                     | H1              | B4                       | The Project not undertaken as a CDM project activity  |
| b                  | P4                     | H6              | B1, B3                   | Exporting electricity from the grid; generating heat from fossil fuel fired boilers; and dumping biomass residues to naturally decay. This is Scenario 2 in ACM0006 |

### STEP 2. Barrier analysis

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. Apply the following sub-steps:

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

The barriers that would prevent the implementation of alternative scenarios are not identified yet.

#### Outcome of Step 2a:

The barriers that would prevent the implementation of alternative scenarios are not identified yet.

#### *Sub-step 2b. Eliminate alternative scenario which are prevented by the identified barriers:*

Neither of the two combined scenarios is eliminated by the alternative scenario

#### Outcome of Step 2b:

Neither of the two combined scenarios is eliminated by the alternative scenario. The two combined scenarios need to be further discussed in Step 3.

### STEP 3. Investment analysis

According to the ACM0006 (Version 06.2), project participants shall identify the most plausible baseline scenario and demonstrate additionality using the latest approved version of the “Combined tool to identify the baseline scenario and demonstrate additionality”.

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<sup>5</sup> Notice on Strictly Prohibiting the Illegal Installation of coal-fired Generators with the Capacity of 135MW or below issued by the General Office of the State Council, Guo Ban Fa Ming Dian decree No. 2002-6.



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However, Version 02.1 of the aforementioned tool establishes in footnote N°2 (on the first page) that for project activities in which one or more alternatives are not available options to project participants (such as grid-connected power projects), a different procedure to demonstrate additionality and identify the baseline scenario must be followed. For example, methodologies that involve alternatives that is not under the control of project participants can continue to use, if desired, the additionality tool (provides benchmark and other tools that utilize information about the markets in which such projects might compete), and provide their own methods to develop and/or assess baseline scenario.

According to the above and considering that the ACM0006 (Version 06.2) in this case applies to a project activity in which not all the alternatives are available options to the project participants, this PDD will use the “step 2 Investment analysis” in the last version of the additionality tool to determine whether the proposed project activity is less economically or financially attractive than the alternatives without the revenue from CER. The investment analysis is conducted in the following steps:

#### ***Sub-step 3a. Determine appropriate analysis method***

Three options can be applied for the investment analysis: the simple cost analysis, the investment comparison analysis and the benchmark analysis.

The simple cost analysis is not applicable for the proposed project because the project activity will produce economic benefit (from electricity sale) other than the CDM related income. The investment comparison analysis is also not applicable for the proposed project because one of the baseline alternatives, as identified in step1, providing the same electricity output by the Central China Power Grid, is not a new investment project. To conclude, the benchmark analysis will be used to identify whether the financial indicators of the proposed project is better than relevant benchmark value.

#### ***Sub-step 3b. Apply benchmark analysis.***

The financial benchmark rate of return (after tax) of Chinese Power Industries is 8% for the IRR of total investment.<sup>3</sup>

#### ***Sub-step 3c. Calculation and comparison of financial indicators.***

1) Parameters needed for calculation of IRR

According to the Feasibility Study Report of the proposed project, parameters needed for calculation of IRR are as follows:

**Table B-2 Parameters for calculation of IRR**

| Parameter                            | Value       | Unit     | Source |
|--------------------------------------|-------------|----------|--------|
| Installed capacity                   | 48          | MW       | FSR    |
| Project Lifetime                     | 20          | years    | FSR    |
| Net Power Generation output          | 253,440     | MWh      | FSR    |
| Net Heat Generation output           | 1,083,204   | GJ       | FSR    |
| Static total investment              | 438,870,000 | RMB      | FSR    |
| Tariff(excl. VAT) in first 15 years  | 557.69      | Yuan/WMh | FSR    |
| Tariff(excl. VAT) after the 15 years | 344.02      | Yuan/WMh | FSR    |
| Annual O&M cost                      | 124,270,000 | RMB      | FSR    |
| Heat price                           | 29.85       | Yuan/GJ  | FSR    |
| Biomass Purchase Price               | 270         | Yuan/t   | FSR    |
| Income tax                           | 25%         |          | FSR    |

<sup>3</sup> State Power Corporation of China. Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects. Beijing: China Electric Power Press, 2003

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|                     |     |       |     |
|---------------------|-----|-------|-----|
| VAT                 | 17% |       | FSR |
| Other Tax           | 10% |       | FSR |
| Depreciation period | 15  | years | FSR |
| Residual Rate       | 4%  |       |     |
| Expected CERs price | 8   | EUR   | FSR |

#### 2) Comparison of the project IRR and the financial benchmark

In accordance with benchmark analysis, if the financial indicators of the proposed project, such as the project IRR, are lower than the benchmark, the proposed project is not considered to be financially attractive.

Table 3 shows the project IRR with and without the income from CERs sale. Without the sales of CERs, the project IRR is 3.97% which is lower than the financial benchmark. Thus the proposed project is not financially acceptable. Taking into account the CDM revenues, the project IRR is 10.69% and higher than the financial benchmark. Therefore, the CDM revenues enable the project to overcome the investment barrier.

**Table B-3 Comparison of IRR with and without the income from CERs sale**

| Item | Without CDM | Benchmark | With CDM |
|------|-------------|-----------|----------|
| IRR  | 3.97%       | 8%        | 10.69%   |

#### *Sub-step 2d. Sensitivity analysis*

For the proposed project, three parameters were selected as sensitive factors to check out the financial attractiveness:

- 1) Static total investment
- 2) Tariff
- 3) Heat Price
- 4) Operational Hours
- 5) Annual O&M Cost

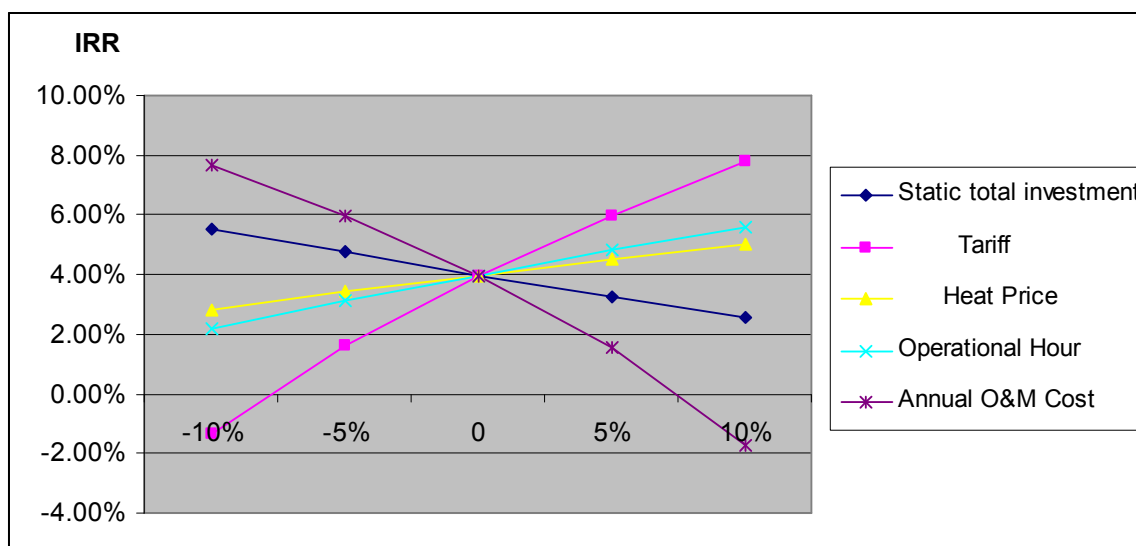
Assuming the above three factors vary in the range of -10% to 10%, the project IRR ( without the income from CERs sales) varies to different extents as shown in Table B-3 and Figure B-1 below.

**TableB-4 Sensitivity analysis of the proposed project**

|                         | -10%   | -5%   | 0     | 5%    | 10%    |
|-------------------------|--------|-------|-------|-------|--------|
| Static total investment | 5.55%  | 4.74% | 3.97% | 3.26% | 2.59%  |
| Tariff                  | -1.34% | 1.62% | 3.97% | 5.99% | 7.79%  |
| Heat Price              | 2.82%  | 3.41% | 3.97% | 4.51% | 5.02%  |
| Operational Hour        | 2.18%  | 3.10% | 3.97% | 4.81% | 5.61%  |
| Annual O&M Cost         | 7.66%  | 5.96% | 3.97% | 1.57% | -1.71% |

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**FigureB-2 Sensitivity analysis of the proposed project**

Within the reasonable changing range of Total Investment, the Static total investment, Expected Tariff, Heat Price, Operational Hours and Annual O&M cost, the IRR of the proposed project is always lower than the investment benchmark, and lacking of financial attractiveness.

#### Outcome of Step 3:

Based on the Investment Analysis above, the proposed project is not financially attractive without consideration of CERs sales revenues. Combined Scenario a “the proposed project not undertaken without being registered as a CDM project activity” is not feasible thus not baseline scenario.

So, the baseline scenario combination of the proposed project is (which belongs to Scenario 2 in the methodology:

| Scenario | Power generation | Heat generation | Use of biomass residues |
|----------|------------------|-----------------|-------------------------|
| 2        | P4               | H6              | B1 or B3                |

#### STEP 4. Common practice analysis

According to the “Combined tool to identify the baseline scenario and demonstrate additionality”, we choose Hunan Province as the relevant geographical area.

The proposed project is the first biomass residues cogeneration project and there is no similar project in this area.

It can be concluded that the proposed project is not common practice in Hunan Province.

In conclusion, the proposed project activity passed all criteria of the “combined tool to identify the baseline scenario and demonstrate additionality”. The baseline scenario 2 in the methodology is the realistic and credible baseline scenario and the proposed project is additional.

**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**

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#### and demonstration of additionality):

>>

ACM0006 requires that the “Combined tool to identify the baseline scenario and demonstrate additionality” is used. Therefore, please refer to the section above where the additionality has been determined.

#### **The CDM consideration and decision making process is presented as follows:**

The project owner wanted to invest and develop some biomass projects for a long time but due to the high cost, low profit of biomass power plants in China, the project owner found it is not feasible to invest in biomass project at that time. Then the project owner learned that some biomass projects were applying for CDM. The project owner began to learn about CDM and consider seeking help from CDM financing. The project owner asked the institute to write FSR for the project. The financial result in the FSR shows that with CER revenue, the IRR of the project is above benchmark, while the IRR is below benchmark without CER revenue. Therefore, the project owner determined to develop the biomass project as CDM project.

**TableB-5 Milestones and Schedule in Project Implementation**

|            |  |
|------------|--|
| May., 2007 | EIA was finished   |
| Jul., 2007 | EIA was approved by EPC  |
| Jun., 2007 | FSR was finished, which showed that without CER revenue, the proposed project is not financially attractive, thus Carbon financing was strongly recommended. |
| Aug., 2007 | Project was approved by DRC  |
| Sep., 2007 | The management board's decision of CDM application was made and issued.  |
| Feb , 2008 | Construction started   |
| Nov., 2007 | CADA signed with CAMCO   |
| Aug.2008   | Contract signed with DOE   |
| Mar., 2009 | Estimated Commission date of the project   |

Based on the analysis in B.4 and the above description, the Project is additional.

#### **B.6. Emission reductions:**

##### **B.6.1. Explanation of methodological choices:**

#### **EMISSION REDUCTION**

The Project reduces CO<sub>2</sub> emissions through substitution of power and heat generation with fossil fuels by energy generation with biomass residues. The emission reduction  $ER_y$  by the project during a given year  $y$  is the difference between the emission reductions through substitution of electricity generation with fossil fuels ( $ER_{electricity,y}$ ), the emission reductions through substitution of heat generation with fossil fuels ( $ER_{heat,y}$ ), project emissions ( $PE_y$ ), emissions due to leakage ( $L_y$ ) and, where this emission source is included in the project boundary and relevant, baseline emissions due to the natural decay or burning of anthropogenic sources of biomass residues ( $BE_{biomass,y}$ ), as equation (1):

$$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y \quad (1)$$

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Where,

$ER_y$  = Emissions reductions of the Project during the year  $y$  ( $tCO_2/yr$ )

$ER_{heat,y}$  = Emission reductions due to displacement of heat during the year  $y$  ( $tCO_2/yr$ )

$ER_{electricity,y}$  = Emission reductions due to displacement of electricity during the year  $y$  ( $tCO_2/yr$ )

$BE_{biomass,y}$  = Baseline emissions due to natural decay or burning of anthropogenic source of biomass residues during the year  $y$  ( $tCO_2/yr$ )

$PE_y$  = Project emissions during the year  $y$  ( $tCO_2/yr$ )

$L_y$  = Leakage emissions during the year  $y$  ( $tCO_2/yr$ )

#### Lifetime aspects

According to ACM0006, for the scenario 2, only heat generation facilities in baseline should be considered the lifetime aspects. Based on the information from the survey of the boiler from the Industry plant area management bureau, the lifetime of the existing boiler is around 20 years, when they are operating well, some can last for 25 years. The baseline, project, and leakage emissions are calculated respectively as following:

#### **A. PROJECT EMISSION**

According the Table in B.3, the project emissions include:

- $CO_2$  emissions from transportation of biomass residues to the project site ( $PET_y$ ),
- $CO_2$  emissions from on-site consumption of fossil fuels due to the project ( $PEFF_y$ ),
- $CO_2$  emissions from consumption of electricity ( $PE_{EC,y}$ )
- Where this emission source is included in the project boundary and relevant:  $CH_4$  emissions from the combustion of biomass residues ( $PE_{biomass,CH_4,y}$ )

Project emissions are calculated as follows:

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH_4} \times PE_{Biomass,CH_4,y} \quad (2)$$

Where,

$PET_y$  =  $CO_2$  emissions during the year  $y$  due to transport of the biomass residues to the project ( $tCO_2/yr$ )

$PEFF_y$  =  $CO_2$  emissions during the year  $y$  due to fossil fuel consumption at the project site that is attributable to the project ( $tCO_2/yr$ )

$PE_{EC,y}$  =  $CO_2$  emissions during the year  $y$  due to electricity consumption at the project site that is attributable to the project ( $tCO_2/yr$ )

$GWP_{CH_4}$  = Global Warming Potential for methane valid for the relevant commitment period

$PE_{biomass,CH_4,y}$  =  $CH_4$  emissions from the combustion of biomass residues during the year  $y$  ( $tCH_4/yr$ )

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

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Because the biomass residues will be transported to the power plant around the project site by trucks, CO<sub>2</sub> emissions from vehicles should be determined. According to the methodology ACM0006, it could be calculated by the following formula based on the distance and vehicle type (option 1):

$$PET_y = \frac{\sum_k BF_{T,k,y}}{TL_y} \cdot AVD_y \cdot EF_{km,CO_2,y} \quad (3)$$

Where,

PET<sub>y</sub> = CO<sub>2</sub> emissions during year y due to transport of the biomass residues to the project plant (tCO<sub>2</sub>/yr)

BF<sub>T,k,y</sub> = Quantity of biomass residue type k that has been transported to the Project site during the year y (tons of dry matter or liter)

TL<sub>y</sub> = Average truck load of the trucks used (tons or liter) during the year y.

