CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

>> Sichuan Animal Farms GHG Mitigation Programme

Version: 1.8

Date: 03/12/2012

A.2. Description of the small-scale programme of activities (PoA):

1. General operating and implementing framework of PoA

The Sichuan Animal Farms GHG Mitigation Programme (hereafter referred to as "The proposed PoA") aims to reduce a large amount of greenhouse gas (GHG) emissions from animal farms in Sichuan by replacing the existing animal manure management systems with biogas digester systems for the recovery of biogas and utilizing the biogas for the generation of electricity and/or thermal energy.

The proposed PoA is expected to include around 300 livestock farms in Sichuan province between the years 2011 and 2015. These farms would generate a significant amount of GHG emissions in absence of the proposed PoA. Each CPA under the PoA will incorporate one or multiple livestock farms according to the limit for emission reductions under small-scale regulations.

In the baseline, the GHG emissions are based on the storage and treatment of animal manure in anaerobic Animal Waste Management System (AWMS) systems, where the organic material decays anaerobically and emits large amounts of methane into the atmosphere. For the included CPAs, only emission reductions from the replacement of the existing anaerobic manure management systems are claimed. Further emission reductions from electricity and heat replacement are not claimed as CERs for simplification.

Under the proposed PoA, advanced technology will be installed on each project farm to recover the biogas (biogas digesters) and to utilize it for the generation of electrical and/or thermal energy.

To simplify the development process, the proposed PoA will only claim one source of emission reductions, which is: the emission reductions owing to the avoidance of methane emission from the existing AWMS. No CERs will be claimed for substituting fossil fuel by biogas for heating and replacement of fossil-fuel intensive electricity generation in the grid. All CPAs under the proposed PoA will apply the same baseline and monitoring methodology *AMS III.D Methane recovery in animal manure management systems (Version 18).*

The biogas digester construction in livestock farms is encouraged by an existing subsidy scheme by the central government. Nevertheless, due to barriers such as high investment cost, operational uncertainty and low income generated for the project implementers, the biogas promotion faces significant hurdles in attracting livestock farmers and commercial financing. The objective of the PoA is to overcome these barriers and to help livestock farm owners to invest in advanced biogas digester systems and to maintain a good operation by providing access to carbon finance.

The proposed PoA will be managed, implemented, operated, and monitored by the Coordinating Entity (C/ME) Chengdu Oasis Science & Technology Co., Ltd. The main tasks will include structuring the PoA framework, screening out applicable farms, writing all related documents, calculating emission reductions, managing CDM related procedures like validation, registration and verification, and the allocation of CER revenues. The digester construction and the maintenance during the operation period, as well as all necessary monitoring will be undertaken by the farm owners.

The implementers of the single CPAs will be the farm owners of the specific farms.

2. Policy measure or stated goal of the PoA

Stated goal of the proposed PoA is to enable livestock farmers in Sichuan to install anaerobic digesters on their farms in order to avoid methane emissions due to the existing lagoons and to utilize the captured biogas to generate electricity and/or thermal energy. However, for simplification, CERs will only be claimed for the avoidance of methane emissions.

Due to a high initial investment for the digester construction and considerable maintenance costs during the operation period, as well as a low financial income for the project implementers, the investment is not financially feasible for the livestock farms. By offering an additional considerable income generated by carbon credits, the PoA will enhance the financial attractiveness and support the farm owners in introducing biogas systems.

Expected outcome of the proposed programme is the promotion of digester distribution in livestock farms as well as the utilization of renewable energy in Sichuan province.

As stated and explained above, by providing the carbon finance support to farm owners, the PoA clearly facilitates additional digester distribution and will achieve a huge amount of GHG emission reduction.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity

Currently there is no mandatory policy or regulation requiring the use of biogas digester technology to treat animal manure produced in livestock farms or to destroy the resulting methane emissions by flaring/combustion or through gainful use systems. There is also no requirement for the displacement of the electricity or thermal energy.

The proposed PoA is implemented voluntarily by the C/ME and all livestock farms and other project participants involved will participate voluntarily.

4. Positive effects of the proposed PoA beyond reducing GHG emissions

As the most obvious and measurable effect, the proposed programme will result in a reduction of GHG emissions. The first CPA (SN: SCAFBG-2011-001) that will be registered with the proposed PoA, is estimated to result in an annual emission reduction of 5,093 tCO_2e and a total emission reduction of 50,934 tCO_2e during the entire 10-year crediting period.

In addition to the emission reduction aspect, the proposed PoA will contribute to local sustainable development in various ways, as by:

- Improving the local environment and human health. The proposed programme aims to reduce negative environmental impacts of intensive livestock production through the installation of biogas digesters and biogas utilization systems. Treatment of large quantities of animal waste through digesters instead of open lagoons will reduce organic material in wastewater, nuisance of odors, and bacteria. Therefore, it leads to better environmental conditions and better life quality in rural communities nearby the livestock farms.
- Diversifying energy supply. The programme will diversify energy sources through biogas production and biogas-based utilization systems. The implementation of the programme can contribute to the reduction of the country's heavy dependence on coal for electricity generation.
- Application of advanced technology. The proposed programme will apply new, advanced, and environmentally friendly technologies for the treatment of animal wastes and the associated utilization. These technologies can be replicated on other livestock farms. This will dramatically reduce livestock-related GHG emissions, provide the potential for new sources of revenue and green power, raise the economic benefits for the livestock industry, promote the utilization of agricultural waste, and hence build a circular economy.

Through the effects described above, the proposed PoA will improve the rural living conditions and environment quality. Furthermore, it reduces GHG emissions by changing the existing manure management systems and by displacing the electricity from grid.

A.3. Coordinating/managing entity and participants of SSC-PoA:

The C/ME is Chengdu Oasis Science & Technology Co., Ltd. (Hereafter to referred to as "Chengdu Oasis" or "Oasis").

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Party involved wishes to be considered as project participant (Yes/No)
People's Republic of China (host)	Chengdu Oasis Science & Technology Co., Ltd.	No
United Kingdom of Great Britain and Northern Ireland	UPM Umwelt-Projekt-Management GmbH	No

A.4. Technical description of the small-scale programme of activities:

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A.4.1. Location of the programme of activities:

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A.4.1.1. Host Party(ies):

>>

People's Republic of China

A.4.1.2. Physical/ Geographical boundary:

The geographical boundary for the proposed PoA is the administrative boundary of Sichuan province, China as shown in Figure 1.

Figure 1: Location of the Sichuan Province in China.

All SSC-CPAs that will be included under the SSC-PoA will be within the defined geographical location of the SSC-PoA area, i.e. Sichuan Province, China.

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

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A.4.2.1. Technology or measures to be employed by the SSC-CPA:

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The technical process and measures employed by a typical CPA in this PoA will comprise four stages as follows:

Stage 1 Biogas production in anaerobic digesters*:* Each livestock farm targeted by a CPA will construct a sealed anaerobic digester for animal manure treatment. After the manure goes through a pre-treatment to remove inorganic impurities, the anaerobic digesters receive the animal manure and maintain a steady–state population of methanogenic bacteria for degradation of organic matters. Methanogenic bacteria convert organic matter into biogas in the anaerobic environment. To ensure a high efficiency of biogas production, measures will be adopted to maintain the air-tightness of the anaerobic digesters during the anaerobic fermentation process.

Stage 2: Biogas collection and purification*:* The biogas derived from the sealed anaerobic digesters is a mixed gas, containing combustible CH_4 and inert CO_2, as well as H_2S. In addition to its toxicity, H_2S may shorten the lifetime of biogas distribution system. Therefore, a desulfurizing system will be used for biogas purification. The purified biogas will be stored in a gas storage system that will be sufficient to store the biogas for more than 12 hours, depending on the actual installation.

Stage 3: Biogas utilization/destruction: For each CPA, several methods to use the generated biogas gainfully are possible:

Generation of electricity for the farm: The biogas can be used to generate electricity in gas engines and generators. The electricity will be used to replace fossil fuel intensive grid electricity and to supply electricity to the auxiliary equipment, such as the digester, purification equipment, pumps, etc.

Generation of thermal energy for the farm: The biogas can be used to fire gas boilers to generate steam that is needed within the farm premises. Purpose of the thermal energy is the heating of the farm buildings, the biogas digesters and animal barns.

Supply of biogas to nearby households: A possible additional use of the biogas is the supply of gas within new gas grids to nearby households.

By combining the different methods of destruction as well as a gas storage system, it is ensured that the whole amount of biogas is destructed. The proposed PoA will only claim CERs from the destruction of methane in the baseline. No CERs will be claimed for emission reductions due to the replacement of fossil fuels for electricity or heat generation by biogas.

In cases where gas engine and boiler face technical issues or are undergoing maintenance, a flare will be used to destroy the gas.

***Stage 4: Land application of sludge*:** The sludge from biogas digesters will be applied as fertilizer on dry land (aerobic treatment) for self-use and/or open market. The project farms will treat the sludge aerobically under the supervision of the C/ME according to the instruction made by the C/ME.

All technologies utilized in the project activity are domestic technologies. No international technology transfer will occur as a result of the proposed PoA.

All installations covered by this PoA and its attached CPAs will be according to the list of technical standards below (or newer comparable standards to be published after the PoA has been registered):

No.	Code	Standard
1.	NY/T 1221-2006	Technical specification for operation maintenance and safety of biogas plant in scale animal and poultry farms
2.	NY/T 1222-2006	Criteria for designing of biogas plant in scale livestock and poultry breeding Farms
3.	NY/T 1220.1-2006	Biogas Code for biogas engineering process design
4.	NY/T 1220.2-2006	Biogas Code for biogas engineering_ design of biogas supply
5.	NY/T 1220.3-2006	Biogas Code for biogas engineering construction and acceptance
6.	NY/T 1220.4-2006	Biogas Code for biogas engineering operation and maintenance
7.	NY/T 1220.5-2006	Biogas Code for biogas engineering evaluation of quality

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

>> This section only describes enrolment criteria for CPAs. Criteria for demonstrating additionality of CPA are depicted in section E.5.

The eligibility criteria under the SSC-PoA shall be stated and checked in each SSC-CPA document as follows. The eligibility criteria need to be applied to each individual installation under each CPA. A new CPA can only be included into the POA, if all included installations fulfil the eligibility criteria.

Nb.	Criterion	Rationale	Evidence Example
1.	The CPA has been approved by the C/ME.	The C/ME manages the CDM implementation of the proposed PoA. It shall therefore approve the CPA in a written statement.	• Written approval letter from the C/ME
2.	The SSC-CPA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.	De-bundling check	• C/ME statement • CPA database • Checking with the official CDM websites

Nb.	Criterion	Rationale	Evidence Example
3.	All relevant applicability criteria of methodology AMS-III.D (Version 18) shall be met.[1]		
3.1.	• Project activities involve the replacement or modification of an anaerobic animal manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane.	Applicability criterion 1 of methodology AMS-III.D (Version 18)	• FSR • EIA
3.1.1.	• The livestock population in the farm is managed under confined conditions;	Applicability criterion 1 of methodology AMS-III.D (Version 18)	• Picture • FSR
3.1.2.	• Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries)	Applicability criterion 1 of methodology AMS-III.D (Version 18)	• FSR • EIA
3.1.3.	• The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5°C;	Applicability criterion 1 of methodology AMS-III.D (Version 18)	• Official Publication (e.g. the Sichuan Statistical Yearbook)
3.1.4.	• In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month, and in case of anaerobic lagoons in the baseline, their depths are at least 1 m;	Applicability criterion 1 of methodology AMS-III.D (Version 18)	• FSR • Design of baseline manure management system
3.1.5.	• No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario.	Applicability criterion 1 of methodology AMS-III.D (Version 18)	• FSR • Pictures

[1] Criteria 3 of AMS III.D, Version 18 is not applicable to the CPAs, as it is only applicable for landfill projects.