AVD<sub>y</sub> = 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<sub>km,CO<sub>2</sub>,y</sub> = Average CO<sub>2</sub> emission factor for the trucks measured during the year y (tCO<sub>2</sub>/km)

k = 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<sub>y</sub>)**

According to the Feasibility Study, the fossil fuels (diesel oil) are only used for boiler start-up, the emissions from combusting fossil fuels are calculated as “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” as following:

$$PEFF_y = PE_{FC,j,y} = \sum_i (FF_{projectplant,i,y} + FF_{projectsite,i,y}) \cdot COEF_{i,y} \quad (4)$$

Where,

PE<sub>FC,j,y</sub> = CO<sub>2</sub> emissions from fossil fuel combustion in process j during the year y (tCO<sub>2</sub> / yr);

FF<sub>projectplant,i,y</sub> = Quantity of fossil fuel type i combusted in the biomass residue fired power plant during the year y (mass or volume unit per year)

FF<sub>projectsite,i,y</sub> = Quantity of fossil fuel type i combusted at the project site for other purposes that are attributable to the project activity during the year y (mass or volume unit per year)

COEF<sub>i,y</sub> = CO<sub>2</sub> emission coefficient of fuel type i in year y (tCO<sub>2</sub> / mass or volume unit);

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

The “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” provides two procedures to determine COEF<sub>i,y</sub>. The Option A requires carbon content and density of the diesel oil used in the project, however the data is not available. Therefore the Option B is adopted as follows:

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$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y} \quad (5)$$

Where,

$NCV_{i,y}$  = weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit);

$EF_{CO2,i,y}$  = weighted average CO<sub>2</sub> emission factor of fuel type i in year y (tCO<sub>2</sub>/GJ);

**c) CO<sub>2</sub> emissions from electricity consumption ( $PE_{EC,y}$ )**

CO<sub>2</sub> 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”. Little electricity will be consumed during the biomass residues pretreatment. The emissions due to auxiliary electricity consumption are calculated as Scenario A in Generic approach of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” as follows:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \cdot EF_{EL,j,y} \cdot (1 + TDL_{j,y}) \quad (6)$$

Where,

$PE_{EC,y}$  = project emissions from electricity consumption in year y (tCO<sub>2</sub> / yr);

$EC_{PJ,j,y}$  = quantity of electricity consumed by the Project electricity consumption source j in year y (MWh);

$EF_{EL,j,y}$  = emission factor for electricity generation for source j in year y. (tCO<sub>2</sub>/MWh)

$TDL_{j,y}$  = average technical transmission and distribution losses for providing electricity to source j in year y.

j = source of electricity consumption in the Project.

In this case, refer to the description of project boundary, the only source of j is the East China Power Grid.

According to the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”(Version 01), the proposed project belongs to Scenario A: Electricity consumption from the grid, so, we choose Option A1: Calculate the combined margin emission factor of the applicable electricity system, using the procedures in the latest approved version of the “Tool to calculate the emission factor for an electricity system” ( $EF_{EL,j/k,l,y} = EF_{grid,CM,y}$ ).

**d) Methane emission from Biomass residues combustion**

Consistent with IPCC Guidelines, CO<sub>2</sub> emissions from biomass combustion at the project site is equal to the release of the CO<sub>2</sub> absorbed on a sustainable basis by plants that is replanted every year. The same treatment is not extended to methane emissions. When biomass is combusted in a well-controlled manner at the project, methane emissions are small in quantity but still not zero.

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

where:

$PE_{biomass,CH_4,y}$  : Project emissions from biomass controlled burning (tCH<sub>4</sub>/yr)

$BF_{k,y}$  : Quantity of biomass residue type  $k$  combusted in the project plant during the year  $y$  (ton)

$NCV_k$  : Net calorific value of the biomass residue type  $k$  (GJ/ton)

$EF_{CH_4,BF}$  : CH<sub>4</sub> emission factor for the combustion of biomass residues in the project plant (tCH<sub>4</sub>/GJ)

According to the chosen baseline methodology, the project proponent will monitor the consumption and Net Calorific Values of each type of biomass consumed in the power plant. However, given that the amounts of each type of biomass remain constant in time (homogeneous biomass mix); this PDD will consider to apply the biomass mix and the corresponding weighted average Net Calorific Value for emission reduction calculations.

**B. EMISSION REDUCTIONS DUE TO DISPLACEMENT OF ELECTRICITY**

According to the methodology ACM0006, emission reductions due to the displacement of electricity 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 CO<sub>2</sub> baseline emission factor for the electricity displaced due to the project ( $EF_{electricity,y}$ ), as follows:

$$ER_{electricity,y} = EG_y \cdot EF_{electricity,y} \quad (7)$$

Where,

$ER_{electricity,y}$  = Emission reductions due to displacement of electricity during the year  $y$  (tCO<sub>2</sub>/yr)

$EG_y$  = Net quantity of increased electricity generation as a result of the Project (incremental to baseline generation) during the year  $y$  (MWh)

$EF_{electricity,y}$  = CO<sub>2</sub> emission factor for the electricity displaced due to the Project during the year  $y$  (tCO<sub>2</sub>/MWh)

In this case, all the electricity displaced is from the East China Power Grid.

**STEP 1: Determination of  $EF_{electricity,y}$**

The Project has been identified as the scenario 2 of ACM0006, i.e. the baseline of the power generation is P4 – “The generation of power in the grid”, the emission factor for the displacement of electricity should correspond to the grid emission factor ( $EF_{electricity,y} = EF_{grid,y}$ ). On the other hand, the installed capacity of the Project is more than 15MW, the  $EF_{grid,y}$  shall be determined as a combined margin (CM), following the guidance in the section “Baselines” in the “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” (ACM0002). Refer to the relevant chapter of ACM0002, the combined margin (CM) should be calculated as the “Tool to calculate the emission factor for an electricity system” (hereafter referred to as the Emission Factor Tool).

**Sub-step 1: Identify the relevant electric power system**

This is identified in B.3. as the Central China Power Grid. For the purpose of determining the operating margin emission factor, the methodology provides following four options to determine the CO<sub>2</sub> emission factor for net electricity import from the Central China power Grid:



- (a) 0 tCO<sub>2</sub>/MWh, or
- (b) The weighted average operating margin (OM) emission rate of the exporting grid; or
- (c) The simple operating margin emission rate of the exporting grid; or
- (d) The simple adjusted operating margin emission rate of the exporting grid.

For this project activity, we choose option (b) to calculate the OM emission rate of the East China Power Grid.

**Sub-step 2: Select an operating margin (OM) method**

The calculation of the operating margin emission factor ( $EF_{grid,OM,y}$ ) is based on one of the following methods:

- a) Simple OM
- b) Simple adjusted OM
- c) Dispatch data analysis OM
- d) Average OM

Option b needs the annual load duration curve of the grid. The data required by this method is not publicly available in China. This option is not applicable.

Option c requires the detailed operating and dispatch data of power plants within the grid, but the dispatch data for the East China Power Network is not publicly available. This option is not applicable.

Option d can be only used when low-cost/ must run resources account for more than 50% of the total amount of grid power generation. As shown in table A1 of annex 3, the CCPG is a coal-fired dominated power grid, where the installed capacity of low cost and must run plants account for 35.95%, 43.81%, 37.89%, 38.60% and 35.12% in 2002, 2003, 2004, 2005 and 2006 respectively. The fractions are all below 50%, so this option is not applicable.

Option a is used when low-cost/ must run resources account for less than 50% of the total amount of grid power generation. ACM0002 defines low cost/must run resources as “Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.” Compared with other generation sources (Hydro, Wind) connected with the CCPG, there is no indication that coal fired plants should be included as “must run.” This was confirmed through the guidelines issued by Chinese DNA on determining baseline emission factor of Chinese grids (available at <http://cdm.ccchina.gov.cn/web/NewsInfo.asp?NewsId=1235>). In these guidelines the emission factor of Chinese regional grids, including the CCPG, was calculated by Chinese experts. In their calculation, the experts did not consider coal as a must run source.

Therefore the Simple OM is selected for the project and the operating margin  $EF_{grid,OM,y}$  is approximated by the generation mix of CCPG, excluding its low cost / must run resources (in this case hydro and wind). Emissions of CO<sub>2</sub> for the generation mix of the CCPG can be directly calculated from the data provided in the China Energy Statistical Yearbook (published annually). This yearbook provides annual data on power generation by fuel source and by province, as well as calorific values of fuels.

The simple OM is calculated ex-ante using a 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation.

**Sub-step 3: Calculate the operating margin emission factor according to selected method**

According to the “Tool to calculate the emission factor for an electricity system”, the Simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub> emissions per unit net electricity generation (tCO<sub>2</sub>/MWh) of all generating power plants serving the system, not including low-operating cost and must-run power plants/units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant/unit (Option A)
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B)
- Based on data 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 (Option C)

According to the Tool, option A should be preferred and must be used if fuel consumption data is available for each power plant/unit. In other cases, option B or option C can be used. For the purpose of calculating the simple OM, Option C should only be used if the necessary data for option A and option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost/ must-run power sources and if the quantity of electricity supplied to the grid by these sources is known.

Data on fuel consumption, power generation and average efficiency of individual power stations is not publicly available in China. Therefore, in the proposed project activity, Option C is used and the following formula is used:

$$EF_{Grid, OM, simple, y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{CO_2, i, y}}{\sum_j EG_y} \quad (8)$$

Where:

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

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

$EF_{CO_2, i, y}$  = CO<sub>2</sub> emission factor of fossil fuel type i in year y (tCO<sub>2</sub>/TJ)

$EG_y$  = net electricity generated and 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 = all fossil fuel types combusted in power sources in the project electricity system in year y,

y = three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex-ante option)

Based on calculation from the China DNA ( see Annex 3), the OM Emission Factor of the Central China Power Grid is 1.2783 tCO<sub>2</sub>e/MWh.

**Sub-step 4: Identify the cohort of power units to be included in the build margin (BM)**

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According to the tool to calculate the emission factor for an electricity system, the sample group of power units  $m$  used to calculate the build margin could consist of either:

- (a) the set of five power plants that have been built most recently, or
- (b) the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently;

The tool also states that project participants should use the set of power units that comprises the larger annual generation. In this case option (b) is used.

In terms of the vintage of the data, two options are given in the tool. In this case Option 1 is chosen: For the first crediting period, the build margin emission factor is calculated 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 5: Calculate the build margin emission factor

According to the tool, the build margin emission factor is the generation-weighted average emission factor ( $\text{tCO}_2/\text{MWh}$ ) of all power units  $m$  during the most recent year  $y$  for which power generation data is available, calculated as follows:

$$EF_{\text{Grid, BM, } y} = \frac{\sum_m EG_{m, y} \cdot EF_{\text{EL, } m, y}}{\sum_m EG_{m, y}} \quad (9)$$

Where:

$EF_{\text{grid, BM, } y}$  = Build margin  $\text{CO}_2$  emission factor in year  $y$  ( $\text{tCO}_2/\text{MWh}$ )

$EG_{m, y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)

$EF_{\text{EL, } m, y}$  =  $\text{CO}_2$  emission factor of power unit  $m$  in year  $y$

$m$  = Power units included in the build margin

$y$  = Most recent historical years for which power generation data is available

Following guidance issued by the CDM Executive Board in response to a request for guidance from an accredited DOE on the determination of the Build Margin in methodology AM0005 in China,  $EF_{\text{BM, } y}$  is calculated as the capacity weighted average emissions factor of new installed capacity rather than the generation weighted factor. Furthermore, it is suggested in the same guidance note that the efficiency level of the best technology commercially available in the provincial/regional or national grid of China is used as a conservative proxy for each fuel type in estimating the fuel consumption when calculating the Build Margin. The suggested approach is followed in the determination of the Build Margin for the purposes of this project.

Because capacities of technologies using coal, oil and gas cannot be separated from the total thermal power generation from available statistics, the following method is used for the calculation: first, use the recent one year available energy balance data and calculate percentages of CO<sub>2</sub> emissions of power generation using solid, liquid and gas fuel in the total CO<sub>2</sub> emission. Second, calculate grid thermal power emission factors, using the percentages (as weights) and emission factors of technologies corresponding to best available efficiencies. Lastly, the thermal power emission factor is multiplied by the percentage of thermal power in the newest 20% capacity in the grid, and the result is the Build Margin emission factor of the grid.

The steps and equations are as follows:

**1. Calculate percentages of CO<sub>2</sub> emission of power generation using solid, liquid and gas fuel in total CO<sub>2</sub> emission.**

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (10)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (11)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (12)$$

Where,

$F_{i,j,y}$  = amount of fuel i (tce) consumed by power plants m in year y,

$COEF_{i,j,y}$  = CO<sub>2</sub> emission coefficient of fuel i (tCO<sub>2</sub> /tce), taking into account the carbon content of the fuels used by power plants m and the oxidation percent of the fuel in year(s) y,

COAL, OIL and GAS refer to coal fuel, oil fuel and gas fuel in the subscript set.