Nb.	Criterion	Rationale	Evidence Example
3.2.	• The project activity satisfies the following conditions	Applicability criterion 2 of methodology AMS-III.D (Version 18)	
3.2.1.	• The residual waste from the animal manure management system shall be handled aerobically.	Applicability criterion 2 of methodology AMS-III.D (Version 18) The farms are advised on aerobic sludge handling according to a guideline from the Sichuan Biogas Society. To confirm the compliance with this criterion, the claimed emission reductions are reduced by the share of farms that do not apply the correct procedures after the monitoring.	• Statement on aerobic application by the Sichuan Biogas Society • Instructions to farms • FSR
3.2.2.	• Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared.	Applicability criterion 2 of methodology AMS-III.D (Version 18)	• FSR • Construction Contract • Equipment purchase contract
3.2.3.	• The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the anaerobic digester. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not apply.	Applicability criterion 2 of methodology AMS-III.D (Version 18)	• FSR

Nb.	Criterion	Rationale	Evidence Example
3.3.	• Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO2 equivalent annually from all Type III components of the project activity.	Applicability criterion 7 of methodology AMS-III.D (Version 18)	• SSC-CPA-DD
4.	The CPA shall fulfil the criteria of additionality demonstration defined in PoA-DD (section E.5.2)	To ensure the CPA is additional	• IRR calculation sheet • ER calculation
5.	All farms meet the criteria below for farms to be included in a certain CPA.		
5.1.	• The farm is located within the geographic boundary of the CPA.	No farm should be located outside the defined CPA boundary.	• CPA farm database • SSC-CPA-DD
5.2.	• The farm will install a new anaerobic biogas digester to generate and recover biogas for utilization.	The digester in the project scenario will recover the biogas generated	• FSR • Construction contract • Equipment Purchase Contract
5.3.	• The farm will install equipment to utilize the biogas to generate electrical and/or thermal energy and/or to supply the gas to local households in the direct surrounding of the farm. No other forms of biogas utilization will be employed (e.g. bottling).	No alternative types of utilization as discussed in methodology AMS-III.H will be employed by the CPAs.	• FSR
5.4.	• One of the following two sub-criteria is fulfilled.		
5.4.1.	• The baseline animal waste management system cannot be physically transported to another site outside the project boundary.	Systems like concrete lagoons or dug holes cannot be transported physically. Therefore, leakage can be excluded.	• Photos

Nb.	Criterion	Rationale	Evidence Example
5.4.2.	• In case the baseline AWMS could be transported physically, it is scrapped, the scrapping has been documented and the scrapped equipment is stored until it was observed by the DOE.	By documenting and proving the scrapping of potentially mobile equipment, leakage can be excluded.	• Prove of scrapping, e.g. pictures • Scrapped equipment
6.	The proposed project and the new CPA do not lead to a diversion of official development assistance (ODA).	Avoidance of CDM leading to a diversion of official development assistance.	• Written letters to state that neither the CDM development process, nor the construction is funded by ODA.
7.	The starting date of the CPA is determined and not prior to the Global Stakeholder Consultation of the PoA.		
7.1.	The start date of the CPA lies either in the future, or can be determined with suitable evidence.	Requirement of EB 65, Annex 38	• Equipment purchase contract
7.2.	The start date of the CPA is not before the date of public web hosting of the PoA documentation (01/03/2012).	Requirement of EB 65, Annex 38	• Equipment purchase contract
8.	The end date of the CPA does not exceed the PoA end date.	The CPAs will automatically be terminated when the PoA reached the end of its end date.	• SSC-CPA-DD
9.	The CPA implements a monitoring plan that is in line with the monitoring plan described in the PoA-DD (section E.7.2)	The monitoring plan of each CPA should be in line with the monitoring plan validated by the DOE and registered with the PoA.	• SSC-PoA-DD • SSC-CPA-DD
10.	Measures to avoid double counting are implemented.		

Nb.	Criterion	Rationale	Evidence Example
10.1.	• The CPA implementers confirm in written statements that: a) All biogas systems to be newly installed under the CPA are not and will not be part of another CDM project or program activity and that no CERs will be claimed for the biogas system other than those to be claimed by the C/ME on behalf of the participating farms respectively; and b) That they are aware and agree with the inclusion of the CPA to the proposed PoA.	The written statements of the CPA implementer compose the first layer of measures to avoid double counting.	• CPA inclusion letter
10.2.	• A check for double counting of single farms biogas plant to a negative result.	The check performed by the C/ME (procedures described in section A.4.4.1) composes the second layer of measures.	• CPA farm databases of all previously included CPAs. • CPA farm database of new CPA. • Documents available on unfccc.int and farm databases in case of overlapping regions.
11.	• An EIA has been conducted for each biogas plant that is part of the new CPA and comes to the conclusion that the project does not have significant negative impacts to the environment. Furthermore, the EIA (table or report) has been approved by the responsible authority.	An EIA needs to be conducted according to the national legislation.	• EIA table or report • EIA approval
12.	• A local stakeholder meeting has been conducted for each biogas plant that is part of the new CPA and did not result in major negative objections against the project by the local stakeholders.	The local stakeholders need to be interviewed to provide sufficient opportunity to address any concerns or objections.	• Stakeholder meeting report • Questionnaires • Meeting records

Nb.	Criterion	Rationale	Evidence Example
13.	• A Feasibility Study has been carried out for each biogas plant and the results have been described in Feasibility Study Reports. Furthermore, the FSRs have been approved by the responsible authority.	The project needs to be planned and approved by the local authorities.	• FSR • FSR approval

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

>> The following shall be demonstrated here:

(i) The proposed PoA is a voluntary coordinated action;

According to the currently applied livestock manure management system for intensive livestock farms the manure is stored under anaerobic conditions without methane recovery and destruction. This manure treatment practice as well as the energy sources are in line with relevant legislation in Sichuan Province. There is no mandatory policy or regulation by national, provincial or local government of China which insists on the treatment of manure by biogas digesters. There are also no requirements for destructing the methane generated in uncovered anaerobic treatment methods. Therefore, the proposed PoA is not implementing any mandatory policy or regulation of the Government of China and is considered as a voluntary action by the C/ME.

Furthermore, the C/ME Chengdu Oasis is a private company that voluntarily engages in the promotion of biogas systems for animal farms in Sichuan.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

As per EB70, Annex 5 the C/ME will demonstrate the additionality at the CPA level by demonstrating their compliance with a pre-defined set of criteria. This is appropriate since the various factors for each different project activities in the CPAs may presents different result. The C/ME will conduct the additionality demonstration for each biogas plant included in the CPA before the farm participation and the CPA inclusion. The analysis will be described in detail in the SSC-CPA-DD.

Following this approach, additionality is demonstrated for a typical CPA in section E.5.1. Based on the outcome of the assessment, precise eligibility criteria against which the additionality of CPAs shall be checked are presented in section E.5.2.

As per the demonstration of additionality in each CPA-DD, the single CPA activities are additional and therefore, they would not be implemented in the absence of the PoA.

(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;

Not applicable. The proposed PoA is not implementing a mandatory policy/regulation.

(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

Not applicable. No mandatory policies and/or regulations are being enforced by the proposed PoA.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

>>Description of the operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA, including:

(i) A record keeping system for each CPA under the PoA,
(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA,
(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.
(iv) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;

Tentative Operating Framework of the PoA

In the paragraphs below a tentative operating structure for the PoA is described. If unexpected events should make certain changes in the structure necessary, such changes will be recorded precisely and be provided to any relevant party in the future.

As the C/ME, Chengdu Oasis is in charge of all tasks related to the CDM and the proposed PoA. These tasks include (inter alia):

- Defining criteria for the participating farms,
- Checking the criteria fulfillment of the potential farms by all means,
- Bundling the farms to form the CPAs,
- Managing and maintaining the CPA database and the farm databases for the separate CPAs,
- Initiating the inclusion of new CPAs to the PoA,
- Conducting the double-counting check, both internal and external checking are included,
- Collecting and maintaining the project files carefully,
- Developing monitoring plan and supervising the monitoring work conducted by the project farms, as well as writing monitoring reports periodically,
- Instructing farms to treat the sludge aerobically,
- Organizing verifications and representing the CPAs including all relevant data to the DOE,
- Communicating with the relevant CDM stakeholders,
- Selling the CERs to the designated buyer,
- And distributing the carbon revenues to project farms.

The project farms will take over the following technical responsibilities by establishing special departments:

- Construct the project biogas digester system as well as biogas destruction system,
- Maintain the project systems in a good operation by all means,
- Install the monitoring system and conduct the monitoring work according to the monitoring plan defined by the C/ME,
- Treat the sludge properly under the C/ME's instruction.

(i) A record keeping system for each CPA under the PoA.

Procedures for identifying each farm as well as each CPA are determined by the serial number. Each farm will be identified by the name of the farm and by a serial number designated by the C/ME. In addition to this, all of the farms will have a geographic location reference (latitude and longitude).

The record that is kept for the CPA organization is displayed in Table 1. It comprises the number of the CPA and the detail identification information of farms involved.

CPA Information

CPA Number:		
Number of farms involved		
Farm A	**Farm owner**	
	Serial Number	
	Name	
	Address	
	latitude	
	longitude	
	Contact person	
	Telephone Number	
	Email	
	ZIP Code	
	Construction Date	
	Commissioning Date	
	Starting Date of Credit Period	
Farm B	**Farm owner**	
	Serial Number	
	Name	
	Address	
	latitude	
	longitude	
	Contact person	
	Telephone Number	
	Email	
	ZIP Code:	
	Construction Date	
	Commissioning Date	
	Starting Date of Credit	

	Period	
……		

Table 1: CPA record keeping system

For the monitoring data, the project farms will install the related metering and recording equipment according to the requirements of the C/ME. As planned, an automatic metering system consisting of the biogas meter(s), and a device called PLC (Programmable Logical Controller) will be installed for each farm and will be used to record, collect, store, and manage the information. The captured data will be stored in the computer and printed out as paper document. For farms, where a PLC is not suitable or not installed due to other reasons, the monitoring data will be recorded manually and digitalized by the C/ME.

Manually recorded data will be documented in a logbook and also saved in a computer database by the livestock farms.

Once a month, the C/ME will collect all CDM related data in form of hard copies and electronic data. This data will be archived in the office of the C/ME in Chengdu and backed up regularly. And the farm owner is responsible for keeping the original records well.

All data acquired within this data recording system will be kept at least until two years after the end of the crediting period of the PoA.

(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA.

In order to avoid double accounting and to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA, the involving farms, shall, in accordance with the eligibility criteria stipulated in section A.4.2.2, confirm in a written statement that:

1. The CPA and all biogas systems to be installed under the CPA have not been and will not be registered as a single CDM project activity or as a CPA under another PoA.
2. The targeted farms are aware and agree that the CPA will be subscribed to the present PoA.

To further ensure that no double counting occurs due to the participants breaking the signed contract, an additional checking on two levels will be undertaken by the C/ME:

1. Internal cross-check procedure: Whenever a new CPA is included in the PoA, the C/ME will confirm that no farm is included within the new CPA that is already included in a CPA that has been included previously. To ensure this, comprehensive comparison of the detailed identification information of farms in new CPA and all previous CPAs will be performed and documented.
2. External cross-check procedure: a cross check of the boundaries of all registered CDM projects and registered PoAs that target the installation of farm digesters in rural areas, will be performed and documented. If such CDM project or PoA with an overlapping project boundary is registered and its project documents are available on the official CDM websites(UNFCCC website, NDRC CDM website, etc), the C/ME will confirm that the new CPA and the existing registered CDM project or PoA do not comprise overlapping farms by checking the location of the involved farms.

(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

The "Guidance for determining the occurrence of debundling under a programme of activities (PoA) , version 03" will be applied to demonstrate that the SSC CPA included in the PoA is not a debundled component of another CDM PoA or another CDM Project activity.

According to Guidelines on Assessment of Debundling for SSC Project Activities, *a proposed small-scale CPA of a PoA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity, which satisfies both conditions (a) and (b) below:*

a) Has the same activity implementer as the proposed small scale CPA or has a coordinating or managing entity, which also manages a large scale PoA of the same technology/measure, and;
b) The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

The C/ME will check the new CPA as well as the farms included according to the guideline mentioned above.

The positive result of the check against both criteria is part of the eligibility criteria. The outcome of the check will be discussed in each CPA-DD.

(iv) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;

As per the eligibility criteria for CPAs in section A.4.2.2, the CPA implementers, i.e. the C/ME and the farms operating the biogas systems, are aware and have agreed that their activity is being subscribed to the proposed PoA.

A.4.4.2. Monitoring plan:

>>The following information shall be provided here:

(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.
(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

According to the Procedures for Registration of a Programme of Activities as a Single CDM Project Activity and Issuance of Certified Emission Reductions for a Programme of Activities (version 04.1), all the CPAs under the proposed PoA will be monitored as per the related methodologies, procedures and guidelines.

All relevant parameters included in the monitoring plan shall be monitored and recorded for each farm of the included CPAs independently. Monitoring reports will be prepared separately for each farm of the

CPAs for the purpose of verification and request for issuance of CERs. To guarantee the uncomplicated access to the CPA data, the C/ME will maintain a database for all included CPAs. The records and documentations pertaining to monitoring and verification for all the included by CPAs will be obtained and archived by the C/ME and will be assessable for the DOE to check the CPA status at any point of time. The DOE will be provided with all the monitoring reports and other programme related documents of each CPA during verification.

For the verification, the C/ME opts for a sampling approach. According to the Standard For Sampling And Surveys For CDM Project Activities And Programme Of Activities, the C/ME proposes a sampling verification that shall ensure a confidence/precision of 90/10.

A.4.5. Public funding of the programme of activities (PoA):

>>

No public funding from Annex 1 countries is provided for the proposed programme of activities (PoA).

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

>>

01/02/2013 or the date of registration, whatever occurs later.