**2. Calculate thermal emission factor**

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (13)$$

Where,

$EF_{Coal,Adv}$ ,  $EF_{Oil,Adv}$  and  $EF_{Gas, Adv}$  are emission factors corresponding to commercially optimal efficient power generation technology using coal, oil and gas.

**3. Calculate the BM of the Grid**

$$EF_{Grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (14)$$

Where,

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$CAP_{Total}$  = new added total capacity,

$CAP_{Thermal}$  = new added thermal power capacity.

The data used to calculate OM and BM emission factors are all publicly available. The generation data and average self consumption rate data are from publicly available China Electric Power Yearbooks. The data of fuel consumption per electricity generated and net calorific values of fuels are from the China Energy Statistical Yearbooks. The  $OXID_i$  and  $EF_{CO2,i}$  data by fuels are from the “2006 IPCC Guidelines for National Greenhouse Gas Inventories,” Volume 2 Energy.

According to the announcement “China's Regional Grid Baseline Emission Factors Renewed”, the weighted average of coal consumption per kWh supplied of 30 new built 600 MW sub critical units in 2006 is adopted to determine the emission factor of the best advanced coal fired generation technology, which is 329.94gce/kWh. In other word, the efficiency of best advanced coal fired generation technology is 37.28%.

The maximum electricity supplied efficiency of oil and gas fired generation plants are regarded as approximate estimation of commercially optimal efficiency technology. Similarly, the fuel consumption per kWh supplied of best advanced oil and gas fired generation technology is determined to be 252 gce/kWh, which means a generation efficiency of 48.81%.

According to the Chinese DNA<sup>6</sup>, the  $EF_{Grid,BM,y}$  for the Central China Power Grid is 0.7156 tCO<sub>2</sub>e/MWh. For the data source and the calculations, please see Annex 3.

**Sub-step 6: Calculate the combined margin emissions factor**

The combined margin emissions factor is calculated as follows:

$$EF_y = w_{OM} \cdot EF_{Grid,OM,y} + w_{BM} \cdot EF_{Grid,BM,y} \quad (15)$$

Where,

$EF_{grid,OM,y}$  = Operating margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)

$EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)

$W_{OM}$  = Weighting of operating margin emissions factor (%)

$W_{BM}$  = Weighting of build margin emissions factor (%)

The defaults weights are used, i.e. each of the Operating Margin and Build Margin is weighted equally.

$$w_{OM} = w_{BM} = 0.5$$

In this case, for the first crediting period:

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y} = 0.9970 \text{ tCO}_2/\text{MWh}$$

**STEP 2: Determination of EG<sub>y</sub>**

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<sup>6</sup> <http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1875.pdf>

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Where scenarios 2 apply,  $EG_y$  corresponds to the net quantity of electricity generation in the Project plant ( $EG_y = EG_{\text{project plant},y}$ ).

**C. EMISSION REDUCTIONS OR INCREASES DUE TO DISPLACEMENT OF HEAT**

According to ACM0006, scenario 2 is applicable for the proposed project. As the identified baseline scenario is the generation of heat in boilers using fossil fuels, and then baseline emission can be calculated through the following formula:

$$ER_{\text{heat},y} = \frac{Q_y \cdot EF_{CO_2,BL,heat,i}}{\epsilon_{\text{boiler}}}$$

Where:

$ER_{\text{heat},y}$ : Emission reductions due to displacement of heat during the year  $y$  in tons of  $CO_2e$ .

$Q_y$ : Net quantity of heat generated in the proposed plant during the year  $y$  in GJ.

$\epsilon_{\text{boiler}}$ : Energy efficiency of the boiler that would be used in the absence of the project activity. The efficiency of boilers to be displaced is conservatively estimated as 100%.

$EF_{CO_2,BL,heat,i}$ :  $CO_2$  emission factor of the fossil fuel type  $i$  used for heat generation in the absence the project activity ( $tCO_2/GJ$ )

According to the ACM0006, in case of scenario 2, the baseline scenario is that all heat generated by the cogeneration project plant would in the absence of the project activity be generated in fossil fuel fired boilers. Thus:  $Q_y = Q_{\text{project plant},y}$

**D. BASELINE EMISSIONS DUE TO NATURAL DECAY OR UNCONTROLLED BURNING OF BIOMASS RESIDUES**

The emissions from avoided disposal of the biomass to be used by the project activity in year  $y$  can be calculated as:

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

where:

$BE_{\text{biomass},y}$ : Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year  $y$  ( $tCO_2e/yr$ )

$GWP_{CH_4}$ : Global Warming Potential of methane valid for the commitment period ( $tCO_2e/tCH_4$ )

$BF_{PJ,k,y}$ : 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 or liter)

$NCV_k$ : Net calorific value of the biomass residue type  $k$  ( $GJ/ton$  of dry matter or  $GJ/liter$ )

$EF_{\text{burning},CH_4,k,y}$ :  $CH_4$  emission factor for uncontrolled burning of the biomass residue type  $k$  during the year  $y$  ( $tCH_4/GJ$ )

**E. LEAKAGE**

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Option L2 (ACM0006, Section Leakage) is used to demonstrate that there is an abundant surplus of the straws in the region of the project activity, and then the leakage can be neglected.

According to the feasibility study report and the biomass availability report, within the region covering a radius of 50km around the proposed project, the total quantity of annual rice husk is 370,000t, the practical and economical available quantity is 270,000t and the project demand for rice husk is approximately 175,800t. Therefore, the available biomass residue is 53% larger than the quantity of rice husk utilized, including the project plant. Besides, the total quantity of annual straws (including cotton straw, rice straw and oil seed rape straw) is 2,350,000t, the practical and economical available quantity is 630,000t and the project demand for straws is approximately 195,600t. Therefore, the available biomass residue is 200% larger than the quantity of rice husk utilized, including the project plant. The utilization of the biomass residues by the project plant is considered to have no influence on the current biomass usage, and therefore the leakage of proposed project is considered 0.

In conclusion, the Project does not result increase of fossil fuel consumptions, i.e. the leakage is zero ( $L_y = 0 \text{ tCO}_2\text{e}$ ).

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

|   |   |
|---|---|
| <b>Data / Parameter:</b>  | $GWP_{CH_4}$  |
| Data unit:  | tCO <sub>2</sub> e/tCH <sub>4</sub>   |
| Description:  | Global warming potential for CH <sub>4</sub>  |
| Source of data used:  | IPCC  |
| Value applied:  | 21 for the first commitment period. Shall be updated according to any future COP/MOP decisions. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC 2006 default value   |
| Any comment:  |   |

|   |  |
|---|--|
| <b>Data / Parameter:</b>  | $EG_y$   |
| Data unit:  | MWh  |
| Description:  | net electricity generated and delivered to the grid by power plant / unit m in year y  |
| Source of data used:  | China Electric Statistical Yearbook, 2005-2007   |
| Value applied:  | Values depend on specifically fuel, referring to Annex 3.  |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the Tool to calculate the emission factor for an electricity system requirement, use accurate and reliable local or national data where available |
| Any comment:  |  |

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|   |  |
|---|--|
| <b>Data / Parameter:</b>  | <b>FC<sub>i,y</sub></b>  |
| Data unit:  | mass or volume unit  |
| Description:  | Amount of fossil fuel type i consumed in the project electricity system in year y  |
| Source of data used:  | China Electric Statistical Yearbook, 2005-2007   |
| Value applied:  | Values depend on specifically fuel, referring to Annex 3.  |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the Tool to calculate the emission factor for an electricity system requirement, use accurate and reliable local or national data where available |
| Any comment:  |  |

|   |  |
|---|--|
| <b>Data / Parameter:</b>  | <b>F<sub>i,j,y</sub></b>   |
| Data unit:  | mass or volume unit  |
| Description:  | The fuel consumption of fuel i in power plant j during year y  |
| Source of data used:  | China Electric Statistical Yearbook, 2005-2007   |
| Value applied:  | Values depend on specifically fuel, referring to Annex 3.  |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the Tool to calculate the emission factor for an electricity system requirement, use accurate and reliable local or national data where available |
| Any comment:  |  |

|   |   |
|---|---|
| <b>Data / Parameter:</b>  | <b>NCV<sub>i,y</sub></b>  |
| Data unit:  | TJ/t, TJ/km <sup>3</sup>  |
| Description:  | 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, 2007   |
| Value applied:  | Values depend on specifically fuel, referring to Annex 3.   |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the Tool to calculate the emission factor for an electricity system requirement, use accurate and reliable local or national data where available. |
| Any comment:  |   |

|  |   |
|--|---|
| <b>Data / Parameter:</b>               | <b>EF<sub>CO2,i,y</sub></b>   |
| Data unit:                             | tC/TJ (tCO <sub>2</sub> e/TJ)   |
| Description:                           | CO <sub>2</sub> emission factor of fossil fuel type i in year y (tCO <sub>2</sub> /GJ)                                |
| Source of data used:                   | IPCC 2006 Revised Guidelines  |
| Value applied:                         | Values depend on specifically fuel, referring to Annex 3.   |
| Justification of the choice of data or | According to the Tool to calculate the emission factor for an electricity system requirement, use IPCC default value. |



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|  |  |
|--|--|
| description of measurement methods and procedures actually applied : |  |
| Any comment:   |  |

|   |  |
|---|--|
| <b>Data / Parameter:</b>  | <b>CAP<sub>i,j,y</sub></b>   |
| Data unit:  | MW   |
| Description:  | Installed capacities of power plant category i of province j in years y. |
| Source of data used:  | China Electric Power Yearbook 2005-2007                                  |
| Value applied:  | See Annex 3 for details.   |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities.                                  |
| Any comment:  |  |

|   |   |
|---|---|
| <b>Data / Parameter:</b>  | <b>EG<sub>grid, imported</sub></b>                          |
| Data unit:  | MWh   |
| Description:  | Electricity imported from other grid to Central China Grid. |
| Source of data used:  | China's Regional Grid Baseline Emission Factors Renewed     |
| Value applied:  | See Annex 3 for details.                                    |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities.                     |
| Any comment:  |   |

|   |  |
|---|--|
| <b>Data / Parameter:</b>  | <b>TDL<sub>j,y</sub></b>   |
| Data unit:  | %  |
| Description:  | average technical transmission and distribution losses for providing electricity to source j in year y.  |
| Source of data used:  | Tool to calculate baseline, project and/or leakage emissions from electricity consumption  |
| Value applied:  | 20   |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Because the data is not available within host country, the default value (20%) can be adopted for project emission calculation according to the Tool to calculate baseline, project and/or leakage emissions from electricity consumption. This is conservative. |
| Any comment:  |  |

|                          |                                 |
|--------------------------|---------------------------------|
| <b>Data / Parameter:</b> | <b>EF<sub>CO2,BL,heat</sub></b> |
|--------------------------|---------------------------------|

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|   |  |
|---|--|
| Data unit:  | tCO <sub>2</sub> /GJ   |
| Description:  | CO <sub>2</sub> emission factor of the fossil fuel type used for heat generation in the absence the project activity |
| Source of data used:  | Default value from IPCC 2006. In the Project, the identified fossil fuel for heat generation is coal.                |
| Value applied:  | 0.0946   |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The data is adopted from IPCC, this is conservative.   |
| Any comment:  |  |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | <i>ε<sub>boiler</sub></i>  |
| Data unit:   |  |
| Description:   | Average net energy efficiency of heat generation in the boiler that would generate heat in the absence of the project activity |
| Source of data to be used:   | ACM0006  |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 100%   |
| Description of measurement methods and procedures to be applied:                                 | Because the data is not available, the default value (100%) can be adopted according to the ACM0006. This is conservative      |
| QA/QC procedures to be applied:  | -  |
| Any comment:   | The data will be fixed during the crediting period which is conservative.  |

|   |   |
|---|---|
| <b>Data / Parameter:</b>  | <i>EF<sub>CH<sub>4</sub>,BF</sub></i>   |
| Data unit:  | tCH <sub>4</sub> /GJ  |
| Description:  | CH <sub>4</sub> emission factor for controlled burning of the biomass residue in the project plant  |
| Source of data used:  | IPCC Default Value ; ACM0006  |
| Value applied:  | 30 for the first commitment period. Considering the conservativeness factor as 1.37, this should be adjusted as:<br>EF <sub>CH<sub>4</sub>,BF</sub> =30*1.37=41.1 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC 2006 default value.<br>The conservative factor is applied, as specified in the baseline methodology.   |

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|              |  |
|--------------|--|
| Any comment: |  |
|--------------|--|

|   |   |
|---|---|
| <b>Data / Parameter:</b>  | $NCV_k * EF_{burning, CH_4, k, y}$  |
| Data unit:  | tCH <sub>4</sub> /tonne   |
| Description:  | CH <sub>4</sub> emission factor for uncontrolled burning of the biomass residue |
| Source of data used:  | IPCC Default Value ; ACM0006  |
| Value applied:  | 0.001971  |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The conservative factor is applied, as specified in the baseline methodology    |
| Any comment:  |   |

|   |  |
|---|--|
| <b>Data / Parameter:</b>  | $EF_{km, CO_2}$  |
| Data unit:  | kgCO <sub>2</sub> e/km   |
| Description:  | Average CO <sub>2</sub> Emission Factor for transportation of biomass with trucks            |
| Source of data used:  | IPCC 2006 default value from the Moderate Control index for the US heavy Duty Diesel Vehicle |
| Value applied:  | 1.011 for the first commitment period  |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC 2006 default value from the Moderate Control index for the US heavy Duty Diesel Vehicle |
| Any comment:  |  |

|   |   |
|---|---|
| <b>Data / Parameter:</b>  | $EF_{CO_2, diesel}$                                       |
| Data unit:  | kgCO <sub>2</sub> e/TJ                                    |
| Description:  | Emission Factor of Diesel                                 |
| Source of data used:  | IPCC 2006 default value (Volume2.Chapter2.P16)            |
| Value applied:  | 74,100 for the first commitment period                    |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC 2006 default value (Volume2.Chapter2.P16) for diesel |
| Any comment:  |   |

|                          |   |
|--------------------------|---|
| <b>Data / Parameter:</b> | $NCV_i$ of fossil fuel combusted in Plant                   |
| Data unit:               | TJ/tonne  |
| Description:             | Net Calorific Value(NCVi) of fossil fuel combusted in plant |
| Source of data used:     | China Energy Statistical Yearbook                           |
| Value applied:           | 0.042652  |

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|   |   |
|---|---|
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The value for Diesel is used for estimation. If other fuels are to be used, the valued will be changed accordingly. |
| Any comment:  |   |

#### B.6.3 Ex-ante calculation of emission reductions:

##### Project emissions

##### **a) Carbon dioxide emissions from combustion of fossil fuels for transportation of biomass residues to the project plant (PET<sub>y</sub>)**

According to the Feasibility Study Report, the Project is designed to consume 175,800t rice husk and 195,600t annually and these biomass residues are transported by 3t, 5t, 8t,10t -loading diesel trucks. The moisture content of rice husk and straws (including cotton straw, rice straw and oil seed rape straw) are 6% and 20.7%. The biggest moisture content of the straws (20.7%) is used when calculating the total dry biomass residues, which is conservative. Besides, the biggest NCV (0.013TJ/tonne) is used when calculating the methane emission which is conservative.