B.2. Length of the programme of activities (PoA):

>> 28 years

SECTION C. Environmental Analysis

>>

C.1.Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at SSC-CPA level ☑

Every livestock farm included in the PoA will undertake environmental analysis. The required EIA outcome tables or EIA reports will be approved by appropriate level of environment agency in Sichuan Province. In addition, the approval letter will be provided to DNA for the national approval of CPA. Hence, the EIA process will be done at CPA level.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The environmental analysis for each project farm included in CPA will be described and reflected in the specific CPA-DD.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

>> According to Chinese environmental regulation, an Environmental Impact Assessment (EIA) is required for biogas projects. However, the required outcome of the EIA for most biogas projects is not a full EIA report, but just an EIA result table. The outcome of the EIA, irrespectively of whether this is a full EIA report or an EIA result table will be approved by the local Environmental Protection Bureau (EPB).

SECTION D. Stakeholders' comments

>>

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at SSC-CPA level ☑

As project farms will have different impact to the surrounding environment as well as various comments from the stakeholders, the C/ME proposes conducting stakeholder consulting at SSC-CPA level.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

The stakeholder consulting process for each project farm included in CPA will be described and reflected in the specific CPA-DD.

D.3. Summary of the comments received:

The stakeholder comments received for each project farm included in CPA will be summarized and described in the specific CPA-DD.

D.4. Report on how due account was taken of any comments received:

The information required will be presented in the specific CPA-DD.

SECTION E. Application of a baseline and monitoring methodology

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

>>
The CPAs included in the proposed Programme will apply the following methodology:

AMS III.D—Methane recovery in animal manure management systems (Version 18)

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

>>
The proposed project will construct biogas digesters to treat livestock manure which is currently treated in open anaerobic lagoons. Biogas produced by biogas digesters will be used or destroyed. The following statement can demonstrate that the CPA can meet the requirement of methodology AMS III.D.

Applicability of AMS-III.D-Version 18	Project activity	Eligibility Criteria reflecting this requirement
1. This methodology covers project activities involving the replacement or modification of anaerobic manure management systems in livestock farms to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered methane. It also covers treatment of manure collected from several farms in a centralized plant. This methodology is only applicable under the following conditions:	As per the eligibility criteria for CPAs presented in section A.4.2.2 a CPA includes replacement or modification the current manure management practice (open lagoon) with an anaerobic digestion system equipped with methane recovery and utilization systems. Methodology is applicable.	3.1
(a) The livestock population in the farm is managed under confined conditions;	(a) As per the eligibility criteria for CPAs presented in section A.4.2.2 under a CPA the livestock is managed under confined conditions;	3.1.1
(b) Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries), otherwise AMS III.H. shall be applied;	(b) As per the eligibility criteria for CPAs presented in section A.4.2.2 manure is discharged into open lagoon, which is not natural water resources; furthermore, the treated manure is used as fertilizer on fields.	3.1.2
(c) The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5℃;	(d) As per the eligibility criteria for CPAs presented in section A.4.2.2 all farms are located in areas with an annual average temperature above 5^{o}C. As shown in Annex 3, the mean annual temperatures of all cities within the geographical boundary of the PoA have been well above 5.0 ^{o}C.	3.1.3

(d) In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than 1 month, and in case of anaerobic lagoons in the baseline, their depths are at least 1 m;	(d) As per the eligibility criteria for CPAs presented in section A.4.2.2 manure waste is left to decay in the open lagoon in the baseline situation and the retention time of manure waste is greater than 1 month;	3.1.4
(e) No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario;	(e) As per the eligibility criteria for CPAs presented in section A.4.2.2 methane is directly released to the atmosphere in the baseline situation;	3.1.5
2. The project activity shall satisfy the following conditions: (a) The final sludge must be handled aerobically，otherwise the related emissions shall be taken into account as per relevant procedures of AMS-III.AO. Methane recovery through controlled anaerobic digestion... In case of soil application of the final sludge the proper conditions and procedures (not resulting in methane emissions) must be ensured. (b) Technical measures shall be used (e.g. flared, combusted) to ensure that all biogas produced by the digester is used or flared. (c) The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the anaerobic digester. If the project proponent can demonstrate that the dry matter content of the manure when removed from the animal barns is larger than 20%, this time constraint will not apply.	(a) As per the eligibility criteria for CPAs presented in section A.4.2.2 under a CPA the sludge will be applied to nearby soil. (b) As per the eligibility criteria for CPAs presented in section A.4.2.2 under a CPA the captured biogas will be used or destroyed. (c) As per the eligibility criteria for CPAs presented in section A.4.2.2 under a CPA the storage time of the manure after removal from the animal barns, including transportation, will not exceed 24 hours before being fed into the anaerobic digester under the project scenario.	3.2 3.2.1 3.2.2 3.2.3
3. Projects that recover methane from landfills shall use AMS-III.G and projects for wastewater treatment shall use AMS-III.H. Project for composting of animal manure shall use AMS-III.F .Avoidance of methane emissions through composting. Project activities involving co-digestion of animal manure and other organic matters shall use the methodology AMS-III.AO .Methane recovery through controlled anaerobic	Not applicable. All CPA included in the POA recover methane from animal manure.	-

digestion.		
4. Different options to utilize the recovered biogas as detailed in paragraph 3 of AMS-III.H are also eligible for use under this methodology. The respective procedures in AMS-III.H shall be followed in this regard.	As per the eligibility criteria for CPAs presented in section A.4.2.2 under a CPA the recovered biogas is only used for electrical or thermal energy generation. No CPA will employ alternative types of utilization (like e.g. botteling) as described in AMS-III.H.	5.3
5. New facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the "General Guidelines to SSC CDM methodologies".	As the project activity covers the installation of biogas digesters to replace the existing manure treatment facilities, the CPAs covered under this PoA are no greenfield projects.	-
6. The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General Guidelines to SSC CDM methodologies".	As per the eligibility criteria for CPAs presented in section A.4.2.2 a CPA will use new equipment that will not replace existing equipment. No methane recovery and utilization equipment was used in the past, so no equipment will be replaced.	3.1 3.1.5
7. Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO2 equivalent annually from all type III components of the project activity.	As per the eligibility criteria for CPAs presented in section A.4.2.2 under a CPA the annual emission reduction from manure management improvement is less than 60kt CO_2e.	3.3

For the inclusion of new CPAs, the applicability of all criteria will be demonstrated for each farm of each CPA. Only if all farms meet the applicability criteria, the CPA can be included.

E.3. Description of the sources and gases included in the SSC-CPA boundary

>>

The geographic sites of all individual biogas systems included in the CPA define the SSC-CPA boundary. A biogas system consists of manure collection, generation, collection and destruction equipment. The SSC-CPA boundary is considered to be the following figure:

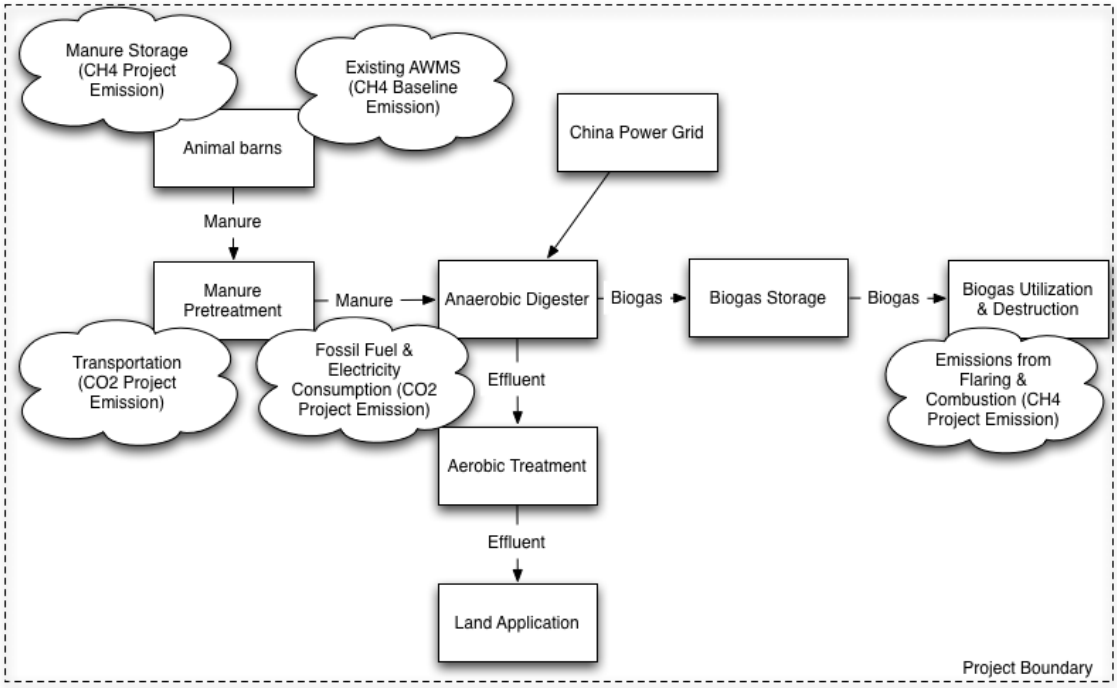

Figure 2: The project boundary (of one farm).

About the emission sources and gases to be included in project boundary, please refer to the following table:

	GHG emission source	Gas	Included?	Justification/Explanation
Baseline emission	Emissions from the open anaerobic lagoon	CO_2	No	Excluded for simplification. This is conservative.
		CH_4	Yes	Major source of baseline emission.
		N_2O	No	Excluded for simplification. This is conservative.
Project emission	Physical leakage of biogas in the manure management systems	CO_2	No	Not applicable; in line with the applied methodologies.
		CH_4	Yes	Major source of project emission
		N_2O	No	Not applicable; in line with the applied methodologies.
	Emissions from flaring or combustion of the gas stream	CO_2	No	Not applicable; in line with the applied methodologies.
		CH_4	Yes	Major source of emission.
		N_2O	No	Not applicable; in line with the applied methodologies.
	CO_2 emissions from onsite electricity and/or fossil fuel consumption	CO_2	If applicable for the specific CPA	Major source of emission if electricity and/or fossil fuel is consumed by the CPA.
		CH_4	No	Not applicable; in line with the applied methodologies.

		N_2O	No	Not applicable; in line with the applied methodologies.
	CO_2 emissions from manure transportation	CO_2	If applicable for the specific CPA	Major source of emission if manure is transported to the biogas plant.
		CH_4	No	Not applicable; in line with the applied methodologies.
		N_2O	No	Not applicable; in line with the applied methodologies.
	Emissions from the storage of manure before being fed into the anaerobic digester	CO_2	No	Not applicable; in line with the applied methodologies.
		CH_4	If applicable for the specific CPA	If the storage time of the manure after removal from the animal barns exceeds 24 hours before being fed into the anaerobic digester, it will be calculate.
		N_2O	No	Not applicable; in line with the applied methodologies.

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

>>
According to methodology AMS III.D the baseline scenario is the situation, in the absence of the project activity, animal manure is left to decay anaerobically within the project boundary and methane is emitted to the atmosphere. As per the eligibility criteria, all farms that are eligible as a CPA currently store manure in an anaerobic AWMS. The calculation of baseline emissions as per the methodology is applied as in section E.6.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

A typical SSC-CPA will install the advanced anaerobic digester system and biogas utilization system in each livestock farm included in the CPA. For each CPA, the additionality shall be chosen using the following approach:

Demonstration of additionality according to "Guidelines On The Demonstration Of Additionality Of Small-Scale Project Activities" (version 09).

Paragraph 1 of those guidelines offers 4 types of barriers, of which the existence of at least one has to be demonstrated for the project to be considered additional. For the CPAs of the proposed PoA that demonstrate additionality using option 1, the existence of an investment barrier will be demonstrated using an investment analysis, that follows the "Guidelines on the assessment of investment of investment analysis" (Version 05).

Investment analysis

For the installations under each CPA, a benchmark analysis can be identified as most suitable financial analysis. Since all CPAs comprise existing farms, they do not face a situation, in which an investment is required (where an investment comparison analysis would be more suitable). Furthermore, the biogas digesters will generate biogas that can be used to generate electricity, an economic benefic, other than the CDM related income is generated. Therefore, also the simple cost analysis is not deemed suitable and the benchmark analysis is chosen for the following.

The financial attractiveness of this project activity for each project farm will be determined by comparing the financial IRR (without CERs) with the appropriate benchmark rate applied in China, which is widely applied at present in China for the project feasibility.

To compare the two values (IRR and benchmark), two suitable values and calculation methods need to be chosen. For the determination of the project's IRR, the pre-tax project IRR calculation has been chosen and consequently, a pre-tax project IRR benchmark is applied for the following analysis.

Currently, the standard benchmark applied for financial feasibility assessment can be obtained from "Economic Evaluation for Construction Project: Methods and Parameters (edition 3)", issued by NDRC and Ministry of Construction, the financial benchmark for the IRR (pre-tax) of Chinese animal husbandry accounts for 7%[2]. However, the benchmark might be updated along with the update of the related official guidance and documentation, which will be applied in financial analysis when conducting financial feasibility assessment for the project. In addition, the C/ME will confirm the appropriate benchmark for the individual livestock farm before the new CPA inclusion as per the latest official source.

After the benchmark determination, the Internal Rate of Returns (IRRs) will be calculated at CPA level for individual farms under two scenarios: with CDM and without CDM revenues.

To make sure the fluctuation of major parameters will not affect the additionality of the CPA, the sensitivity analysis will be applied to each individual farm project for further assessment.

The CPA is additional if the conditions below are simultaneously satisfied:

a) The IRR of the investment for the individual farm in the CPA is calculated based on specific input parameters and the method provided in section E.5.1 of the PoA-DD.
b) A suitable and applicable IRR benchmark is quantified in the CPA-DD.
c) IRR calculation result without CDM for each farm included is lower than the benchmark IRR defined, showing that the project is not a financially attractive option.
d) IRR with expected CDM revenue for each farm included is higher than the IRR excluding CDM revenues, showing that the project becomes financially more feasible after considering the CDM.
e) The sensitivity analysis shows that the IRR without CDM for each farm included is still lower than the benchmark IRR defined after considering the variation of the major parameters or the scenarios in which the benchmark is exceeded, are unlikely.

The calculation of the IRR of a typical farm shall be presented in excel format with applied formulas and will be submitted along with the CPA DD. All assumptions of critical parameters have to be substantiated

[2] The third edition of Economic Evaluation for Construction Project: Methods and Parameters 2006

with reliable sources or evidence where available.

The expected input parameters for IRR calculation is as following, which might be adjusted for the specific case to reflect the specific situation of each CPA:

Item	Value	Unit	Source
Total static investment			
- Construction			
- Equipment purchase			
- Equipment installation			
- Other expense			
- Basic reserve fund			
Subsidy received			
Project life time (incl. construction period)			
Daily biogas sold			
Price of gas supply to farm (excl. VAT)			
Power capacity			
Daily electricity generation			
Daily electricity self consumption			
Yearly operation days			
Electricity price from grid (excl. VAT)			
Annual O&M cost			
- Material			
- Power expenses			
- Labour costs			
- Repair fee			
Residual Rate			
Annual solid sludge amount			
Price of solid sludge			
Annual liquid sludge amount			
Price of liquid sludge			
Value-added Tax			
Education Additional Expense Tax			
Annual service value			
City Maintenance and Construction Tax			
CER price			
RMB/EUR Exchange Rate			

Table 2: Parameters of the IRR calculation.

Generally values that were applied at the moment of the investment decision shall be used for the analysis above. Mostly, the Feasibility Study will be public sources. For these cases, it will be demonstrated, that

the time between the Feasibility Study and the investment decision is sufficiently short, to ensure that the input values and results of the financial analysis in the FSR have been applicable at the time of investment decision.

Event	Date
Feasibility Study Finalization	
Investment Decision	

The calculation results of the IRR with and without CDM compared to benchmark are presented as:

Indicator	Value
Benchmark	
IRR without CDM	
IRR with CDM	

Table 3: IRR calculation result.

The sensitivity analysis will follow the latest guideline published by the EB. The expected factors for sensitivity analysis and variation ranges will be as following (if applicable in the specific case):

Indicator	-10%	-5%	0%	5%	10%
Total static investment					
Subsidy Received					
Electricity price					
Annual electricity generation					
Thermal energy generation					
Fossil fuel price					
Biogas price					
Annual biogas sold					
O&M Costs					
Sludge price					
Biogas production					

Table 4: Sensitivity analysis of the IRR (excl. CDM).

After the calculation of IRR results of the sensitivity analysis, the results will be discussed. In case, one of the scenarios exceeds the identified benchmark, the likelihood of this scenario will be discussed and a justification for the discussion will be provided. Only CPAs for which such scenario is unlikely will be considered additional .

Summary and conclusion

The demonstration of additionality, outlined above, will be applied on each individual farm in the CPA for additionality demonstration. These criteria are translated into the criteria for assessing the

additionality of a SSC-CPA as described below and the eligibility criteria as described in section A.4.2.2. By assessing these key factors for all new farm that will be included, the C/ME can assure that all CPAs included are additional and meet all requirements of all applied standards.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

The criteria below shall be checked upon inclusion of a CPA to the proposed PoA in order to demonstrate that the additionality arguments presented in section E.5.1 fully apply to the CPA.

Following the descriptions in section E.5.1, to demonstrate that the project activity is additional, each installation covered under a new CPA needs to fulfill the criteria below:

1. The additionality is demonstrated through a financial analysis by showing that:

   a) IRR calculation result without CDM for each farm included is lower than the benchmark IRR defined, showing that the project is not a financially attractive option.
   b) IRR with expected CDM revenue for each farm included is higher than the IRR calculated without consideration of the CDM revenues. Thereby, it is shown that the financial barrier is alleviated.
   c) The sensitivity analysis shows that the IRR without CDM for each farm included is still lower than the benchmark IRR defined after considering the variation of the major parameters. In case the IRR exceeds the benchmark for one or more of the scenarios, an analysis needs to come to the conclusion that the critical scenarios are unlikely to happen.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

AMS.III.D --Methane recovery in animal manure management systems[3]
(Version 18, Sectoral Scope 15, EB63)

Reference Tools

"Tool to calculate the emission factor for an electricity system" (Version 02.2.1, EB63) – Calculation of the grid emission factor
"Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01, EB39) – Monitoring procedures
"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02, EB 41) – Monitoring procedures
"Project emissions from flaring" (Version 2.0.0, EB 68)

[3] http://cdm.unfccc.int/methodologies/DB/APIHMNNKLNBU8MY8DK7TRQ9XQJJGLT,(Link valid:22nd Sep 2011)

Furthermore, the calculation of project emissions due to the use of electricity is calculated according to methodology AMS I.D, version 17 and project emissions due to transportation of manure are calculated according to AMS III.AO, version 1. Standard emission factors for light and heavy vehicles are used from the Methodological tool "Project and leakage emissions from road transportation of freight".

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

AMS.III.D --Methane recovery in animal manure management systems (Version 18)

1. Baseline emissions

Based on the AMS.III.D, baseline methane emissions from the open anaerobic lagoon for each individual farm can be calculated using the following equation:

$$BE_{III.D,y} = GWP_{CH_4} \cdot D_{CH_4} \cdot UF_b \cdot \sum_{j,LT} MCF_j \cdot B_{0,LT} \cdot N_{LT,y} \cdot VS_{LT,y} \cdot MS\%_{Bl,j} \quad (1)$$

Where:

$BE_{III.D,y}$	Baseline emissions covered by methodology AMS III.D in year y (tCO2e)
GWP_{CH_4}	Global Warming Potential for CH4 (21)
D_{CH_4}	CH_4 density (0.00067 t/m3 at room temperature (20 °C) and 1 atm pressure)
UF_b	Model correction factor to account for model uncertainties (0.94)
j	Index of animal waste management system
LT	Index for all types of livestock
MCF_j	Annual methane conversion factor (MCF) for the baseline animal waste management system "j" (%)
$B_{0,LT}$	Maximum methane producing capacity for the volatile solid generated for animal type LT (m^3 CH_4(kgdm)-1)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers). See equation 2 for details.
$VS_{LT,y}$	Volatile solids for livestock LT entering the animal manure management system in year y (on a dry matter weight basis, kg dm/animal/year) This value is calculated as $VS_{LT,d} * 365$.
$MS\%_{Bl,j}$	Fraction of manure handled in baseline animal manure management system "j"

The annual average number of animals $N_{LT,y}$ will be determined according to the following formula:

$$N_{LT,y} = N_{da,y} \cdot \left(\frac{N_{p,y}}{365}\right) \quad (2)$$

Where:

$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers).
$N_{da,y}$	Number of days animal is alive in the farm in the year y (days)
$N_{p,y}$	Number of animals produced annually of type LT for the year y

	(numbers)

There is no country specific data for B_0, *VS* or *MCF*. Therefore, according to paragraph 10 (a), 10 (b) and 10 (f), default values from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4, Cahpter 10 will be used for the three parameters.

For the choice of default values B_0 and *VS*, the methodology in Paragraph 10 (d) makes the following provisions:

B_0 *or* VS *values applicable to developed countries can be used provided the following four conditions are satisfied:*

- *The genetic source of the livestock originates from an Annex I Party;*
- *The farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;*
- *The use of FFR can be validated (through on-farm record keeping, feed supplier, etc.);*
- *The project specific animal weights are more similar to developed country IPCC default values.*

Therefore, new CPAs shall justify the choice of default values from the IPCC guidelines according to these criteria. In case all criteria are met, a farm within a new CPA shall apply the values for developed countries. In case one or more criteria are not fulfilled, default values for Asia shall be applied for the farm.

2. Project emission

Based on the AMS.III.D, the project activity emissions consist of:
(a) Physical leakage of biogas in the manure management systems which includes production, collection, and transport of biogas to the point of flaring/combustion or gainful use ($PE_{PL,y}$);
(b) Emissions from flaring or combustion of the gas stream ($PE_{flare,y}$);
(c) CO_2 emissions from use of electricity or fossil fuel for the operation of all the installed facilities ($PE_{power,y}$);
(d) CO_2 emissions from incremental transportation distances;
(e) Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$).

Thus, the total project emissions in the animal farm n ($PE_{n,y}$) are calculated as:

$$PE_{IIID,y} = PE_{power,y} + PE_{flare,y} + PE_{storage,y} + PE_{PL,y} + PE_{transp,y} \quad (3)$$

Where:

$PE_{III.D,y}$	Project emissions covered by methodology AMS III.D in year y (tCO2e)
$PE_{power,y}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y (tCO_2e)
$PE_{flare,y}$	Emissions from flaring or combustion of the biogas stream in the year y (tCO_2e)
$PE_{storage,y}$	Emissions from the storage of manure (tCO_2e)
$PE_{PL,y}$	Emissions due to physical leakage of biogas in year y (tCO_2e)
$PE_{transp,y}$	Emissions from incremental transportation in the year y (tCO_2e)

2.1 CH_4 emission from physical leakage ($PE_{PL,y}$)

The CH_4 emission from physical leakage shall be calculated as per Paragraph 13 option b of AMS III.D, Version 18. A default value of 0.05 m^3 biogas leaked/m^3 biogas produced will be used.

2.2 CO_2 emissions from flaring or combustion of the gas stream ($PE_{flare,y}$)

For the CPAs under the PoA, all biogas is used to utilize energy. A flare will be only installed as a backup solution. Therefore, no project emissions will be calculated ex-ante. Hence, the value of $PE_{flare,y}$ is zero.

However, to calculate the emission reduction ex-post, the following equation from the methodological tool "Project emissions from flaring" v. 2.0.0 will be applied:

$$PE_{flare,y} = GWP_{CH_4} \cdot \sum_{m=1}^{525600} F_{CH4,RG,m} \cdot \left(1 - \eta_{flare,m}\right) \cdot 10^{-3} \quad (4)$$

Where:

$PE_{flare,y}$	Project emissions covered by methodology AMS III.D in year y (tCO_2e)
GWP_{CH_4}	Global Warming Potential for CH4 (21 tCO_2e/tCH_4)
$F_{CH4,RG,m}$	Mass flow of methane in the residual gas in the minute m (kg)
$\eta_{flare,m}$	Flare efficiency in minute m

The flare efficiency will be determined in accordance to the tool:

Open flare
In the case of open flares, the flare efficiency in the minute m ($\eta_{flare,m}$) is 50% when the flame is detected in the minute m ($Flame_m$), otherwise $\eta_{flare,m}$ is 0%.

For an enclosed flare, option A from the tool (Default Value) will be applied:

The flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating:

1. The temperature of the flare ($T_{EG,m}$) and the flow rate of the residual gas to the flare ($F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m; and
2. The flame is detected in minute m ($Flame_m$).

For enclosed flares that are defined as low height flares, the flare efficiency in the minute m $\eta_{flare,m}$) shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in Options A or B. For example, the default value applied should be 80%, rather than 90%, and if for example the measured value was 99%, then the value to be used shall correspond to 89%.

2.3 CO_2 emissions from the use of electricity or fossil fuel for the operation of the installed facilities in the year y ($PE_{power,y}$)

According to paragraph 15 of the applied methodology, AMS-I.D "Grid connected renewable electricity generation" shall be used for the calculation of project emissions from electricity and the emission factor for the fossil fuel shall be used for the calculation of project emissions due to the use of fossil fuel:

$$PE_{power,y} = PE_{el,y} + PE_{FC,j,y} \quad (5)$$

Where:

$PE_{power,y}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y (tCO_2e)
$PE_{el,y}$	Project emissions due to the use of electricity (tCO_2e).
$PE_{FC,j,y}$	Project emissions due to the use of fossil fuel (tCO_2e).