The farthest distance that the trucks will travel is 50km. In order to keep conservativeness, the longest distance and the smallest loading capacity is chosen, namely: AVD<sub>y</sub> is adopted as 100km (2\*50) and the loading per truck is adopted as 3t.

The CO<sub>2</sub> emission factor for the trucks is 1.011 kgCO<sub>2</sub>e/km, which is IPCC 2006 default value from the Moderate Control index for the US heavy Duty Diesel Vehicle (assuming the 3t-loading truck is diesel heavy truck). Refer to the equation (3), the emissions from biomass residues transportation are calculated as follow: PET<sub>y</sub> = (175,800t + 195,600t) / 3t \* 100km \* 0.001011tCO<sub>2</sub>e/km = 12,516tCO<sub>2</sub>e The actual emissions from the transportation will be calculated according to monitored data.

##### **b) Carbon dioxide emissions from on-site consumption of fossil fuels (PEFF<sub>y</sub>)**

According to the project owner, the fossil fuel (diesel) is only used for boiler start-up, and the quantity of fossil fuel consumed in the project plant is estimated as 50t per year, and fossil fuel consumed for other purposes is assumed to be 0.

The NCV<sub>i,y</sub> and EF<sub>CO<sub>2</sub>,i,y</sub> are adopted IPCC default value. Therefore the PEFF<sub>y</sub> is calculated as follow: PEFF<sub>y</sub> = 50t \* 0.042652TJ/t \* 74.1tCO<sub>2</sub>e/TJ = 158 tCO<sub>2</sub>e The actual emissions will be calculated according to monitored diesel consumptions.

##### **c) CO<sub>2</sub> emissions from electricity consumption (PEEC<sub>y</sub>)**

There will be some electricity consumption in the biomass residues pretreatment, and it is estimated as 3,714MWh. So, the CO<sub>2</sub> emissions from electricity consumption (PEEC<sub>y</sub>) can be calculated as:

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$EF_{EL,j,y}(=EF_{grid,CM,y})$  is calculated in Annex 3 as 0.9970 tCO<sub>2</sub>e/MWh, where:  $PE_{EC,y} = 3,714\text{MWh} * 0.9970\text{tCO}_2\text{e/MWh} * (1+20\%) = 4,443\text{tCO}_2\text{e}$

#### **d) Methane emission from Biomass residues combustion( $PE_{biomass,CH_4,y}$ )**

According to the Feasibility Study Report, the quantity of rice husk and straws (including cotton straw, rice straw and oil seed rape straw) consumed annually are 175,800t and 195,600t, and their moisture content are 6% and 20.7%(the highest value of these different straws, for conservative), Net Calorific Value 3100kal/kg(0.013TJ/tone).

CH<sub>4</sub> emission factor for controlled burning of the biomass residue in the project plant,  $EF_{CH_4,BF}=41.1\text{kgCH}_4/\text{TJ}$ , Which is adopted IPCC default value.

So,  $PE_{biomass,CH_4,y}=(175,800t * (1-6\%)+195,600t * (1-20.7\%)) * 0.013\text{TJ/tone} * 41.1\text{kgCH}_4/\text{TJ}=171\text{tCH}_4$

**Therefore the project emissions are calculated as:  $PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH_4} * PE_{biomass,CH_4,y}$**   
 $PE_{biomass,CH_4,y} = 12,516\text{tCO}_2\text{e} + 158\text{tCO}_2\text{e} + 4,443\text{tCO}_2\text{e} + 21 * 171 = 20,700\text{tCO}_2\text{e}$

### **Emission reductions due to displacement of electricity**

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

Based on the description in B.6.1 and detailed calculation in Annex 3, the  $EF_{electricity,y} = EF_{grid,y} = 0.9970\text{tCO}_2\text{e/MWh}$ .

#### **Step 2: Determination of $EG_y$**

According to the Feasibility Study Report, the delivered electricity is 253,440MWh per year, i.e.  $EG_y = 253,440\text{MWh}$ . Therefore:  $ER_{electricity,y} = 253,440\text{MWh} * 0.9970\text{tCO}_2\text{e/MWh} = 252,667\text{tCO}_2\text{e}$

### **Emission reductions or increases due to displacement of heat**

According to the Feasibility Study Report, the Project is designed to supply 1,083,204GJ heat per year. The CO<sub>2</sub> emission factor of the fossil fuel type (coal) used for heat generation in the absence the Project is adopted from IPCC 2006, i.e.  $EF_{CO_2,BL,heat} = 0.0946\text{tCO}_2\text{e/GJ}$ . The efficiency of the boiler is assumed to be 100% for conservativeness. Therefore:  $ER_{heat,y} = 1,083,204\text{GJ} * 0.0946\text{tCO}_2\text{e/GJ} / 100\% = 102,471\text{tCO}_2\text{e}$

### **Uncontrolled burning or decay of biomass baseline emission**

According to the Feasibility Study Report, the quantity of rice husk consumed annually is 175,800t, and its moisture content is 6%, the quantity of straws (including cotton straw, rice straw and oil seed rape straw) is 195,600t with moisture 20.7%(the highest value of these different straws, for conservative).

CH<sub>4</sub> emission factor for uncontrolled burning of the biomass residue, i.e.  $NCV_k * EF_{burning,CH_4,k,y} = 0.001971\text{tCH}_4/\text{tonne biomass}$ , which is from IPCC default value.

So, Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year y,

$$BE_{biomass,y} = GWP_{CH_4} \cdot \sum_k BF_{PJ,k,y} \cdot NCV_k \cdot EF_{burning,CH_4,k,y} = 21\text{tCH}_4/\text{tCO}_2 * (175,800t * (1-6\%)+195,600t * (1-20.7\%)) * 0.001971\text{tCH}_4/\text{tonne} = 13,260\text{tCO}_2\text{e}$$

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#### Leakage

Based on the description in B.6.1, the leakage of the Project is not taken into account, i.e.  $L_y = 0 \text{ tCO}_2\text{e}$

#### Emission Reductions

Refer to the equation (1), the emission reductions are calculated as:

$$ER_y = ER_{\text{heat},y} + ER_{\text{electricity},y} + BE_{\text{biomass},y} - PE_y - L_y = 347,698 \text{ tCO}_2\text{e}$$

The  $ER_{\text{heat},y}$  is not claimed in the first half year.

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

| Year                                     | Estimation of project activity emissions (tonnes of CO <sub>2</sub> e) | Estimation of baseline emissions (tonnes of CO <sub>2</sub> e) | Estimation of leakage (tonnes of CO <sub>2</sub> e) | Estimation of overall emission reductions (tonnes of CO <sub>2</sub> e) |
|--|--|--|---|---|
| 01/07/2009-30/06/2010                    | 20,700   | 317,162  | 0   | 296,462   |
| 01/07/2010-30/06/2011                    | 20,700   | 368,398  | 0   | 347,698   |
| 01/07/2011-30/06/2012                    | 20,700   | 368,398  | 0   | 347,698   |
| 01/07/2012-30/06/2013                    | 20,700   | 368,398  | 0   | 347,698   |
| 01/07/2013-30/06/2014                    | 20,700   | 368,398  | 0   | 347,698   |
| 01/07/2014-30/06/2015                    | 20,700   | 368,398  | 0   | 347,698   |
| 01/07/2015-30/06/2016                    | 20,700   | 368,398  | 0   | 347,698   |
| <b>Total (tonnes of CO<sub>2</sub>e)</b> |  |  |   | 2,380,679   |

*Note: The  $ER_{\text{heat},y}$  is not claimed in the first half year.*

### B.7 Application of the monitoring methodology and description of the monitoring plan:

#### B.7.1 Data and parameters monitored:

| Data / Parameter:  | $BF_{k,y}$   |
|--|--|
| Data unit:   | Tons of dry matter   |
| Description:   | Quantity of biomass residue type $k$ combusted in the project plant in 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 | $K=\text{Rice husk}$ : 165,252t<br>$K=\text{Straws (including cotton straw, rice straw and oil seed rape straw)}$ : 155,111t                               |
| Description of measurement methods   | Use weight meters. Adjust for the moisture content in order to determine the quantity of dry biomass. The quantity shall be crosschecked with the quantity |

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|                                 |   |
|---------------------------------|---|
| and procedures to be applied:   | of electricity generated and any fuel purchase receipts. Continuously, prepare annually an energy balance   |
| QA/QC procedures to be applied: | The meter will undergo calibration/maintenance subject to appropriate industrial standards. Direct measurements at the plant site will be cross-checked with an annual energy balance that is based on purchased quantities and stock changes |
| Any comment:                    | The data on quantity of biomass residues combusted in the boiler will be collected separately for all types of biomass residues. The data will be kept for minimum two years after the last crediting period                                  |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | <b>BF<sub>T,k,y</sub></b>  |
| Data unit:   | Tones of dry matter  |
| Description:   | Quantity of biomass residue type <i>k</i> that has been transported to the Project site during the year <i>y</i> where <i>k</i> are the types of biomass residues used in the project plant in year <i>y</i> .   |
| Source of data to be used:   | Measured data by weighbridge   |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | <i>K</i> =Rice husk: 165,252t<br><i>K</i> =Straws (including cotton straw, rice straw and oil seed rape straw): 155,111t   |
| Description of measurement methods and procedures to be applied:                                 | Each truck will be measured twice, loading weight and empty weight. The transferred biomass residues will be aggregated daily, monthly and yearly.   |
| QA/QC procedures to be applied:  | The measuring range of the weighbridge is from 0 to 30 tones, the minimum scale is 0.01 tone. The weighbridge will be calibrated and maintained according to relevant standards and regulars. The biomass residues purchase invoice will be kept for double check. |
| Any comment:   | Dry weight   |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | Moisture content of the biomass residues   |
| Data unit:   | % water content  |
| Description:   | Moisture content of each biomass residue type <i>k</i>   |
| 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 | 6% for the rice husk, 20.7% for straws (including cotton straw, rice straw and oil seed rape straw)  |
| Description of measurement methods and procedures to be applied:                                 | Continuously monitored by moisture analyzer. Moisture content of the biomass residues will be both measured in collection points and in power plant. |
| QA/QC procedures to be applied:  | The analyzers will be calibrated and undergo maintenance subject to appropriate industry standard annually   |

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| Any comment: | The moisture content of the biomass residues are taken into consideration in all the calculations of emission reductions. In case of dry biomass, monitoring of this parameter is not necessary. |
|--------------|--|

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | $NCV_k$  |
| Data unit:   | KJ/Kg  |
| Description:   | Net calorific value of the biomass residue of type k utilized in the project   |
| Source of data to be used:   | Feasibility Study Report   |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | k=rice husk: 12958<br>k=straws (including cotton straw, rice straw and oil seed rape straw):12540  |
| Description of measurement methods and procedures to be applied:                                 | Measure the NCV based on the dry biomass. This parameter will be measured taking at least three samples(dry matter) for each measurement |
| QA/QC procedures to be applied:  | Measurements will be carried out at reputed laboratories and according to relevant international standards.                              |
| Any comment:   | -  |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | $AVD_y$  |
| Data unit:   | km   |
| Description:   | 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  |
| Source of data to be used:   | On site records maintained at project site (log books)   |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 100  |
| Description of measurement methods and procedures to be applied:                                 | The data is recorded at the central collecting station for it is close to the project plant, based on the information given by the truck driver about the biomass supply site and the distance from the project. |
| QA/QC procedures to be applied:  | The data on distance of fuel supply site from the plant can be verified by cross checking data records on the distances available with information from other sources (e.g. maps )                               |
| Any comment:   | If the biomass residues are supplied from different sites, this parameter will be taken from the longest distance.   |

|                            |   |
|----------------------------|---|
| <b>Data / Parameter:</b>   | $TL_y$  |
| Data unit:                 | Tonne   |
| Description:               | Average truck load of the trucks used during the year y |
| Source of data to be used: | Measured data by weighbridge                            |
| Value of data applied      | 3   |



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|  |  |
|--|--|
| for the purpose of calculating expected emission reductions in section B.5 |  |
| Description of measurement methods and procedures to be applied:           | Each truck will be measured twice, loading weight and empty weight. The loading data will be averaged monthly and yearly.                                  |
| QA/QC procedures to be applied:  | The weighbridge will be calibrated and maintained according to relevant standards and regulars. Check consistency of load records will be done frequently. |
| Any comment:   | -  |

|  |  |
|--|--|
| <b>Data / Parameter:</b>   | $FF_{project\ plant\ i, y}$  |
| Data unit:   | tons   |
| Description:   | Quantity of fossil fuel type $i$ combusted in the project plant during 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 | 50   |
| Description of measurement methods and procedures to be applied:                                 | Use weight meters.   |
| QA/QC procedures to be applied:  | The meter will under go calibration/maintenance subject to appropriate industrial standards. The consistency of metered fossil fuel consumption quantities can be cross checked with fuel purchased quantities and the stock change records  |
| 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). The data on quantity of fossil fuel combusted in the boiler will be collected separately for all types of fossil fuels |

|  |   |
|--|---|
| <b>Data / Parameter:</b>   | $FF_{project\ site, i, y}$  |
| Data unit:   | tons  |
| Description:   | Quantity of fossil fuel type $i$ combusted in the project site for other purposes that are attributable to the project activity during year $y$ |
| Source of data to be used:   | On-site measurements  |
| Value of data applied for the purpose of calculating expected emission reductions in | 0   |