Generally, the electricity for the operation of the installed facilities should be generated by the facilities themselves based on animal manure. In this case, this part of the project emissions is zero. If the aminal farm still need buy electricity from the local power grid (Central China Power Grid), the resulting emissions can be calculated based on the following equation as per the referenced "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

$$PE_{el,y} = EC_{PJ,y} \cdot EF_{CO_2} \cdot (1 + TDL_y) \quad (6)$$

Where:

$PE_{power,y}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year y (tCO_2e)
$EC_{PJ,y}$	Net quantity of electricity consumed by the project in farm p, year y (MWh)
EF_{CO_2}	Emission factor of Central China Power Grid (tCO_2e/MWh)
TDL_y	Average technical transmission and distribution losses for providing year *y*. In line with the applied tool, a default value of 20% will be applied.

The project emissions due to the use of fossil fuel will be calculated as per the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*, using the amount of fossil fuel combusted and its emission factor. Since there are no local values available in China, the CPAs will use IPCC default values;

$$PE_{FC,y} = \sum_i FC_{i,y} \cdot COEF_{i,y} \quad (7)$$

Where:

$PE_{FC,j,y}$	Project emissions due to the use of fossil fuel (tCO_2e).
$FC_{i,j,y}$	Is the quantity of fuel type i combusted during the year y (mass or volume unit/yr);
$COEF_{i,y}$	Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit)
i	Are the fuel types combusted during the year y

with

$$COEF_{i,y} = NCV_{i,y} \cdot EF_{CO_2,i,y} \quad (8)$$

Where:

$COEF_{i,y}$	Is the CO_2 emission coefficient of fuel type i in year y (tCO_2/mass or volume unit)
$NCV_{i,y}$	Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit)
$EF_{CO_2,i,y}$	Is the weighted average CO2 emission factor of fuel type i in year y (tCO_2/GJ)
i	Are the fuel types combusted in process j during the year y

2.4 CO_2 emissions from incremental transportation distances

As per the relevant paragraph in AMS III.D, Project emissions due to incremental transport distances are calculated based on the incremental distances between:

(a) The collection points of manure and the compost treatment site as compared to the baseline solid waste disposal site or manure treatment site;
(b) When applicable, the collection points of manure and treatment site as compared to baseline wastewater treatment site;
(c) Treatment sites and the sites for soil application, landfilling and further treatment of the produced compost.

The project emissions due to incremental transportation distances will be calculated following methodology AMS III.AO[4]:

$$PE_{transp,y} = \frac{Q_y}{CT_y} \cdot DAF_w \cdot EF_{CO_2,transport} + \frac{Q_{res-waste,y}}{CT_{res-waste,y}} \cdot DAF_{res-waste} \cdot EF_{CO_2,transport} \quad (9)$$

Where:

$PE_{transp,y}$	Emissions from incremental transportation in the year y (tCO_2e)
Q_y	Quantity of raw manure transported the year *y* (tonnes)
CT_y	Average truck capacity for transportation (tonnes/truck)
DAF_w	Average incremental distance for manure transportation (km/truck)
$EF_{CO_{2,transport}}$	CO2 emission factor from fuel use due to transportation (kgCO2/km, default values 245 gCO2/km for light vehicles and 129 gCO2/km for heavy vehicles as per tool "Project and leakage emissions from road transportation of freight")
$Q_{res-waste,y}$	Quantity of residual waste transported the year y (tonnes)
$CT_{res-waste,y}$	Average truck capacity for residual waste transportation (tonnes/truck)
$DAF_{res-waste}$	Average incremental distance for residual waste transportation (km/truck)

Generally, in most cases the manure will be transported through underground pipes, without fossil fuel

[4] The methodology has references to methodologies AMS III.AO and AMS III.F. Since the calculation according to AMS III.AO is the most conservative one, this method is applied.

consumption. In this case, the value of PE_{transp} is zero. In case that there is an incremental distance for manure transportation for a specific farm, the project emission will be calculation based on the equation above.

2.5 Emissions from the storage of manure before being fed into the anaerobic digester ($PE_{storage,y}$)

Project emissions on account of storage of manure before being fed into the anaerobic digester shall be accounted for if both condition (a) and condition (b) below are satisfied:

(a) The storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic digester; and
(b) The dry matter content of the manure when removed from the animal barns is less than 20%.

The following equation shall be used to calculate project emissions from manure storage:

$$PE_{storage,y} = GWP_{CH_4} \cdot D_{CH_4} \sum_{LT,l} \left[\frac{365}{AI_l} \sum_{d=1}^{AI} \left(N_{LT,y} \cdot VS_{LT,d} \cdot MS\%_l \left(1 - e^{-k(AI_i - d)}\right) \cdot MCF_l \cdot B_{0,LT} \right) \right] \quad (10)$$

Where:

$PE_{storage,y}$	Emissions from the storage of manure (tCO_2e)
GWP_{CH_4}	Global Warming Potential for CH4 (21)
D_{CH_4}	CH_4 density (0.00067 t/m^3 at room temperature (20 °C) and 1 atm pressure)
AI_l	Annual average interval between manure collection and delivery for treatment at a given storage device l (days)
$N_{LT,y}$	Annual average number of animals of type "LT" in year "y" (numbers)
$VS_{LT,d}$	Amount of volatile solid production by type of animal LT in a day (kg VS/head/d)
$MS\%_l$	Fraction of volatile solids (%) handled by storage device l
k	Degradation rate constant (0.069)
d	Days for which cumulative methane emissions are calculated; d can vary from 1 to 45 and to be run from 1 up to AIl
MCF_l	Annual methane conversion factor for the project manure storage device l from Table 10.17, Chapter 10, Volume 4 (%)
$B_{0,LT}$	Maximum methane producing capacity for the volatile solid generated for animal type LT (m^3 $CH_4(kgdm)^{-1}$)

For each farm included under the proposed POA, the storage of manure before being fed into the anaerobic digester may be different. In case both conditon(a) and (b) mentioned above are satified for a specific farm, the project emissions will be calculate by the equation above. If not, the value of $PE_{storage,y}$ is zero.

3. Leakage

According to paragraph 17 of the applied methodology, for AMS-III.D, no leakage calculation is required.

In addition to paragraph 17, paragraph 27 of the methodology requires to justify the destruction of replaced equipment in case the project activity involves replacement of equipment that might also be transferred outside the project boundary and cause leakage emissions.

Although this project activity does replace existing manure management systems, these systems (e.g. open lagoon) cannot be transferred to other locations outside the project boundary (ref. eligibility criteria 5.4.1). The facilities used to store and treat animal manure are not mobile equipment, but stationary installations. Thus, the leakage for this PoA is considered 0.

4. Emission reduction

Based on baseline emissions and project emissions, the annual emission reduction can be calculated:

$$ER_{III.D,y} = BE_{III.D,y} - PE_{III.D,y} \quad (11)$$

The emission reductions achieved by the project activity will be determined ex post through direct measurement of the amount of methane fuelled, flared or gainfully used. It is likely that the project activity involves manure treatment steps with higher methane conversion factors (MCF) than the MCF for the manure treatment systems used in the baseline situation, therefore the emission reductions achieved by the project activity is limited to the ex post calculated baseline emissions minus project emissions using the actual monitored data for the project activity. The emission reductions achieved in any year are the lower value of the following:

$$ER_{III.D,y,ex\ post} = min\left[\left(BE_{III.D,y,ex\ post} - PE_{III.D,y,ex\ post}\right), \left(MD_y - PE_{power,y,ex\ post}\right)\right] \quad (12)$$

Where:

$ER_{III.D,y,ex\ post}$	Emission reductions achieved by the project activity based on monitored values for year y (tCO_2e)
$BE_{III.D,y,ex\ post}$	Baseline emissions calculated using equation 2 (for projects using option in paragraph 9 (a))[5] using ex post monitored values of $N_{LT,y}$ and if applicable $VS_{LT,y}$
$PE_{III.D,y,ex\ post}$	Project emissions calculated using equation 10 using ex post monitored values of $N_{LT,y}$, $MS\%_y$, and if applicable $VS_{LT,y}$
MD_y	Methane captured and used gainfully by the project activity in year y (tCO_2e).
$PE_{powery,ex\ post}$	Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year y (tCO_2e)

The value MD_y will be determined according to the following equation;

$$MD_y = BG_{Burnt,y} \cdot w_{CH_4} \cdot D_{CH_4} \cdot FE \cdot GWP_{CH_4} \quad (13)$$

[5] of methodology AMS III.D, version 18.

Where:

MD_y	Methane captured and used gainfully by the project activity in year y (tCO_2e).
$BG_{Burnt,y}$	Biogas flared or combusted in year y (m^3)
w_{CH_4}	Methane content in biogas in the year y (volume fraction). A default value of 60% is applied as per the methodology.
D_{CH_4}	CH_4 density (0.00067 t/m^3 at room temperature (20 °C) and 1 atm pressure)
FE	Flare efficiency in year y (fraction). Default values as per section E.7.1 will be used.
GWP_{CH_4}	Global Warming Potential for CH4 (21)

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Data / Parameter:	EF_{OM}
Data unit:	tCO_2/MWh
Description:	Operating Margin Emission Factor of Central China Power Grid
Source of data used:	2011 Baseline Emission Factors for Regional Power Grids in China, Published by China's DNA, at http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf Baseline Emission Factors for Power Grids in China, sourced from China Energy Statistical Yearbook (2008-2010), China Electric Power Yearbook(2008-20010)and 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	1.0297
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according to the updated Baseline Emission Factors for Power Grids in China based on " Tool to calculate the emission factor for an electricity system" and EB guidance
Any comment:	

Data / Parameter:	EF_{BM}
Data unit:	tCO_2/MWh
Description:	Build Margin Emission Factor of Central China Power Grid
Source of data used:	2011 Baseline Emission Factors for Regional Power Grids in China, Published by China's DNA, at: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf Baseline Emission Factors for Power Grids in China, sourced from China Energy Statistical Yearbook (2008-2010), China Electric Power Yearbook(2008-20010） and 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.4191
Justification of the choice of data or description of	Calculated according to the updated Baseline Emission Factors for Power Grids in China based on "Tool to calculate the emission factor for an electricity system" and EB guidance

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$VS_{LT,y}$**
Data unit:	kg/head/year
Description:	Volatile solids excreted by animals per year per head
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10A-4,10A-5, 10A-7, 10A-8, 10A-9
Value applied:	Non-Developed Countries: Breeding Swine: 109.5, Market Swine: 109.5, Dairy cow: 1,022, Other cow: 839.5, Broilers: 7.3; Layers: 7.3 Developed Countries: Breeding Swine: 167.9, Market Swine: 109.5, Dairy cow: 1,861.5, Other cow: 949, Broilers: 131.4; Layers: 142.35
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value above is the default value for the generic livestock of non-developed country. It will be adjusted for the farm involving the generic livestock from the developed country.
Any comment:	

Data / Parameter:	**$VS_{LT,d}$**
Data unit:	kg/head/day
Description:	Volatile solids excreted by animals per day per head
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10A-4,10A-5, 10A-7, 10A-8, 10A-9
Value applied:	Non-Developed Countries: Breeding Swine: 0.3, Market Swine: 0.3, Dairy cow: 2.8, Other cow: 2.3, Broilers: 0.02; Layers: 0.02 Developed Countries: Breeding Swine: 0.46, Market Swine: 0.3, Dairy cow: 5.1, Other cow: 2.6, Broilers: 0. 36; Layers: 0.39
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value above is the default value for the generic livestock of non-developed country. It will be adjusted for the farm involving the generic livestock from the developed country.
Any comment:	

Data / Parameter:	**B_0**
Data unit:	m^3/kg of VS
Description:	maximum CH_4 producing capacity of manure produced by an animal
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10A-4,10A-5, 10A-7, 10A-8, 10A-9
Value applied:	Non-Developed Countries: Breeding Swine: 0.29, Market Swine: 0.29, Dairy

	cow: 0.24, Other cow: 0.18, Broilers: 0.24; Layers: 0.24 Developed Countries: Breeding Swine: 0. 45, Market Swine: 0. 45, Dairy cow: 0.13, Other cow: 0.1, Broilers: 0.36; Layers: 0. 39
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value above is the default value for the generic livestock of non-developed country. It will be adjusted for the farm involving the generic livestock from the developed country.
Any comment:	

Data / Parameter:	$MS\%_{BL,j}$
Data unit:	%
Description:	Fraction of manure handled in baseline animal manure management system "j"
Source of data used:	Project owner
Value applied:	100%
Justification of the choice of data or description of measurement methods and procedures actually applied :	All manure from farm was treated in the anaerobic lagoon in the baseline scenario and will be treated in the project digester.
Any comment:	

Data / Parameter:	TDL_y
Data unit:	%
Description:	Average technical transmission and distribution losses for providing year *y*
Source of data to be used:	As per the *Tool to calculate baseline, project and/or leakage emissions from electricity consumption*, a default value of 20% is used as the value is used to calculate project emissions.
Value applied:	20
Description of measurement methods and procedures to be applied:	The most recent value from any update version of the *Tool to calculate baseline, project and/or leakage emissions from electricity consumption* will be used.
QA/QC procedures to be applied:	-
Any comment:	

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each SSC-CPA[6]:
(Copy this table for each data and parameter)

Data / Parameter:	$BG_{burnt,y}$
Data unit:	nm^3
Description:	The total amount of biogas supplied to the boiler, generator, flare and/or households.
Source of data to be used:	Flow meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Annually, based on continuous flow measurement with accumulated volume recording (e.g. hourly/daily accumulated reading). If the biogas flared and fuelled (or utilized) is continuously monitored separately, the two fractions can be added to determine the biogas recovered. In that case, recovered biogas need not be monitored separately.
QA/QC procedures to be applied:	Flow meters will undergo maintenance/calibration subject to appropriate industry standard by qualified entity. The systems will be built and operated to ensure that there is no air ingress into the biogas pipeline.
Any comment:	As per the methodology, a default methane concentration of 60% is applied. Therefore, the methane concentration of the biogas will not be monitored. To monitor the biogas flow, biogas flow meters will be employed that measure flow, pressure and temperature and displays or outputs the normalised flow of biogas, therefore, there is no need for separate monitoring of pressure and temperature of the biogas.

Data / Parameter:	$F_{CH4,RG,m}$
Data unit:	kg
Description:	Mass flow of methane in the residual gas on a dry basis at reference conditions in the minute m (kg)
Source of data to be used:	Calculated according to the applied methodology.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The methodology already provides procedures to calculate the mass flow of methane in the residual gas stream. As per the methodology, the gas flow is measured. Applying the default concentration of 60% as per the methodology and the density of methane as per the methodology, the mass flow of methane is

[6] Note that depending on the specific technical solution of the CPAs, not all parameters listed below are applicable to each CPA. The CPA-DDs will only list the relevant monitoring parameters.

	calculated.
QA/QC procedures to be applied:	Flow meters will undergo maintenance/calibration subject to appropriate industry standard by qualified entity. The systems will be built and operated to ensure that there is no air ingress into the biogas pipeline.
Any comment:	As per the methodology, a default methane concentration of 60% is applied. Therefore, the methane concentration of the biogas will not be monitored.

Data / Parameter:	$\eta_{flare,m}$
Data unit:	%
Description:	Flare efficiency in minute m (fraction)
Source of data to be used:	Default Values
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	As per the methodology, 100% will be assumed for the efficiency for the share of biogas that is used for energy purposes. In case a flare is installed at the specific CPA, it will be determined as per the provisions in the methodological tool "Project emissions from flaring": Open flare In the case of open flares, the flare efficiency in the minute m ($\eta_{flare,m}$) is 50% when the flame is detected in the minute m ($Flame_m$), otherwise $\eta_{flare,m}$ is 0%. For an enclosed flare, option A from the tool (Default Value) will be applied: The flare efficiency for the minute m ($\eta_{flare,m}$) is 90% when the following two conditions are met to demonstrate that the flare is operating: 1. The temperature of the flare ($T_{EG,m}$) and the flow rate of the residual gas to the flare is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m; and 2. The flame is detected in minute m ($Flame_m$). For enclosed flares that are defined as low height flares, the flare efficiency in the minute m $\eta_{flare,m}$) shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in Options A or B. For example, the default value applied should be 80%, rather than 90%, and if for example the measured value was 99%, then the value to be used shall correspond to 89%.
QA/QC procedures to be applied:	The efficiency will be determined as per the methodological tool "Project emissions from flaring".
Any comment:	This is only applicable to CPAs with an installed flare.

Data / Parameter:	$T_{EG,m}$

Data unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare in minute m
Source of data to be used:	Measurements by project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measure the temperature of the exhaust gas in the flare by an appropriate temperature measurement equipment. Measurements outside the operational temperature specified by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Flare manufacturers will provide suitable monitoring ports for the monitoring of the temperature of the flare. These would normally be expected to be in the middle third of the flare. Where more than one temperature port is fitted to the flare, the flare manufacturer will provide written instructions detailing the conditions under which each location shall be used and the port most suitable for monitoring the operation of the flare according to manufacturers specifications for temperature.
QA/QC procedures to be applied:	Temperature measurement equipment will be replaced or calibrated in accordance with their maintenance schedule.
Any comment:	Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. These events should be noted in the site records along with any corrective action that was implemented to correct the issue. Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met

Data / Parameter:	$Flame_m$
Data unit:	Flame on or Flame off
Description:	Flame detection of flare in the minute m
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measure using a fixed installation optical flame detector: Ultra Violet detector or Infra Red or both. Once per minute. Detection of flame recorded as a minute that the flame was on, otherwise recorded as a minute that the flame was off
QA/QC procedures to be applied:	Equipment shall be maintained and calibrated in accordance with manufacturer's recommendations.
Any comment:	Applicable to all flares

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	Net electricity consumed by the project in farm p.
Source of data to be used:	Electricity meter, onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Each farm will individually monitor the electricity imports from the grid to operate the project and the electricity generated and delivered to the farm. The difference of these two figures is the net electricity consumed. Data will be reported monthly.
QA/QC procedures to be applied:	Electricity will be subject to regular maintenance and testing regime to ensure accuracy once a year.
Any comment:	

Data / Parameter:	$FC_{i,j,y}$
Data unit:	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description:	Quantity of fuel type i combusted in process j during the year y
Source of data to be used:	Continuously onsite measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
QA/QC procedures to be applied:	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ per mass or volume unit (e.g. GJ/m^3, GJ/ton)
Description:	Weighted average net calorific value of fuel type i in year y
Source of data to be used:	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	As per the utilized fuel.
Description of measurement methods and procedures to be applied:	The data will be cross-checked with the latest publications of IPCC.
QA/QC procedures to be applied:	The data will be cross-checked with the latest publications of IPCC.
Any comment:	

Data / Parameter:	$EF_{CO_2,i,y}$
Data unit:	tCO_2/GJ
Description:	Weighted average CO_2 emission factor of fuel type i in year y
Source of data to be used:	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	As per the utilized fuel.
Description of measurement methods and procedures to be applied:	The data will be crosschecked with the latest publications of IPCC.
QA/QC procedures to be applied:	The data will be crosschecked with the latest publications of IPCC.
Any comment:	

Data / Parameter:	$\mathbf{N_{da,y}}$
Data unit:	Number
Description:	Number of days animal is alive in the farm in the year y (number)
Source of data to be used:	Farm owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	

Description of measurement methods and procedures to be applied:	Livestock number will be monitored and reported monthly.
QA/QC procedures to be applied:	The value will be determined based on monthly counting records to be provided by the farm owner. They can be crosschecked with sales records. Different types of livestock for which different default values are applied will be listed on these records separately.
Any comment:	

Data / Parameter:	$N_{p,y}$
Data unit:	Number
Description:	Number of animals produced annually of type LT for the year y (number)
Source of data to be used:	Farm owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Livestock number will be monitored and reported monthly.
QA/QC procedures to be applied:	The value will be determined based on monthly counting records to be provided by the farm owner. They can be crosschecked with sales records. Different types of livestock for which different default values are applied will be listed on these records separately.
Any comment:	Archive electronically during the crediting period plus 2 years.

Data / Parameter:	MCF_j
Data unit:	fraction
Description:	Annual methane conversion factor (MCF) for the baseline animal manure management system j
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10.17
Value of data applied for the purpose of calculating expected emission reductions in section B.5	

No.	City	Annual average temperature	MCF
1.	Mianyang	17.0	75
2.	Guang'an	17.9	76
3.	Suining	17.4	76
4.	Dazhou	17.7	76
5.	Ziyang	17.8	76
6.	Meishan	17.8	76
7.	Neijiang	17.9	76

	8.	Leshan	18.0	76	
	9.	Zigong	18.6	77	
	10.	Yibin	18.9	77	
	11.	Luzhou	178.1	76	
	12.	Chengdu	16.8	75	
	13.	Panzhihua	21.3	78	
	14.	Deyang	16.8	75	
	15.	Guangyuan	16.6	75	
	16.	Nanchong	17.9	76	
	17.	Yaan	16.8	75	
	18.	Bazhou	17.0	75	
	19.	Maerkang	9.5	66	
	20.	Kangding	8.0	66	
	21.	Xichang	17.8	76	

Description of measurement methods and procedures to be applied:	The mean annual temperature will be achieved from official sources (e g. Sichuan Statistic Year Book) and MCF_j will be retrieved from the IPCC Guidelines as listed above.
QA/QC procedures to be applied:	Will be checked by the C/ME directly.
Any comment:	

Data / Parameter:	$MS\%_l$
Data unit:	%
Description:	Fraction of volatile solids (%) handled by storage device l
Source of data used:	Laboratory analysis
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	In case manure is stored for longer than 24 hours after removal from the barns and before feeding into the digester, this value will be monitored monthly.
QA/QC procedures to be applied:	Will be monitored monthly in case the manure is stored for more than 24 hours between removal from the barns and feeding into the digester.
Any comment:	

Data / Parameter:	$\mathbf{nd_y}$
Data unit:	Days
Description:	Number of days that the animal manure management system was operational
Source of data used:	Farm records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	

Description of measurement methods and procedures to be applied:	Annually, based on daily records and monthly aggregation If any farm has no operations on a given day it needs to be documented (e.g. logbook) and taken into account for the calculation of $BE_{ex\text{-}post}$
QA/QC procedures to be applied:	All data will be electronically archived for a period of two years from the end of the crediting period.
Any comment:	

Data / Parameter:	**AI_l**
Data unit:	days
Description:	Annual average interval between manure collection and delivery for treatment at digester
Source of data to be used:	Regular record by Farm owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Annually, based on monthly records
Description of measurement methods and procedures to be applied:	In case, the storage time of the manure after removal from the animal barns, including transportation, exceeds 24 hours before being fed into the anaerobic digester, and the dry matter content of the manure when removed from the animal barns is less than 20%, *AI* shall be recorded. Annual amount based on record of *AI*.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Q_y
Data unit:	tons
Description:	Quantity of raw manure transported the year *y*
Source of data to be used:	Onsite data sheets recorded monthly using weigh bridge.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Onsite data sheets recorded monthly using weigh bridge. Weigh bridge will be subject to periodic calibration.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	CT_y

Data unit:	tons/truck
Description:	Average truck capacity for transportation
Source of data to be used:	On site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	On site measurement using weigh bridges.
QA/QC procedures to be applied:	Onsite data sheets using weigh bridge. Weigh bridge will be subject to periodic calibration.
Any comment:	

Data / Parameter:	DAF_w
Data unit:	km/truck
Description:	Average incremental distance for manure transportation
Source of data to be used:	On site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Onsite measurement by project owner.
QA/QC procedures to be applied:	The distance will be cross-checked with publically available sources.
Any comment:	

Data / Parameter:	$Q_{res-waste,y}$
Data unit:	tons
Description:	Quantity of residual waste transported the year *y*
Source of data to be used:	Onsite data sheets recorded monthly using weigh bridge.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods	Onsite data sheets recorded monthly using weigh bridge. Weigh bridge will be subject to periodic calibration.

and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$CT_{res-waste,y}$
Data unit:	tons/truck
Description:	Average truck capacity for residual waste transportation
Source of data to be used:	On site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	On site measurement using weigh bridges.
QA/QC procedures to be applied:	Onsite data sheets using weigh bridge. Weigh bridge will be subject to periodic calibration.
Any comment:	

Data / Parameter:	$DAF_{res-waste}$
Data unit:	km/truck
Description:	Average incremental distance for manure transportation
Source of data to be used:	On site measurement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Onsite measurement by project owner.
QA/QC procedures to be applied:	The distance will be cross-checked with publically available sources.
Any comment:	

Data / Parameter:	$EF_{CO_2,transport}$
Data unit:	$kgCO_2/t$ km
Description:	CO_2 emission factor from fuel use due to transportation
Source of data used:	Methodological tool "Project and leakage emissions from road transportation of freight"

Value of data applied for the purpose of calculating expected emission reductions in section B.5	Light vehicles: 0.245 $kgCO_2/t$ km $*DAF_w$ Heavy vehicles: 0.129 $kgCO_2/t$ km $*DAF_w$
Description of measurement methods and procedures to be applied:	The appropriate data will be reviewed annually.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Proper soil application of residual waste
Data unit:	
Description:	The proper application of residual waste
Source of data used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The aerobic soil application of digester effluent shall be evaluated against a description of aerobic procedures by the Sichuan Biogas Association. In case the applied measures of effluent treatment do not meet the standard, project emissions shall be calculated according to the methodology.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	Genetic source of the production operations livestock
Data unit:	
Description:	Genetic source of the production operations livestock
Source of data used:	Farm-Specific suitable evidence
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	In case the CPA applies developed country VS values, the genetic origin of the animals shall be monitored. The developed country values are only applicable if the genetic origin of the animals is an Annex I party.
QA/QC procedures to be applied:	