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| section B.5  |  |
| Description of measurement methods and procedures to be applied: | Use weight meters.   |
| QA/QC procedures to be applied:                                  | Cross-check the measurements with an annual energy balance that is based on purchased quantities and stock changes   |
| 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) |

|  |   |
|--|---|
| <b>Data / Parameter:</b>   | $EC_{PJ,j,y}$   |
| Data unit:   | MWh/yr  |
| Description:   | The quantity of electricity consumed by the Project electricity consumption source j in year y  |
| Source of data to be used:   | Measured by meters  |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | It is estimated as 3,714MWh.  |
| Description of measurement methods and procedures to be applied:                                 | Hourly measurement and monthly recording; 100% of data will be monitored and electronic archived.   |
| QA/QC procedures to be applied:  | The accuracy of the meter is 0.5s and it will be calibrated and maintained according to relevant national regulations and/or standards. The electricity purchased invoice will be kept for double-checking. |
| Any comment:   |   |

|  |   |
|--|---|
| <b>Data / Parameter:</b>   | <b>EGy</b>  |
| Data unit:   | MWh   |
| Description:   | Net quantity of increased electricity generation as a result of the Project (incremental to baseline generation) during the year y                      |
| Source of data to be used:   | Measured by meters  |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 253,440   |
| Description of measurement methods and procedures to be applied:                                 | Hourly measurement and monthly recording; 100% of data will be monitored and electronic archived.   |
| QA/QC procedures to be applied:  | The accuracy of the meter is 0.5s and it will be calibrated and maintained according to relevant national regulations and/or standards. The electricity |

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|              |   |
|--------------|---|
|              | sales invoice will be kept for double-checking. |
| Any comment: | Double checked by receipt of sales.             |

|  |   |
|--|---|
| <b>Data / Parameter:</b>   | <b>Q<sub>v</sub></b>  |
| Data unit:   | GJ/yr   |
| Description:   | Quantity of increased heat generation in the Project (incremental to heat generation in any existing cogeneration plants) that displaces heat generation in fossil fuel fired boilers during the year y                 |
| Source of data to be used:   | Thermal meter   |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 1,083,204   |
| Description of measurement methods and procedures to be applied:                                 | The meter is installed on main heat supplying pipe. The meter will measure the flow, temperature and pressure individually and then calculate the supplied heat. The meter will measure the supplied heat continuously. |
| QA/QC procedures to be applied:  | The heat sales invoice will be kept for double-checking.  |
| Any comment:   |   |

|  |   |
|--|---|
| <b>Data / Parameter:</b>   | <b>-</b>  |
| Data unit:   | Tons  |
| Description:   | Quantity of biomass residues of type k that are available   |
| Source of data to be used:   | Feasibility Study Report of the proposed project  |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | k=rice husk: 270,000 t<br>k=straws (including cotton straw, rice straw and oil seed rape straw): 630,000t |
| Description of measurement methods and procedures to be applied:                                 | Surveys or statistics from local agricultural bureau if national statistics is not available.             |
| QA/QC procedures to be applied:  | This parameter will be reviewed annually according to the project data and official data.                 |
| Any comment:   | This parameter is applicable since approach L <sub>2</sub> is utilized to rule out leakage.               |

### **B.7.2 Description of the monitoring plan:**

This monitoring plan is to serve as a guideline for the project owner to monitor the emission reduction of the proposed project. The contents of the Monitoring Plan are highlighted as follows:

#### 1. The Operational and Management Structure for Monitoring

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To monitor the project emission reductions and any leakage effects, the project owner will set up a CDM Monitoring Office and designate a qualified staff responsible for all relevant matters, including monitoring of emission reductions, data collection and archiving, QC/QA, and verification. The structure of the CDM Monitoring Office is outlined in Figure B-3.

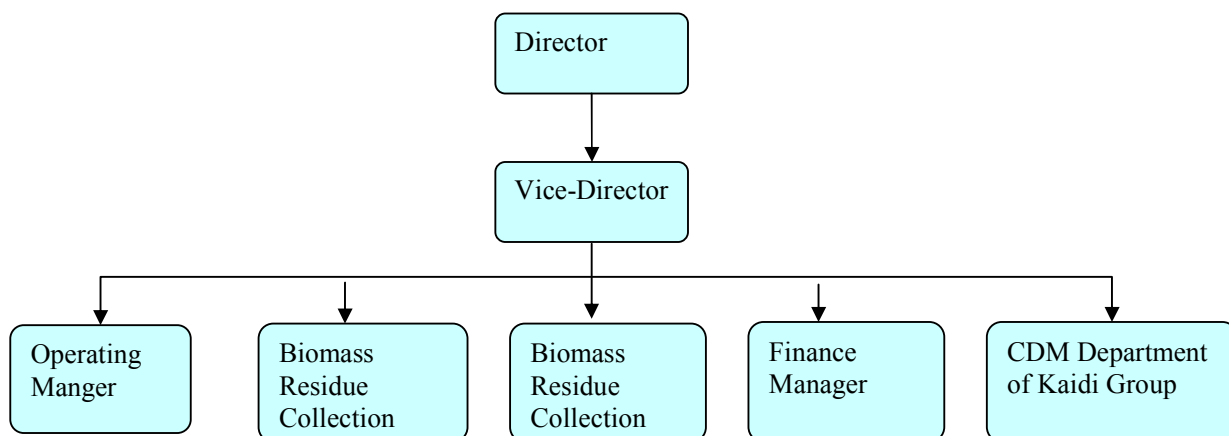


Figure B-3 Organization Chart of the CDM Project Management Office

Wuhan Kaidi Holding Investment Co., Ltd is the investor of Hunan Yueyang Kaidi Biomass Power Project. Yueyang Kaidi Green Energy Development Co., Ltd. is as the shareholding company under Kaidi. The staffs of Yueyang Kaidi Green Energy Development Co., Ltd.at the biomass residues collection sites will record the data to be monitored concerning with information of biomass residues purchased from local area.

The manager of the collection sites will be responsible for quality control and summary of this information. When the biomass is transported to the site of the power plant, the data of the biomass residues collection and transportation will be recorded by the staff of Yueyang Kaidi Green Energy Development Co., Ltd. and stored in the power plant. The summary of biomass consumption by the power plant will be calculated by the CDM Project Manager of the proposed project monthly. Another data to be recorded is the fossil fuel consumption by the power plant and on-site electricity consumption. The related responsible operators will record this data, and the CDM manager will collect the data monthly. When the plant starts heat supply to local district, the net heat supply to the users will be collected and recorded by staffs of Yueyang Kaidi Green Energy Development Co., Ltd. Other related data need to be monitored are described in Section 5 below.

The CDM manager will in charge of the implementation of this Monitoring Plan and summarizing the results. The results will be checked by the General Manger of Yueyang Kaidi Green Energy Development Co., Ltd. ensuring the quality and accuracy of the data monitored. The monthly summary will be reported to the headquarter of Wuhan Kaidi Holding Investment Co., Ltd in Beijing. The CDM Manager of the Wuhan Kaidi Holding Investment Co., Ltd will calculate the emission reductions of the proposed project and develop reports with the support from Camco Limited

The responsibilities for carrying out these tasks are broadly elaborated in below.

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Responsibilities of the proposed project in Yueyang: Operating Manager of the plant: Overall management of the implementation of the monitoring plan and quality control of data and records.

Head of Staw Collection Stations: straw collection and summarizing the data collected at the collection stations in terms of types, amount, and transportation record, etc of straws. Ensuring the biomass at the sites will not be stored over half year.

Engineering Department of the plant: in charge of the monitoring of ammeters and calibration, biomass consumption of NCV of each kind of biomass, fossil fuel consumption within the power plant including boilers, crashing machines,etc, as well as maintenance of equipments

Procurement Dept. of the plant: cross checking the monitoring records with receipt and procurement records.

## 2. Calibration of Meters & Metering

### 2.1 Electricity output ammeter

An agreement should be signed between the project owner and the Grid that defines the metering arrangements and the required quality control procedures to ensure accuracy. The accuracy of the ammeter will be 0.5s. The metering equipment will be properly calibrated and checked annually for accuracy according to Technical Administrative Code of Electric Energy Metering (dl/t448-2000) . The project owner will prepare backup procedures to deal with any errors occurred to the meters. In case of any errors happens, the grid-connected electricity generated by the proposed project shall be determined by the project owner and the Grid jointly according to the error handling procedures.

Calibration is carried out by the Grid with the records being provided to the project owner, and these records will be maintained by the project owner and the third party designated.

All the monitoring equipment installed is indicated in the following figure.

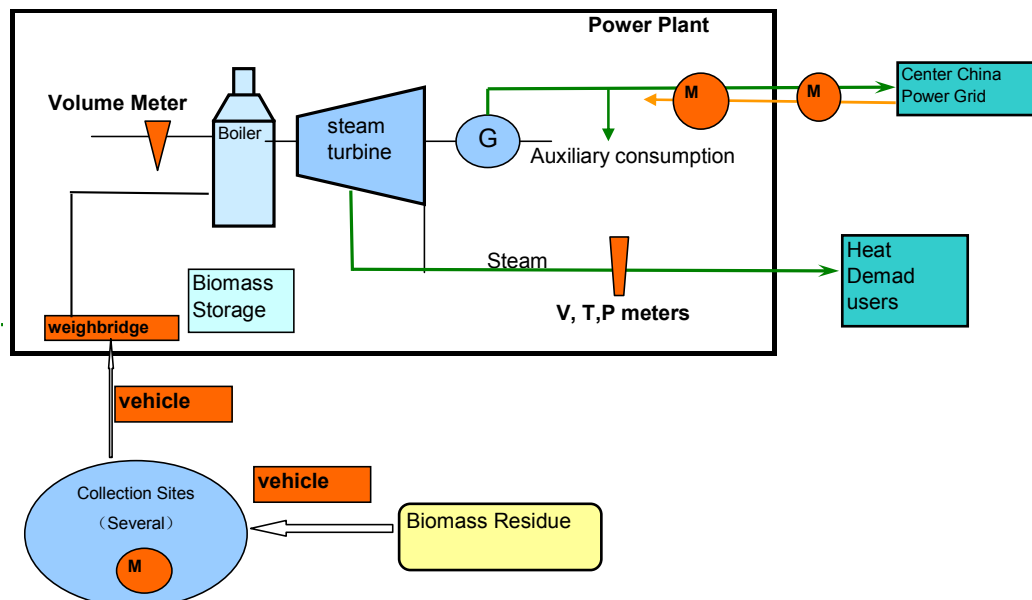


Figure B-4 Project boundary and monitoring map

## **2.2 Heat supply meter**

When the proposed project starts heat supply, the heat supply meter including flow meter, pressure meter and temperature meter will be installed at the output of the power plant. The metering equipment will be properly calibrated and checked annually for accuracy. The project owner will prepare backup procedures to deal with any errors occurred to the meters. In case of any errors happens, the heat supplied to the users by the proposed project shall be determined by the project owner and the users jointly according to the error handling procedures.

Calibration is carried out by the project owner, and these records will be maintained by the project owner and the third party designated.

## **2.3 Electricity input ammeter**

**Following the same process as listed in 2.1.**

## **2.4 Biomass residues consumption**

The project owner will conduct an energy balance analysis to verify the amounts of biomass residues collected at the collection sites, purchased at biomass procurement department of the power plant and combusted by the boilers. If significant difference among the three sources identified, the project developer will conduct further check the original records to find out reasons and correct. If the significant difference can't be resolved, the most conservative value of biomass utilized by the proposed project will be applied as monitoring results.

## **3. Monitoring**

Meters of electricity and heat employed by the proposed project will follow the national measurement standard.

### **3.1 Net Electricity Generated**

Grid-connected electricity generated by the proposed project will be monitored through metering equipment at the substation continuously (interconnection facility connecting the facility to the Grid). The data can also be monitored and recorded at the on-site control center using a computer system. The meter reading will be readily accessible for DOE. Calibration tests records will be maintained for verification.

### **3.2 Availability of Biomass Residues**

The project developer will provide evidence to DOE concerning with the availability of Biomass residues resource in the nearby counties. This will be obtained from official information yearly. If it is not available, the data will be calculated or estimated based on a survey conducted by project developer yearly.

### **3.3 Biomass Residues Consumption of the Power Plant**

The quality and type of biomass residues burned by the power plant will be monitored during the operation of the power plant, including all the necessary parameters of the biomass residues to be monitored according to Section B.7 of this PDD. All relevant records will be maintained for verification.

### **3.4 Fossil Fuel Consumption by the boiler**

Fossil Fuel Consumption by the boiler during the operation will be recorded and monitored during the operation period of the proposed project. All relevant records will be maintained for verification. Flow meter will be equipped in the sucker and return pipe to monitor the quantity of diesel consumption.

### **3.5 Transportation of Biomass residues**

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The project developer of the proposed project will structure a recording and monitoring system within the biomass residues supply and management system covering all the biomass collection sites established by the proposed project. The quantity and type of biomass, transportation vehicle and transportation distance to the collection sites will be recorded by company staffs at the sites. The receipts and records regarding with biomass purchase by the proposed project will be documented and summarized for verification. The transportation of the biomass from the collection sites to the power plant will be monitored and documented by the project developer to determine the fossil fuel consumption by the biomass transportation activity. The transportation records will be documented and maintained for verification.

#### **3.6 Heat supplied**

The heat supply monitoring will only start after the proposed project starts heat supply to local users. Heat supplied by the proposed project will be monitored through metering equipments at the end of users continuously. The meter reading will be readily accessible for DOE. Calibration tests records will be maintained for verification.

#### **3.7 Electricity purchased from the grid**

When the biomass residues is pretreated, the proposed project needs a certain amount of electricity from grid. This amount will be metered, and the record be kept for examination.

The meter reading will be readily accessible for DOE. Calibration tests records will be maintained for verification.

#### **3.8 Leakage**

Amount of biomass types consumed and Quantity of biomass types that is available in surplus in the counties that defined in Project Boundary will be monitored to check the leakage effect brought by the operation of the proposed project. This will be obtained from official information, such as agriculture statistics and survey of Counties defined within Project Boundary that supply biomass residues to the proposed project. If it is not available, the data will be calculated or estimated based on a survey conducted by project developer with the support from governmental entity. If any leakage occurs during the crediting period, the project developer will determine the parameters in terms of leakage effects according the definition in the PDD with the support from local government entity.

### **4. Quality Assurance and Quality Control**

The quality assurance and quality control procedures for recording, maintaining and archiving data shall be improved as part of this CDM project activity. This is an on-going process that will be ensured through the CDM in terms of the need for verification of the emissions on an annual basis according to this PDD and the CDM manual.

### **5. Data Management System**

This provides information on record keeping of the data collected during monitoring. Record keeping is the most important exercise in relation to the monitoring process. Without accurate and efficient record keeping, project emission reductions cannot be verified. Below follows an outline of how project related records would be managed.

Overall responsibility for monitoring of GHG emissions reduction will rest with the CDM responsible person of the proposed project. The CDM manual sets out the procedures for tracking information from the primary source to the end-data calculations in paper document format. It is the responsibility of the proposed project owner to provide additional necessary data and information for validation and verification requirements of respective DOE. Physical documentation such as paper-based maps,

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diagrams and environmental assessment will be collated in a central place, together with this monitoring plan. All paper-based information will be stored by the project owner and kept at least one copy.

#### 6. Verification and Monitoring Results

The verification of the monitoring results of the project is a mandatory process required for all CDM projects. The main objective of the verification is to independently verify that the project has achieved the emission reductions as reported and projected in the PDD. It is expected that the verification will be done annually.

#### 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)

>>

Date of completion: 27/08/ 2008

Name of persons determining the baseline study and monitoring methodology:

| Contact Information of the responsible person  | Is organisation a Project Participant <i>Yes/No</i> |
|--|---|
| Sun Li, Gong Jing, Liu Yanan<br>Camco International Limited<br>Floor 14, Lucky Tower A, No. 3 North Road,<br>East 3rd Ring Road, Chaoyang District,<br>Beijing, China 100027<br>Tel: (86 10) 8448 1623<br>Fax: (86 10) 8448 2432<br>email: <a href="mailto:lilian.sun@camcoglobal.com.cn">lilian.sun@camcoglobal.com.cn</a><br><a href="mailto:kerry.gong@camcoglobal.com.cn">kerry.gong@camcoglobal.com.cn</a><br><a href="mailto:melody.liu@camcoglobal.com.cn">melody.liu@camcoglobal.com.cn</a><br>Website: <a href="http://www.camcoglobal.com.cn">www.camcoglobal.com.cn</a> | Yes   |



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**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:**

>>

25/01/2008 (Key Equipment Purchase Contract Signed Date, the construction begin date is 26/02/2008 )

**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**

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

>>

01/07/2009

**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

**SECTION D. Environmental impacts**

>>

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

>>

The EIA of the proposed project was completed by Changsha Environmental Protection Vocational and Technical School and approved by Hunan Environmental Protection bureau. The summary of this evaluation is as following:

**1. Air**

In the construction period, the waste gas resource is mainly from, such as the road dust during the transporting process, automobile emission, emissions from excavator and bulldozer, and so on. Some measures will be taken to reduce these negative effects: sprinkling to repress the dust, keep the ground humidity, and clear the soil daggered out in time.

After the project being implemented, there will be waste gas from the boiler. Then, the boiler waste gas will be treated by the bag filter, the dust removal efficiency of which is higher than 99.8%. Furthermore, the waste gas will be out though the high chimney (100m height, 2.5m internal diameter) to reduce the air pollution by the air diffusion and self-clean ability.

**2. Waste Water**

During construction, the waste water is mainly from: rainwater, wash water from all kinds of machinery and automobiles, and domestic wastewater. In the construction site, sedimentation tank and oil separation tank will be constructed to treat the waste water. For the washing water oily and with high suspended matter, it will be discharged after treatment. Mortars and lime mortar will be treated specially, and be sent to treated together with other solid waste after drying.

When the project is in operation, the domestic waste water will be treated by be the second stage biochemical treatment in buried treatment equipments.

In the project operation process, there will be industrial cooling water, which is mainly the cooling water of all kinds of equipments. This cooling water doesn't contact with any harmful substance, and it don't contains any other pollutants except the water temperature is a little higher.

The water will be collected for recovery and the recovery water mainly be used for boiler cooling water, oil region washing water, afforestation and so on. Oily wastewater will be separated the oil and water by the oil-water separator and then reused as industrial water;

**3. Noise**

During construction, the project noise is mainly from: fixed and successive drilling, construction machinery noise, and fluid traffic noise. The noise in the construction process belongs to the medium and low frequency noise, and they will decay quickly as the distance. Furthermore, some effective measures will be taken to reduce negative impacts: Arrange the construction time reasonably, manage the automobile well, set hovels around the noisy equipments, and so on.

When the project is operated, the noise source is mainly from machinery noise and gas dynamic noise from the exhaust pipe. The noise control measures include: choosing the equipments with high efficiency and little noise, taking vibration reduction measures when fixing equipments, taking sound proof measures to the noisy equipments, to control the noise in the standard range.

#### 4. Solid Waste

The solid waste produced in the construction period is mainly the construction residues and the domestic waste from workers. The construction waste will be collected and treated as soon as possible, and the domestic waste will be collected and sent to local environmental protection department for treatment.

During project operation, the solid waste is mainly: boiler ash residues, domestic waste and sludge from the water treatment station. The ash residues will be used for producing White Carbon Black. The waste and sludge from the water treatment station will be collected by local environmental protection department for municipal treatment.

#### 5. Conclusion

After the above measurements performed, the negative impacts on environments will be minimized below the requirements of laws and regulations during the construction and implementation. Furthermore, as renewable power project, the proposed project can reduce the consumption of fossil fuel sources and GHG emission.

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

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According to EIA, no significant environmental impacts are discovered by the project participants or the host party. Hunan Environmental Protection Bureau has approved the EIA in Jul., 23<sup>th</sup>, 2007 .

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#### SECTION E. Stakeholders' comments

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##### E.1. Brief description how comments by local stakeholders have been invited and compiled:

In May 19<sup>th</sup>-20<sup>th</sup>, 2007, the project owner carried out the stakeholder comments investigation together with EIA organization in the neighbouring area. The interviewees include the farmer, worker, official and other different occupation persons covering different age levels. Among them, Male is 28 and Female is 22. 50 copies questionnaires were distributed and all of them were collected. Information about the meeting participants is given in the following table.

**Table E-1** Statistical form for basic information of meeting participants

| Basic information | Classified items          | Person number | Percentage ( % ) |
|-------------------|---------------------------|---------------|------------------|
| Age               | younger than 18 year old  | 6             | 12%              |
|                   | between 18 to 35 year old | 20            | 40%              |
|                   | between 36 to 55 year old | 19            | 38%              |
|                   | older than 55 year old    | 5             | 10%              |
| Occupation        | Farmers                   | 26            | 52%              |
|                   | Workers                   | 8             | 16%              |
|                   | Officials                 | 5             | 10%              |
|                   | Staffs                    | 7             | 14%              |
|                   | Others                    | 4             | 8%               |
| Gender            | Male                      | 28            | 56%              |
|                   | Female                    | 22            | 44%              |
| Education         | under middle school       | 2             | 4%               |
|                   | middle school             | 26            | 52%              |
|                   | Diploma and above         | 22            | 44%              |

The questions in the questionnaire including:

- Would you consider the project important?
- Do you agree with the construction of the project?
- What is the environmental problem associated with the project that you are most concerned about?
- What is the effect of the project on local ecologic environment?
- Are you satisfied with the methods proposed to alleviate the environment impacts?
- Do you think the project will improve the local economy?
- Do you think the project will improve local employment opportunities?

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#### **E.2. Summary of the comments received:**

>>

Among them, 80% interviewees think the proposed project is very important, and 20% think it's important. All of the interviewees agree with the construction of the proposed project.

For the most concerned environmental problem, 42% of them think it's noisy pollution and 48% think there is no significant influence on the environment. 46% think the proposed project can improve the local ecological environment and 54% think it has no impacts on the ecological environment. 98% of the interviewees are satisfied with the methods proposed to alleviate the environment impacts and 2% have no idea about it.

96% think the proposed project can promote local economic development, and 2% think it have no significant impact. 96% of them think the proposed project can supply more employment opportunities, 2% think it can not and 2% have no idea.

The outcome of the survey indicated that it is generally believed that the construction of the project will contribute to the local environment and to the development of local enterprises and improve the local employment situation. The participants said that they wish the project could be put into operation as soon as possible. By participating the meeting, all the participants had a better understanding of both the project and the CDM, and expressed their full support for the development of the project.

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

>>

The residents and local government are all very supportive to the proposed project. No negative comments have been received on the project. However, there are few persons who express some concerns about noise. The project owner will take following measures to reduce the impacts: choosing the equipments with high efficiency and little noise, taking vibration reduction measures when fixing equipments, taking sound proof measures to the noisy equipments, to control the noise in the standard range.

Furthermore, the project owner also make a decision to further the project publication together with local government to eliminates that public concerns. And, the project owner will make best use of the CDM and facilitate the project construction. In the future project operation period, the project owner will keep good contact with the local stakeholders, and invite them to supervise their actions for environmental protection.

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**Annex 1**

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

|                  |  |
|------------------|--|
| Organization:    | Yueyang Kaidi Green Energy Development Co., Ltd. |
| Street/P.O.Box:  | Yinan Village, Yingtian Town                     |
| Building:        |  |
| City:            | Quyuan District, Yueyang City                    |
| State/Region:    | Hunan Province                                   |
| Postfix/ZIP:     | 414418   |
| Country:         | P.R. China.                                      |
| Telephone:       | 0730—5967901                                     |
| FAX:             | 0730—5727556                                     |
| E-Mail:          | qgyin@126.com                                    |
| URL:             |  |
| Represented by:  | Yin Qingguo                                      |
| Title:           | General Manager                                  |
| Salutation:      | Mr.  |
| Last Name:       | Yin  |
| Middle Name:     |  |
| First Name:      | Qingguo  |
| Department:      | Yueyang Kaidi Green Energy Development Co., Ltd. |
| Mobile:          | 15071158095                                      |
| Direct FAX:      | 0730—5727556                                     |
| Direct tel:      | 0730—5967901                                     |
| Personal E-Mail: | qgyin@126.com                                    |

|                 |  |
|-----------------|--|
| Organization:   | Camco International Limited                                  |
| Street/P.O.Box: | Green Street   |
| Building:       | Channel House  |
| City:           | St Helier  |
| State/Region:   | Jersey   |
| Postfix/ZIP:    | JE2 4UH  |
| Country:        | Channel Islands  |
| Telephone:      | +44 (0)20 7665 1865  |
| FAX:            | +44 (0)20 7665 1871  |
| E-Mail:         |  |
| URL:            | <a href="http://www.camcoglobal.com">www.camcoglobal.com</a> |
| Represented by: |  |
| Title:          | Mrs  |
| Salutation:     | Director   |
| Last Name:      | Rawlins  |
| Middle Name:    |  |
| First Name:     | Madeleine  |
| Department:     |  |

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|                  |  |
|------------------|--|
| Mobile:          |  |
| Direct FAX:      | +86 10 8448 1385   |
| Direct tel:      | +86 10 8448 2499   |
| Personal E-Mail: | <a href="mailto:Project.participant.cn@camcoglobal.com">Project.participant.cn@camcoglobal.com</a> |

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**Annex 2**

**INFORMATION REGARDING PUBLIC FUNDING**

There is no public funding in the project activity.