Data / Parameter:	The formulated feed rations (FFR)

Data unit:	
Description:	The formulated feed rations (FFR)
Source of data used:	Farm-Specific suitable evidence
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	In case the CPA applies developed country VS values, the FFR shall be monitored. The developed country values are only applicable if the farm uses formulated feed rations (FFR) which are optimized for the various animal(s), stage of growth, category, weight gain/productivity and/or genetics;
QA/QC procedures to be applied:	

E.7.2. Description of the monitoring plan for a SSC-CPA:

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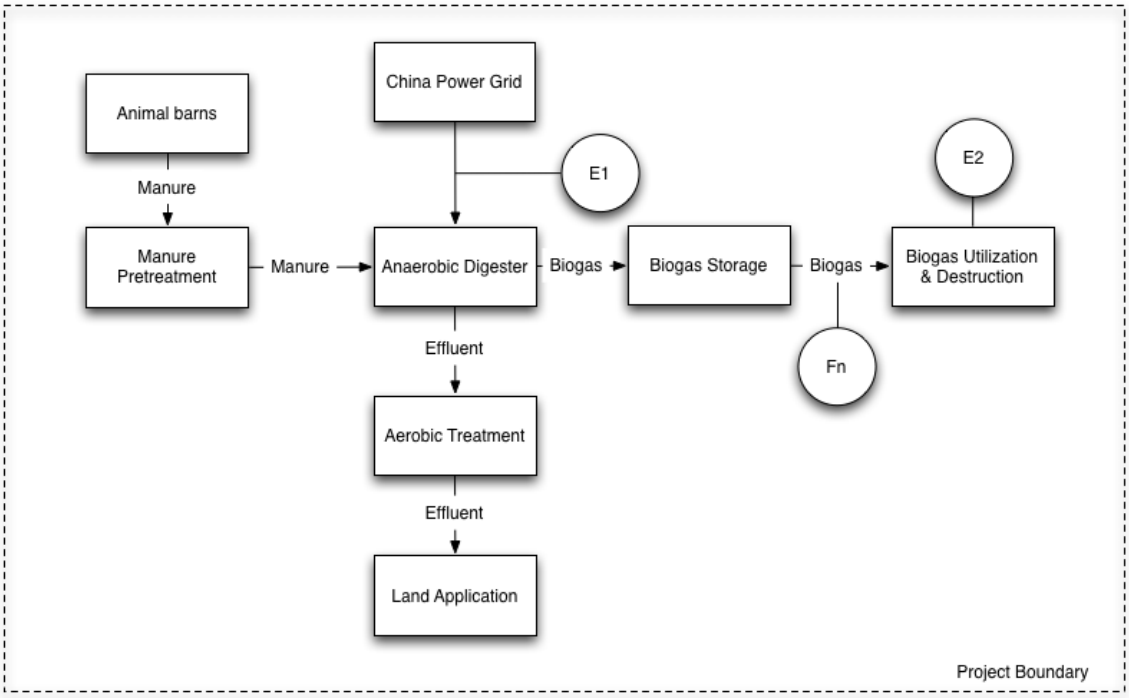
Organizational setup

The C/ME will be responsible for the management of the CPAs. The conduction of the monitoring and collection of the data will be forwarded to the C/ME from the included farms. The farm shall establish a specific department to take care of the monitoring work. The monitoring staff will be trained by the C/ME and outsourced experts.

Data monitored

Each individual farm will be responsible for conducting monitoring work under the instruction of the C/ME. The following chart shows the meters that are physical installed at the project site. The meters E1 and E2 measure the electricity that is imported from the grid to operate the project and that is generated and supplied to the farm by the generator.

The meters Fn measure the relevant gas flows: and Fn measure the gas flow to the different destruction equipment (i.e. boiler, genset, flare and/or households). Note that in the following figure, Fn can represent several meters, as each gas stream is monitored individually.



(1) Biogas production: The project participants will monitor biogas destroyed by the installed equipment, i.e. boiler, gas engine, local gas grid and/or flare. To monitor the biogas flows, either included meters that will display the flow under norm conditions will be used or temperature and pressure will be monitored at the same measuring points in addition.
(2) Biogas utilization system: the electricity generator will be the main utilization system for most of the CPAs. For the emission reduction of this proponent, electricity imported from the grid for project operation and electricity generated by the project will be measured continuously with energy meters. The electricity meters will be in compliance with relevant standards in China and calibrated periodically by an officially accredited entity. The invoices of electricity purchases verify the electricity consumed by each biogas plant under the CPA of the PoA.
(3) Livestock population: the responsibility of monitoring and recording this parameter relies on the farms under the CPA. The parameters include the method and frequency to monitor the livestock population, slaughter and sale, feed, percentage of manure fed to biogas digester.
(4) Land application: Training on the biogas residual system is provided by the C/ME and outsourced experts. The training imparts how-how to treat the biogas residual aerobically.
(5) Transportation: The parameters related to the transportation of manure, i.e. the distance and the total mass transported.
(6) Other parameters: The parameters which are taken from published sources such as IPCC 2006 Guidelines should be updated according to the latest available public data source.

All meters used in the proposed project should comply with national standards and manufacture's recommendations including precision requirements and calibration. All the equipment used should be serviced and maintained in accordance with the manufacturers' instructions.

Data management

All paper-based information and the electronic database will be submitted to the C/ME by the farm owner periodically and be stored by the C/ME during the crediting period plus 2 years and provided to the DOE.

Due to the targeted number of CPAs in Sichuan province, suitable meters are planned to be kept available to replace broken equipment quickly. However, in cases where no data is monitored for a certain period of time, no CERs shall be claimed for that period.

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

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Date of completion of the application of the baseline study and monitoring methodology: 11/12/2012.

Name of the responsible company and person:

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UPM Umwelt-Projekt-Management GmbH is a project participant of this PoA.

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

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Annex 2

The proposed PoA is not supported by any public funding.

Annex 3

BASELINE INFORMATION

1. Average annual temperatures (2009) ˚C)[7]

No.	City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
1	Mianyang	6.0	11.2	13.0	17.8	21.4	25.0	25.3	25.3	23.0	17.6	11.0	7.7	17.0
2	Guang'an	6.5	11.4	13.5	18.2	21.0	24.7	27.6	27.0	25.5	18.6	11.6	8.7	17.9
3	Suining	6.4	11.3	13.7	18.0	21.2	24.3	26.7	25.8	24.4	17.9	11.0	8.5	17.4
4	Dazhou	6.5	10.8	13.1	17.9	21.0	25.3	28.0	27.4	24.7	18.9	10.8	8.3	17.7
5	Ziyang	6.7	11.9	14.0	18.6	22.3	25.1	25.9	25.9	23.9	18.4	11.6	8.7	17.8
6	Meishan	6.7	11.9	13.8	18.7	22.3	25.4	25.9	26.2	23.8	18.6	11.5	8.7	17.8
7	Neijiang	7.0	12.2	14.1	18.6	21.7	24.5	26.4	26.2	24.7	18.6	11.8	8.9	17.9
8	Leshan	7.3	12.6	14.2	18.9	21.9	25.1	25.7	26.1	23.8	18.6	12.2	9.4	18.0
9	Zigong	7.8	13.3	15.0	19.6	23.3	25.2	26.5	26.6	25.2	19.3	12.8	9.7	18.6
10	Yibin	8.2	13.8	15.0	19.8	22.5	25.6	27.0	26.8	25.1	19.5	13.2	10.3	18.9
11	Luzhou	7.4	13.2	14.4	18.7	21.2	24.2	26.6	26.5	24.9	18.7	12.2	9.4	18.1
12	Chengdu	5.7	10.8	12.5	17.5	21.1	24.6	24.9	25.0	22.7	17.7	10.7	7.9	16.8
13	Panzhihua	12.2	18.7	21.4	24.2	27.0	25.9	26.1	24.6	24.7	21.7	15.2	13.4	21.3
14	Deyang	5.6	11.0	12.6	17.8	21.4	24.8	25.1	25.1	22.6	17.2	10.6	7.4	16.8
15	Guangyuan	5.3	10.4	12.8	17.2	20.3	24.9	25.9	25.1	22.3	17.4	10.0	7.1	16.6
16	Nanchong	6.6	11.2	13.8	18.2	21.4	24.9	27.4	26.7	25.3	18.7	11.6	9.0	17.9
17	Yaan	6.5	11.2	12.9	17.5	20.7	24.5	24.9	24.8	22.6	17.4	11.0	8.0	16.8
18	Bazhong	5.9	10.3	12.6	17.3	20.4	24.5	26.9	26.1	24.0	18.2	10.2	7.9	17.0
19	Maerkang	0.5	5.2	7.6	10.9	14.0	14.9	17.2	16.0	15.3	9.6	3.5	-0.3	9.5
20	Kangding	-1.8	3.9	4.8	8.0	11.0	13.5	15.8	15.7	14.5	8.5	2.9	-0.3	8.0
21	Xichang	9.3	16.5	17.6	18.1	21.9	21.7	23.0	22.5	22.5	18.1	11.9	10.5	17.8

[7] Sichuan Statistical Yearbook 2010, Page 202

2. **Calculation of the CCPG Grid Emission Factor**

Where, the calclulation of $EF_{CO2,y}$ is shown as follows:

In accordance with the "Tool to calculate the emission factor for an electricity system (version 2.2.1)",the emission factor of grid electricity generation ($EF_{EG,GR,y}$) should be determined by calculating the operating margin (OM) and build margin (BM) as well as the combined margin (CM).

This PDD refers to the Operating Margin (OM) Emission Factor and the Build Margin (BM) Emission Factor published by the Chinese DNA on 20th Oct 2010, which is publicly available at this website:

http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf

The steps of calculating the emission factor are stated as follows. All the data quoted in the calculation process are presented in Annex 3 of the PDD.

Step 1: Identify the relevant electric system

The Chinese DNA has published a delineation of the project electricity system and connected electricity systems, according to the "Tool to calculate the emission factor for an electricity system (Version 2.2.1)". These delineations can be used. The electricity generated from the proposed project is supplied to the Central China Power Grid (CCPG). The spatial extension of the CCPG comprises all power plants that are physically connected to it, which covers Henan province, Hubei province, Hunan province, Jiangxi province, **Sichuan province** and the municipality of Chongqing.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

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

In the proposed project, only grid power plants are included in the calculation. So the Option I is chosen.

Step 3: Select a method to determine the operating margin (OM)

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

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM, or
(d) Average OM.

Any of the four methods can be used, the simple OM method (Option (a)) can only be used if low-cost/ must-run resources constitute of less than 50% of total Grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. Among the total electricity generation of the Central China Power Grid which the proposed project is connected to, the amount of low cost/must run resources accounts for 38.54% (2004), 38.18% (2005), 35.26% (2006),

35.47% (2007) and 39.27% (2008)[8], all less than 50%. Thus, the method (a) Simple OM can be used to calculate the baseline emission factor of operating margin for the proposed project.

For the simple OM, the emission factor is selected to be calculated using either of the data vintages between any of: ex-ante option or ex-post. For this PDD ex-ante option is selected, which is 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, without requirement to monitor and recalculate the emissions factor during the crediting period.

Step 4: Calculate the operating margin emission factor according to the 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_2 emissions per unit net electricity generation (tCO_2e/MWh) of all power plants serving the system, not including low cost / must run power plants / units. The three following options may be used to calculate the simple OM emission factor:

- Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
- Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

  Option B can only be used if:

  (a) The necessary data for Option A is not available; and

  (b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the Grid by these sources is known; and

  (c) Off-Grid power plants are not included in the calculation (i.e., if Option I has been chosen in

According to "Tool to calculate the emission factor for an electricity system" (version 02.2.1), Option A should be preferred and must be used if fuel consumption data is available for each power plant / unit. However, due to the necessary data, including the fuel consumption and net electricity generation of each power plant, is not available in China, Option B is adopted. Accordingly only nuclear and renewable power generation are considered as low-cost/must-run power sources and data of the quantity of electricity supplied to the Grid by these sources should be available for the calculation.

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

$$EF_{grid,OM,simple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y} \quad (3)$$

Where:

$EF_{grid,OM,simple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	The amount of fuel i (in a mass or volume unit) consumed by project electricity system in year(s) y

[8] China Electric Power Yearbook, 2005-2009

$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO_2,i,y}$	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
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	Either the 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), following the guidance on data vintage in *step 2*

The simple OM is calculated with reference to the *2011 Baseline Emission Factors for Regional Power Grids in China*[9] issued by the Chinese DNA.

Step 5: Calculate the build margin (BM) emission factor

Two options can be chosen to calculate the build margin:

Option 1: For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

In terms of vintage of data, Option 1 is chosen.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EM_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (4)$$

Where:

$EM_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)

[9] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf

$EG_{m,y}$	Net quantity of electricity generated and delivered to the Grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	Power units included in the build margin
y	Most recent historical year for which power units included in the build margin

In accordance with the "Tool to calculate the emission factor for an electricity system", the CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance of options A1, A2 or A3 under Step 4(a) *Simple OM* , using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

On account of data availability, the following adapted calculation has been approved by the CDM EB. Using this modified method, newly-built capacity is weighted by the composition of power generation technologies, and then emission factors are calculated using the efficiencies of the best available technologies.