# PROJECT DESIGN DOCUMENT FORM (CDM PDD)

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### Annex 3

#### BASELINE INFORMATION

According to the approved methodology ACM0002 and the document “China's Regional Grid Baseline Emission Factors Renewed”, released at <http://cdm.ccchina.gov.cn/> on 18 July 2008, the  $EF_{grid,CM,y}$ ,  $EF_{grid,OM,y}$ , and  $EF_{grid,BM,y}$  of Central China Power Grid could be calculated as following:

#### A. Electricity Generation of Central China Power Grid (2002-2006)

Table A1. Electricity Generation of Central China Power Grid (2002-2006)

| Year | Electricity Generation (Unit: 10 <sup>8</sup> KWh) |         |         |         |        | Split of low-cost/must-run resources |
|------|--|---------|---------|---------|--------|--------------------------------------|
|      | Total  | Hydro   | Thermal | nuclear | Others |                                      |
| 2002 | 3127.88  | 1124.40 | 2003.47 | 0       | 0      | 35.95%                               |
| 2003 | 8345.05  | 3655.70 | 4689.35 | 0       | 0      | 43.81%                               |
| 2004 | 4396.36  | 1665.89 | 2730.47 | 0       | 0      | 37.89%                               |
| 2005 | 4964.30  | 1915.48 | 3048.25 | 0       | 0.57   | 38.60%                               |
| 2006 | 5478.59  | 1922.96 | 3554.53 | 0       | 1.02   | 35.12%                               |

Sources: China Electric Power Yearbook 2003-2007

#### B. Calculation of Operating Margin Emission Factor ( $EF_{grid,OM,y}$ )

Table B1. Electricity Generation of East China PowerGrid in 2004

|              | Electricity generation of fuel-fired power plants (MWh) | Auxiliary power ratio (%) | Total Electricity Supplied to the Grid (MWh) |
|--------------|---|---------------------------|--|
| Jiangxi      | 30127000  | 7.04                      | 28,006,059                                   |
| Henan        | 109352000   | 8.19                      | 100,396,071                                  |
| Hubei        | 43034000  | 6.58                      | 40,202,363                                   |
| Hunan        | 37186000  | 7.47                      | 34,408,206                                   |
| Chongqing    | 16520000  | 11.06                     | 14,692,888                                   |
| Sichuan      | 34627000  | 9.41                      | 31,368,599                                   |
| <b>Total</b> |   |                           | 249,074,186                                  |

Sources: China Electric Power Yearbook 2005

Table B2. Electricity Generation of Central China Power Grid in 2005

|         | Electricity generation of fuel-fired power plants (MWh) | Auxiliary power ratio (%) | Total Electricity Supplied to the Grid (MWh) |
|---------|---|---------------------------|--|
| Jiangxi | 30000000  | 6.48                      | 28,056,000                                   |
| Henan   | 131590000   | 7.32                      | 121,957,612                                  |

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|              |          |      |             |
|--------------|----------|------|-------------|
| Hubei        | 47700000 | 2.51 | 46,502,730  |
| Hunan        | 39900000 | 5    | 37,905,000  |
| Chongqing    | 17584000 | 8.05 | 16,168,488  |
| Sichuan      | 37202000 | 4.27 | 35,613,475  |
| <b>Total</b> |          |      | 286,203,305 |

*Sources: China Electric Power Yearbook 2006*

**Table B3. Electricity Generation of Central China Power Grid in 2006**

|              | <b>Electricity<br/>generation of<br/>fuel-fired<br/>power plants<br/>(MWh)</b> | <b>Auxiliary power<br/>ratio (%)</b> | <b>Total Electricity<br/>Supplied to the Grid<br/>(MWh)</b> |
|--------------|--|--------------------------------------|---|
| Jiangxi      | 34449000   | 6.17                                 | 32,323,497  |
| Henan        | 151235000  | 7.06                                 | 140,557,809   |
| Hubei        | 54841000   | 2.75                                 | 53,332,873  |
| Hunan        | 46408000   | 4.95                                 | 44,110,804  |
| Chongqing    | 23487000   | 8.45                                 | 21,502,349  |
| Sichuan      | 44193000   | 4.51                                 | 42,199,896  |
| <b>Total</b> |  |                                      | 334,027,226   |

*Sources: China Electric Power Yearbook 2007; China Energy Statistical Yearbook 2007*

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**Table B4. Calculation of Operating Margin Emission Factor of Central China Power Grid in 2004**

| Fuel  | Unit                           | Jiangxi<br>A | Henan<br>B | Hubei<br>C | Hunan<br>D | Chongqing<br>E | Sichuan<br>F | Total<br>G=A+...+F | Emission Factor <sup>1</sup><br>(tC/TJ)<br>H      | Oxidation<br>n <sup>2</sup> (%)<br>I | Average Low<br>Caloric Value <sup>3</sup><br>(MJ/t or<br>km <sup>3</sup><br>J | CO <sub>2</sub> Emission<br>(tCO <sub>2</sub> e)<br>K=G*H*I*F*44/12/<br>1000 (mass)<br>K=G*H*I*F*44/12/<br>1000 (Volume) |
|---|--------------------------------|--------------|------------|------------|------------|----------------|--------------|--------------------|---|--------------------------------------|---|--|
| Raw Coal  | 10 <sup>4</sup> t              | 1863.8       | 6948.5     | 2510.5     | 2197.9     | 875.5          | 2747.9       | 17144.1            | 25.8  | 100                                  | 20908   | 339,092,605  |
| Cleaned coal  | 10 <sup>4</sup> t              |              | 2.34       |            |            |                |              | 2.34               | 25.8  | 100                                  | 26344   | 58,316   |
| Other Washed Coal   | 10 <sup>4</sup> t              | 48.93        | 104.22     |            |            | 89.72          |              | 242.87             | 25.8  | 100                                  | 8363  | 1,921,441  |
| Coke  | 10 <sup>4</sup> t              |              | 109.61     |            |            |                |              | 109.61             | 29.2  | 100                                  | 28435   | 3,337,011  |
| Coke Oven Gas   | 10 <sup>8</sup> m <sup>3</sup> |              |            | 1.68       |            | 0.34           |              | 2.02               | 12.1  | 100                                  | 16726   | 149,900  |
| Other Gas   | 10 <sup>8</sup> m <sup>3</sup> |              |            |            |            | 2.61           |              | 2.61               | 12.1  | 100                                  | 5227  | 60,527   |
| Crude Oil   | 10 <sup>4</sup> t              |              | 0.86       | 0.22       |            |                |              | 1.08               | 20  | 100                                  | 41816   | 33,118   |
| Gasoline  | 10 <sup>4</sup> t              |              | 0.06       |            |            | 0.01           |              | 0.07               | 18.9  | 100                                  | 43070   | 2,089  |
| Diesel Oil  | 10 <sup>4</sup> t              | 0.02         | 3.86       | 1.7        | 1.72       | 1.14           |              | 8.44               | 20.2  | 100                                  | 42652   | 266,627  |
| Fuel Oil  | 10 <sup>4</sup> t              | 1.09         | 0.19       | 9.55       | 1.38       | 0.48           | 1.68         | 14.37              | 21.1  | 100                                  | 41816   | 464,893  |
| PLG   | 10 <sup>4</sup> t              |              |            |            |            |                |              | 0                  | 17.2  | 100                                  | 50179   | 0  |
| Refinery Gas  | 10 <sup>4</sup> t              | 3.52         | 2.27       |            |            |                |              | 5.79               | 15.7  | 100                                  | 46055   | 153,506  |
| Natural Gas   | 10 <sup>8</sup> m <sup>3</sup> |              |            |            |            |                | 2.27         | 2.27               | 15.3  | 100                                  | 38931   | 495,775  |
| Other Petroleum Products  | 10 <sup>4</sup> t              |              |            |            |            |                |              | 0                  | 20  | 100                                  |   |  |
| Other Coking Products   | 10 <sup>4</sup> t              |              |            |            |            |                |              | 0                  | 25.8  | 100                                  | 28435   | 0  |
| Other Energy  | 10 <sup>4</sup> tce            |              | 16.92      |            | 15.2       | 20.95          |              | 53.07              | 0   | 100                                  | 0   | 0  |
| <b>Net electricity imported from Central China Grid (MWh)</b>           |                                |              |            |            |            |                |              |                    | <b>Total CO<sub>2</sub> Emission: 346,035,810</b> |                                      |   |  |
| <b>Total emission of the Central China Power Grid(tCO<sub>2</sub>e)</b> |                                |              |            |            |            |                |              |                    | <b>346,035,810</b>                                |                                      |   |  |
| <b>OM emission factor of the CCPG (tCO<sub>2</sub>e/MWh)</b>            |                                |              |            |            |            |                |              |                    | <b>249,074,186</b>                                |                                      |   |  |
|   |                                |              |            |            |            |                |              |                    | <b>1.38929</b>                                    |                                      |   |  |

Sources: China Electric Power Yearbook 2005

1,2 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, chapter 1, page 1.21-1.24, table 1.3 and 1.4.

3 China Energy Statistical Yearbook 2007, Page 287

Table B5. Calculation of Operating Margin Emission Factor of Central China Power Grid in 2005

| Fuel  | Unit                           | Jiangxi<br>A        | Henan<br>B          | Hubei<br>C          | Hunan<br>D          | Chongqing<br>E | Sichuan<br>F        | Total<br>G=A+...+F | Emission Factor <sup>1</sup><br>(tC/TJ)<br>H | Oxidation<br>n <sup>2</sup> (%)<br>I | Average Low<br>Caloric Value <sup>3</sup><br>(MJ/t or<br>km <sup>3</sup><br>J | CO <sub>2</sub> Emission<br>(tCO <sub>2</sub> e)<br>K=G*H*I*F*44/12/<br>1000 (mass)<br>K=G*H*I*F*44/12/<br>1000 (Volume) |
|---|--------------------------------|---------------------|---------------------|---------------------|---------------------|----------------|---------------------|--------------------|--|--------------------------------------|---|--|
| Raw Coal                                    | 10 <sup>4</sup> t              | 1869.2 <sub>9</sub> | 7638.8 <sub>7</sub> | 2732.1 <sub>5</sub> | 1712.2 <sub>7</sub> | 875.4          | 2999.7 <sub>7</sub> | 17827.75           | 25.8   | 100                                  | 20908   | 352,614,497  |
| Cleaned coal                                | 10 <sup>4</sup> t              | 0.02                |                     |                     |                     |                |                     | 0.02               | 25.8   | 100                                  | 26344   | 498  |
| Other Washed Coal                           | 10 <sup>4</sup> t              |                     | 138.12              |                     |                     |                |                     | 228.11             | 25.8   | 100                                  |   | 1,804,669  |
| Coke  | 10 <sup>4</sup> t              |                     | 25.95               |                     | 105                 |                |                     | 130.95             | 29.2   | 100                                  | 8363  | 3,986,695  |
| Coke Oven Gas                               | 10 <sup>8</sup> m <sup>3</sup> |                     |                     | 1.15                |                     | 0.36           |                     | 1.51               | 12.1   | 100                                  | 16726   | 112,054  |
| Other Gas                                   | 10 <sup>8</sup> m <sup>3</sup> |                     | 10.2                |                     |                     | 3.12           |                     | 13.32              | 12.1   | 100                                  | 5227  | 308,897  |
| Crude Oil                                   | 10 <sup>4</sup> t              |                     | 0.82                | 0.36                |                     |                |                     | 1.18               | 20   | 100                                  | 41816   | 36,185   |
| Gasoline                                    | 10 <sup>4</sup> t              |                     | 0.02                |                     |                     | 0.02           |                     | 0.04               | 18.9   | 100                                  | 43070   | 1,194  |
| Diesel Oil                                  | 10 <sup>4</sup> t              | 1.3                 | 3.03                | 2.39                | 1.39                | 1.38           |                     | 9.49               | 20.2   | 100                                  | 42652   | 299,798  |
| Fuel Oil                                    | 10 <sup>4</sup> t              | 0.64                | 0.29                | 3.15                | 1.68                | 0.89           | 2.22                | 8.87               | 21.1   | 100                                  | 41816   | 286,959  |
| PLG   | 10 <sup>4</sup> t              |                     |                     |                     |                     |                |                     | 0                  | 17.2   | 100                                  | 50179   | 0  |
| Refinery Gas                                | 10 <sup>4</sup> t              | 0.71                | 3.41                | 1.76                | 0.78                |                |                     | 6.66               | 15.7   | 100                                  | 46055   | 176,572  |
| Natural Gas                                 | 10 <sup>8</sup> m <sup>3</sup> |                     |                     |                     |                     |                | 3                   | 3                  | 15.3   | 100                                  | 38931   | 655,209  |
| Other petroleum Products                    | 10 <sup>4</sup> t              |                     |                     |                     |                     |                |                     | 0                  | 20   | 100                                  | 38369   | 0  |
| Other Coking Products                       | 10 <sup>4</sup> t              |                     |                     |                     | 1.5                 |                |                     | 1.5                | 25.8   | 100                                  | 28435   | 40,349   |
| Other Energy                                | 10 <sup>4</sup> t              |                     | 2.88                |                     | 1.74                | 32.8           |                     | 37.42              | 0  | 100                                  | 0   | 0  |
| Total CO <sub>2</sub> Emission: 360,323,575 |                                |                     |                     |                     |                     |                |                     |                    | Total CO <sub>2</sub> Emission: 360,323,575  |                                      |   |  |

Net electricity imported from Central China Grid (MWh)

Total emission of the Central China Power Grid(tCO<sub>2</sub>e)OM emission factor of the CCPG (tCO<sub>2</sub>e/MWh)

Sources: China Electric Power Yearbook 2006

Table B6. Calculation of Operating Margin Emission Factor of Central China Power Grid in 2006

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| Fuel  | Unit                           | Jiangxi<br>A | Henan<br>B  | Hubei<br>C  | Hunan<br>D  | Chongqing<br>E | Sichuan<br>F | Total<br>G=A+ ...<br>+F | Emission<br>Factor <sup>1</sup><br>(tC/TJ)<br>H   | Oxidation<br>n <sup>2</sup> (%)<br>I | Average Low<br>Caloric Value <sup>3</sup><br>(MJ/t or<br>km <sup>3</sup> )<br>J | CO <sub>2</sub> Emission<br>(tCO <sub>2</sub> e)<br>K=G*H*I*F*44/12/<br>1000 (mass)<br>K=G*H*I*F*44/12/<br>1000 (Volume) |
|---|--------------------------------|--------------|-------------|-------------|-------------|----------------|--------------|-------------------------|---|--------------------------------------|---|--|
| Raw Coal  | 10 <sup>4</sup> t              | 1926.0<br>2  | 8098.0<br>1 | 3179.7<br>9 | 2454.4<br>8 | 1184.3         | 3285.2<br>2  | <b>20127.82</b>         | 25.8  | 100                                  | 20908   | 398,107,508  |
| Cleaned coal  | 10 <sup>4</sup> t              |              |             |             |             | 5.79           |              | <b>5.79</b>             | 25.8  | 100                                  | 26344   | 144,295  |
| Other Washed<br>Coal  | 10 <sup>4</sup> t              | 4.51         | 104.12      |             | 8.59        | 79.21          |              | <b>196.43</b>           | 25.8  | 100                                  | 8363  | 1,554,036  |
| Briquette   |                                |              |             |             |             |                |              |                         |   |                                      |   |  |
| Coke  | 10 <sup>4</sup> t              |              | 17.23       |             | 0.32        |                | 0.01         | <b>0.01</b>             | 26.6  | 100                                  | 20908   | 204  |
| Coke Oven Gas   | 10 <sup>8</sup> m <sup>3</sup> |              | 0.52        | 1.07        | 4.24        | 0.38           | 0.01         | <b>6.22</b>             | 29.2  | 100                                  | 28435   | 534,299  |
| Other Gas   | 10 <sup>8</sup> m <sup>3</sup> | 12.69        | 3.95        |             | 1.7         | 4.36           | 0.01         | <b>22.71</b>            | 12.1  | 100                                  | 16726   | 461,572  |
| Crude Oil   | 10 <sup>4</sup> t              |              | 0.49        |             |             |                |              | <b>0.49</b>             | 12.1  | 100                                  | 5227  | 526,655  |
| Gasoline  | 10 <sup>4</sup> t              |              | 0.01        |             |             |                |              | <b>0.01</b>             | 20  | 100                                  | 41816   | 15,026   |
| Diesel Oil  | 10 <sup>4</sup> t              | 0.91         | 2.23        | 1.41        | 1.78        | 0.96           |              | <b>7.29</b>             | 18.9  | 100                                  | 43070   | 298  |
| Fuel Oil  | 10 <sup>4</sup> t              | 0.51         | 1.26        | 1.31        | 0.8         | 0.57           | 3.49         | <b>7.94</b>             | 20.2  | 100                                  | 42652   | 230,298  |
| PLG   | 10 <sup>4</sup> t              |              |             |             |             |                |              | <b>0</b>                | 21.1  | 100                                  | 41816   | 256,872  |
| Refinery Gas  | 10 <sup>4</sup> t              | 0.86         | 8.1         | 1           | 0.97        |                |              | <b>10.93</b>            | 17.2  | 100                                  | 50179   | 0  |
| Natural Gas   | 10 <sup>8</sup> m <sup>3</sup> |              |             | 0.28        |             | 0.16           | 18.63        | <b>19.07</b>            | 15.7  | 100                                  | 46055   | 289,780  |
| Other petroleum<br>Products   | 10 <sup>4</sup> t              |              |             |             |             |                |              | <b>0</b>                | 15.3  | 100                                  | 38931   | 4,164,943  |
| Other Coking<br>Products  | 10 <sup>4</sup> t              |              |             |             |             |                | 0.01         | <b>0.01</b>             | 20  | 100                                  | 38369   | 0  |
| Other Energy  | 10 <sup>4</sup> t<br>tee       | 17.45        | 37.36       | 31.55       | 18.29       | 29.35          |              | <b>134</b>              | 25.8  | 100                                  | 28435   | 269  |
|   |                                |              |             |             |             |                |              | <b>0</b>                | 0   | 100                                  | 0   | 0  |
| <b>Net electricity imported from Central China Grid (MWh)</b>           |                                |              |             |             |             |                |              |                         | <b>Total CO<sub>2</sub> Emission: 406,286,055</b> |                                      |   |  |
| <b>Total emission of the Central China Power Grid(tCO<sub>2</sub>e)</b> |                                |              |             |             |             |                |              |                         | <b>408,776,270</b>                                |                                      |   |  |
| <b>OM emission factor of the CCPG (tCO<sub>2</sub>e/MWh)</b>            |                                |              |             |             |             |                |              |                         | <b>337,056,176</b>                                |                                      |   |  |
|   |                                |              |             |             |             |                |              |                         | <b>1.212784</b>                                   |                                      |   |  |

*Sources: China Electric Power Yearbook 2007; China Energy Statistic Yearbook 2007*

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**Table B7. Weighted-average OM emission factor of Central China Power Grid (2004-2006)**

|   | <b>2004</b> | <b>2005</b> | <b>2006</b> | <b>Weighted-average OM emission factor</b> |
|---|-------------|-------------|-------------|--|
| Total Emission, tCO <sub>2</sub>          | 346,035,810 | 360,323,575 | 408,776,270 |  |
| Total power supply, MWh                   | 249,074,186 | 286,203,305 | 337,056,176 |  |
| OM emission factor, tCO <sub>2</sub> /MWh | 1.38929     | 1.25898     | 1.212784    | <b>1.2783</b>                              |

Therefore, the  $EF_{grid,OM,simple}$  could be calculated as:

$$EF_{grid,OM,simple} = (346,035,810 + 360,323,575 + 408,776,270) / (249,074,186 + 286,203,305 + 337,056,176) = \mathbf{1.2783} \text{ tCO}_2\text{e/MWh}$$

**C. Calculation of the Build Margin Emission Factor ( $EF_{grid,BM,y}$ )**

**Table C1 Emission Factor of Best Technology**

|                                | <b>Variable</b> | <b>Electricity supply efficiency</b> | <b>Emission factor of fuel (tC/TJ)</b> | <b>Oxidation rate</b> | <b>Emission factor (tCO<sub>2</sub>/MWh)</b> |
|--------------------------------|-----------------|--------------------------------------|--|-----------------------|--|
|                                |                 | A                                    | B                                      | C                     | $D = 3.6/A/1000 * B * C * 44/12$             |
| <b>Coal-based power plants</b> | $EF_{Coal,Adv}$ | 37.28%                               | 25.8                                   | 1                     | 0.9135                                       |
| <b>Gas-based power plants</b>  | $EF_{Gas,Adv}$  | 48.81%                               | 15.3                                   | 1                     | 0.4138                                       |
| <b>Oil-based power plants</b>  | $EF_{Oil,Adv}$  | 48.81%                               | 21.1                                   | 1                     | 0.5706                                       |

*Sources: China's grid baseline BM calculation progress, NRDC*

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**Table C2 The Proportion Of CO<sub>2</sub> Emission From Solid, Liquid, Gas Fuel For Generating Electricity**

| Fuel            | Unit                           | Jiangxi | Henan   | Hubei   | Hunan   | Chongqing | Sichuan | Total     | Caloric   | Emission | Oxidatio | Emiss                   |
|-----------------|--------------------------------|---------|---------|---------|---------|-----------|---------|-----------|-----------|----------|----------|-------------------------|
|                 |                                | A       | B       | C       | D       | E         | F       | G=A+...+F | H (KJ/kg) | I        | J        | K=F*G*H*I*44/12<br>/100 |
| Raw Coal        | 10 <sup>4</sup> t              | 1926.02 | 8098.01 | 3179.79 | 2454.48 | 1184.3    | 3285.22 | 20127.82  | 20908     | 25.8     | 1        | 398,107,508             |
| Cleaned Coal    | 10 <sup>4</sup> t              | 0       | 0       | 0       | 0       | 5.79      | 0       | 5.79      | 26344     | 25.8     | 1        | 144,295                 |
| Other Washed    | 10 <sup>4</sup> t              | 4.51    | 104.12  | 0       | 8.59    | 79.21     | 0       | 196.43    | 8363      | 25.8     | 1        | 1,554,036               |
| Briquette       | 10 <sup>4</sup> t              | 0       | 0       | 0       | 0       | 0         | 0.01    | 0.01      | 20908     | 26.6     | 1        | 204                     |
| Coke            | 10 <sup>4</sup> t              | 0       | 17.23   | 0       | 0.32    | 0         | 0       | 17.55     | 28435     | 29.2     | 1        | 534,299                 |
| <b>Subtotal</b> |                                |         |         |         |         |           |         |           |           |          |          | <b>400,340,342</b>      |
| Crude Oil       | 10 <sup>4</sup> t              | 0       | 0.49    | 0       | 0       | 0         | 0       | 0.49      | 41816     | 20       | 1        | 15,026                  |
| Gasoline        | 10 <sup>4</sup> t              | 0       | 0.01    | 0       | 0       | 0         | 0       | 0.01      | 43070     | 18.9     | 1        | 298                     |
| Kerosene        | 10 <sup>4</sup> t              | 0       | 0       | 0       | 0       | 0         | 0       | 0         | 43070     | 19.6     | 1        | 0                       |
| Diesel Oil      | 10 <sup>4</sup> t              | 0.91    | 2.23    | 1.41    | 1.78    | 0.96      | 0       | 7.29      | 42652     | 20.2     | 1        | 230,298                 |
| Fuel Oil        | 10 <sup>4</sup> t              | 0.51    | 1.26    | 1.31    | 0.8     | 0.57      | 3.49    | 7.94      | 41816     | 21.1     | 1        | 256,872                 |
| Other Petroleum | 10 <sup>4</sup> t              | 0       | 0       | 0       | 0       | 0         | 0       | 0         | 38369     | 20       | 1        | 0                       |
| Other Coking    | 10 <sup>4</sup> t              | 0       | 0       | 0       | 0       | 0         | 0.01    | 0.01      | 28435     | 25.8     | 1        | 269                     |
| <b>Subtotal</b> |                                |         |         |         |         |           |         |           |           |          |          | <b>502,763</b>          |
| Natural Gas     | 10 <sup>7</sup> m <sup>3</sup> | 0       | 0       | 2.8     | 0       | 1.6       | 190.7   | 190.7     | 38931     | 15.3     | 1        | 4,164,943               |
| Coke Oven Gas   | 10 <sup>7</sup> m <sup>3</sup> | 0       | 5.2     | 10.7    | 42.4    | 3.8       | 62.2    | 62.2      | 16726     | 12.1     | 1        | 461,572                 |
| Other Gas       | 10 <sup>7</sup> m <sup>3</sup> | 126.9   | 39.5    | 0       | 17      | 43.6      | 227.1   | 227.1     | 5227      | 12.1     | 1        | 526,655                 |
| PLG             | 10 <sup>4</sup> t              | 0       | 0       | 0       | 0       | 0         | 0       | 0         | 50179     | 17.2     | 1        | 0                       |
| Refinery Gas    | 10 <sup>4</sup> t              | 0.86    | 8.1     | 1       | 0.97    | 0         | 10.93   | 10.93     | 46055     | 15.7     | 1        | 289,780                 |
| <b>Subtotal</b> |                                |         |         |         |         |           |         |           |           |          |          | <b>5,442,950</b>        |
| <b>Total</b>    |                                |         |         |         |         |           |         |           |           |          |          | <b>406,286,055</b>      |

Sources: China Energy Statistical Yearbook 2007

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Calculate with relevant data and formulae, the value for  $\lambda_{Coal}$  is 98.54% the value for  $\lambda_{Oil}$  is 0.12% and the value for  $\lambda_{Gas}$  is 1.34%.

Therefore,

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9064 \text{ tCO}_2\text{e/MWh.}$$

**Table C3 Installed capacity of the Central China Power Grid in 2006**

| Installed Capacity | Unit   | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total  |
|--------------------|--------|---------|-------|-------|-------|-----------|---------|--------|
| Fuel-fired         | M      | 6568    | 32603 | 11623 | 10715 | 5594      | 9555    | 76658  |
| Hydro              | M      | 3288    | 2553  | 8521  | 8648  | 1979      | 17730   | 42719  |
| Nuclear            | M      | 0       | 0     | 0     | 0     | 0         | 0       | 0      |
| Wind & Others      | M<br>W | 0       | 106   | 0     | 0     | 0         | 0       | 106    |
| Total              | M      | 9856    | 35262 | 20144 | 19363 | 7573      | 27285   | 119483 |

Sources: China Electric Power Yearbook 2007

**Table C4 Installed capacity of the Central China Power Grid in 2005**

| Installed Capacity | Unit   | Jiangxi | Henan   | Hubei   | Hunan   | Chongqing | Sichuan | Total   |
|--------------------|--------|---------|---------|---------|---------|-----------|---------|---------|
| Fuel-fired         | M      | 5906    | 26267.8 | 9526.3  | 7211.6  | 3759.5    | 7496    | 60167.2 |
| Hydro              | M      | 3019    | 2539.9  | 8088.9  | 7905.1  | 1892.7    | 14959.6 | 38405.2 |
| Nuclear            | M      | 0       | 0       | 0       | 15116.7 | 0         | 0       | 0       |
| Wind & Others      | M<br>W | 0       | 0       | 0       | 7211.6  | 24        | 0       | 24      |
| Total              | M      | 8925    | 28807.7 | 17615.2 | 7905.1  | 5676.2    | 22455.6 | 98596.4 |

Sources: China Electric Power Yearbook 2006

**Table C5 Installed capacity of the Central China Power Grid in 2004**

| Installed Capacity | Unit   | Jiangxi | Henan   | Hubei   | Hunan   | Chongqing | Sichuan | Total   |
|--------------------|--------|---------|---------|---------|---------|-----------|---------|---------|
| Fuel-fired         | M      | 5496    | 21788.5 | 9590.3  | 6779.5  | 3271.1    | 6900.3  | 53825.7 |
| Hydro              | M      | 2549.9  | 2438    | 7415.1  | 7448.2  | 1407.9    | 13382.9 | 34642   |
| Nuclear            | M      | 0       | 0       | 0       | 0       | 0         | 0       | 0       |
| Wind & Others      | M<br>W | 0       | 0       | 0       | 0       | 0         | 0       | 0       |
| Total              | M      | 8045.9  | 24226.5 | 17005.4 | 14227.7 | 4679      | 20283.2 | 88467.7 |

Sources: China Electric Power Yearbook 2005

**Table C6. Calculation of BM Emission Factor of Central China Power Grid (2004-2006), MW**

| New Capacity<br>2004 | New Capacity<br>2005 | New Capacity<br>2006 | New Capacity<br>2005-2006 | Percentage of<br>New Capacity<br>Additions |
|----------------------|----------------------|----------------------|---------------------------|--|
|----------------------|----------------------|----------------------|---------------------------|--|



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|                         | <b>A</b> | <b>B</b> | <b>C</b> | <b>D=C-B</b> |                |
|-------------------------|----------|----------|----------|--------------|----------------|
| Fuel-fired (MW)         | 53825.7  | 60167.2  | 76658    | 16490.8      | 78.95%         |
| Hydro (MW)              | 34642    | 38405.2  | 42719    | 4313.8       | 20.65%         |
| Nuclear (MW)            | 0        | 0        | 0        | 0            | 0.00%          |
| Wind(MW)                | 0        | 24       | 106      | 82           | 0.39%          |
| Total                   | 88467.7  | 98596.4  | 119483   | 20886.6      | <b>100.00%</b> |
| Percentage of Year 2006 | 74.04%   | 82.52%   | 100%     |              |                |

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} = 0.9064 \times 78.95\% = 0.7156 \text{ tCO}_2/\text{MWh}.$$

**D. Calculation of the Baseline Emission Factor (  $EF_{grid,CM,y}$  )**

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y} = 0.5 \times 1.2783 + 0.5 \times 0.7156 = 0.9970 \text{ tCO}_2/\text{MWh}$$

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**Annex 4**

**MONITORING INFORMATION**

**No Supplement Information.**