Because capacities of technologies using coal, oil and gas can't be separated from the total thermal power generation from available statistics, the following method is used for the calculation: First, use recent one year available energy balance data and calculate percentages of CO_2 emissions of power generation using solid, liquid and gas fuel in the total CO_2 emission. Second, calculate Grid thermal power emission factor, 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 (BM) emission factor of the Grid.

The equations are as follows:

1. Calculate percentage of CO_2 emission of power generation using solid, liquid and gas fuel in the total CO_2 emission.

$$\lambda_{coal,y} = \frac{\sum_{i \in coal,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (5)$$

$$\lambda_{oil,y} = \frac{\sum_{i \in oil,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (6)$$

$$\lambda_{gas,y} = \frac{\sum_{i \in gas,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (7)$$

Where:

$F_{i,j,y}$	The fuel *i* consumed by the province *j* in the year y (in a mass or volume unit)
$EF_{CO2,i,j,y}$	The CO_2 emission coefficient (tCO_2e /MJ) of fuel *i*
$NCV_{i,y}$	Net calorific value of fuel i in year y (MJ/ a mass or volume unit） The feet *Coal, Oil* and *Gas* is for solid fuels, liquid fuels and gas fuels.

2. Calculate Grid thermal power emission factor

$$EF_{thermal} = \lambda_{coal,y} \times EF_{coal,Adv} + \lambda_{oil,y} \times EF_{oil,Adv} + \lambda_{gas,y} \times EF_{gas,Adv} \quad (8)$$

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 BM emission factor

$$EF_{grid,BM,y} = \frac{CAP_{thermal,y}}{CAP_{total,y}} \times EF_{thermal,y} \quad (9)$$

Where:

$CAP_{thermal,y}$	The newly built thermal capacity at year *y*.
$CAP_{total,y}$	Total newly built capacity at year *y*.

The build margin emissions factor ($EF_{Grid,BM,y}$) is calculated with reference to the *2011Baseline Emission Factors for Regional Power Grids in China* issued by Chinese DNA[10]

Step 6: Calculate the combined margin (CM) emissions factor

The baseline emission factor is the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$):

$$EF_{CO2} = \omega_{OM} \times EF_{grid,OM,y} + \omega_{BM} \times EF_{grid,BM,y} \quad (10)$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

Where the weight w_{OM} and w_{BM} by default, are 50% for the first crediting period.

According to the emission factor value provided by Chinese DNA:

	EF_{OM}(tCO_2/MWh)	**EF_{BM}(tCO_2/MWh)**	**$EF_{EG,GR,y}$**
CCPG	1.0297	0.4191	0.7244

[10] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf

Calculation of CO_2 Emission of Central China Power Grid in 2007

Fuel Types	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	Default Carbon content (tc/TJ)	Carbon oxidation rate (%)	Emission factor of the fuel ($kgCO_2/TJ$)	NCV (MJ/ t,m3)	CO_2 emissions (tCO_2e) L=G×J×K/100000 (mass)
		A	B	C	D	E	F	G= A+B+C +D+E+F	H	I	J	K	L=G×J /10000 (volume)
Raw coal	10^4t	2200.57	9357	34791	2683.81	1 47.7	239	**22507.89**	25.8	100	87,300	20,908	410,829,404
Clea Coal	10^4t		3.07			3.8		**6.87**	25.8	100	87,300	26,344	157,998
Other washed coal	10^4t	0.04	87.16		2.06	96.42		**185.68**	25.8	100	87,300	8,363	1,355,631
Moulded coal	10^4t						0.01	**0.01**	26.6	100	87,300	20,908	183
Coke	10^4t							**0**	29.2	100	95,700	28,435	0
Coke oven gas	10^8m^3	0.08	2.61	0.25	0.31	0.91		**4.16**	12.1	100	37,300	16,726	259,534
Other coal gas	10^8m^3	29.17	25.79		24.69		23.98	**103.63**	12.1	100	37,300	5,227	2,020,444
Crude oil	10^4t		0.43					**0.43**	20	100	71,100	41,816	12,784
Gasoline	10^4t				0.04	0.01		**0.05**	18.9	100	67,500	43,070	1,454
Diesel oil	10^4t	0.98	3.21	2.51	2.83	1.93		**11.46**	20.2	100	72,600	42,652	354,863
Fuel oil	10^4t	0.42	1.25	1.33	0.63	0.64	1.74	**6.01**	21.1	100	75,500	41,816	189,742
LPG	10^4t							**0**	17.2	100	61,600	50,179	0
Refinery gas	10^4t	1.43	10.01	0.97	0.7			**13.11**	15.7	100	48,200	46,055	291,022
Natural gas	10^8m^3		0.12	0.18		0.2	1.87	**2.37**	15.3	100	54,300	38,931	501,007
Other petroleum production	10^4t							**0**	20	100	75,500	41,816	0
Other coke production	10^4t							**0**	25.8	100	95,700	28,435	0
Other fuel	10^4t	23.43	63.65	35.95	29.46	23.21		**175.7**	0	0	0	0	0
												Sum	**415,9 4,066**

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The thermal power generation of the CCPG in 2007

Provinces	Electricity generation (10^8kWh)	Electricity generation (Wh)	Self-consumption by the gird (%)	Electricity supply of the Grid (MWh)
Jiangxi	42	42,100,000	7.72	38,849,8
Henan	173	177,300,000	7.55	163,913,850
Hubei	609	60,900,000	6.69	5,825,7 0
Hunan	542	54,200,000	7.18	50,308,440
Chongqing	288	28,800,000	9.2	26,150,400
Sichuan	451	45,100,000	.68	4 ,185,3
Total				**377, 33,680**

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China Electricity Yearbook 2008

OM of Central China Power Grid in 2007

Electricity imported from Northwest Power Grid (MWh)	A	3,005,400
OM of Northwest Power Grid	B	1.01129
Emission of Central China Power Grid (tCO_2)	C=415,974,066+A*B	419,013,395
Total electricity supply of Central China Power Grid	D=377,233,680+3,005,400	380,239,080
$EF_{OM,2007}$ (tCO_2/MWh)	E=C/D	**1.10197**

Calculation of CO_2 Emission of Central China Power Grid in 2008

Fuel Types	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	Default Carbon content (tc/TJ)	Carbon oxidation rate (%)	Emission factor of the fuel ($kgCO_2/TJ$)	NCV (MJ/t,m3)	CO_2 emissions (tCO_2e) L=G×J×K/10 0000 (mass)
		A	B	C	D	E	F	G= A+B+C +D+E F	H	I	J	K	L=G×J×K/10 000 (vo ume)
Raw oal	10^4t	2137.08	9480.74	2852.29	2620.44	1421.42	2727.61	21239.58	25.8	100	87,300	20,908	387,679,342
Clean Coal	10^4t		1.68			3.27		4.95	25.8	100	87,300	26,344	113,842
Other wash d coal	10^4t	0.04	80.54		2.06	101.75		184.39	25.8	100	87,300	8,363	1,346,213
Moulded coal	10^4t				6.12		0.01	6.13	26.6	100	87,300	20,908	111,889
Coke	10^4t		0.78		0.92			1.7	29.2	100	95,700	28,435	46,261
Coke oven gas	10^8m^3	0.1	4.19	0.37	0.24	6.66	0.01	11.57	12.1	100	37,300	16,726	721,829
Other coal gas	10^8m^3	23.67	41.36		3.31	0.37	0.01	68.72	12.1	100	37,300	5,227	1,339,814
Crude oil	10^4t		0.17					0.17	20	100	71,100	41,816	5,054
Gasoline	10^4t							0	18.9	100	67,500	43,070	0
Diesel oil	10^4t	0.88	7.02	2.82	3.41	1.59		15.72	20.2	100	72,600	42,652	486,775
Fuel oil	10^4t	0.07	1.45		1.29		3.14	5.95	21.1	100	75,500	41,816	187,848
LPG	10^4t							0	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.21	3.91	2.78	0.71		0.01	7.62	15.7	100	48,200	46,055	169,153
Natural gas	10^8m^3		4.02	0.16		0.05	12.92	17.15	15.3	100	54,300	38,931	3,625,430
Other petroleum production	10^4t			0.59				0.59	20	100	72,200	41,816	17,813
Other coke production	10^4t						0.01	0.01	25.8	100	95,700	28,435	272
Other fuel	10^4t	18.16	68.11	62.35	11.42	64.87		224.91	0	0	0	0	0

Sum 395,851,534

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The thermal power generation of the CCPG in 2008

Provinces	Electricity generation (10^8kWh)	Electricity generation (MWh)	Self-consumption by the gird (%)	Electricity supply of the Grid (MWh)
Jiangxi	405	40,500,000	6.5	37,867,500
Henan	1890	189,000,000	7.22	17 ,354,200
Hubei	553	55,300,000	6.62	51,639,140
Hunan	537	53,700,000	6.46	50,230,980
Chongqing	286	28,600,000		28,600,000
Sichuan	401	40,100,000	10.2	36,005,790
Total				**379,697,610**

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OM of Central China Power Grid in 2008

Electricity imported from Northwest Power Grid (MWh)	A	3,144,070
OM of Northwest Power Grid	B	.98254
Emission of Central China Power Grid (tCO_2)	C=415,974,066+A*B	398,974,078
Total electricity supply of Central China Power Grid	D=377,233,680+3,005,400	382,874,880
$EF_{OM,2007}$ (tCO_2/MWh)	E=C/D	1.04205

Calculation of CO_2 Emission of Central China Power Grid in 2009

Fuel Types	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Subtotal	Default Carbon content (tc/TJ)	Carbon oxidation rate (%)	Emission factor of the fuel ($kgCO_2/TJ$)	NCV (MJ/t,m3)	CO_2 emissions (tCO_2e) L=G×J×K/10 0000 (mass)
		A	B	C	D	E	F	G= A+B+C +D+E F	H	I	J	K	L=G×J×K/10 000 (vo ume)
Raw oal	10^4t	2184.31	9339.64	2888.29	2810.69	1413.64	2817.31	21453.88	25.8	100	87,300	20,908	391,590,892
Clean Coal	10^4t		3.35					3.35	25.8	100	87,300	26,344	77,044
Other wash d coal	10^4t		59.93			136.75	97.94	294.62	25.8	100	87,300	8,363	2,150,991
Moulded coal	10^4t				2.63			2.63	26.6	100	87,300	20,908	48,005
Coke	10^4t		1.08	0.06	0.09			1.23	29.2	100	95,700	28,435	33,471
Coke oven gas	10^8m^3	0.09	6.04	1.2		1.03		8.36	12.1	100	37,300	16,726	521,564
Other coal gas	10^8m^3	30.76	56.64		4.23	7.57		99.2	12.1	100	37,300	5,227	1,934,074
Crude oil	10^4t		0.1					0.1	20	100	71,100	41,816	2,973
Gasoline	10^4t							0	18.9	100	67,500	43,070	0
Diesel oil	10^4t	0.69	4.28	1.23	1.55	1.19		8.94	20.2	100	72,600	42,652	276,830
Fuel oil	10^4t	0.02	1.44	0.48	1.27	0.06	4	7.27	21.1	100	75,500	41,816	229,522
LPG	10^4t							0	17.2	100	61,600	50,179	0
Refinery gas	10^4t	0.25	2.18	0.82	1.91			5.16	15.7	100	48,200	46,055	114,544
Natural gas	10^8m^3		7.69	0.27		0.14	21.84	29.94	15.3	100	54,300	38,931	6,329,176
Other petroleum production	10^4t			0.29				0.29	20	100	72,200	41,816	8,755

Other coke production	10^4t							0	25.8	100	95,700	28,435	0
Other fuel	10^4t	12.47	76.3	26.69	14.96	84.8		215.22	0	0	0	0	0
		2184.31	9339.64	2888.29	2810.69	1413.64	2817.31	21453.88	25.8	100	87,300	20,908	391,590,892

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The thermal power generation of the CCPG in 2009

Provinces	**Electricity generation (10^8kWh)**	**Electricity generation (MWh)**	**Self-consumption by the gird (%)**	**Electricity supply of the Grid (MWh)**
Jiangxi	445	44,500,000	5.8	41,919,000
Henan	1985	198,500,000	6.62	185,359,300
Hubei	630	63,000,000	6.21	59,087,700
Hunan	634	63,400,000	6.39	59,348,740
Chongqing	306	30,600,000		30,600,000
Sichuan	504	50,400,000	7.92	46,408,320
Total				422,723,060

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OM of Central China Power Grid in 2009

Electricity imported from Northwest Power Grid (MWh)	A	3,262,010
OM of Northwest Power Grid	B	1.00759
Electricity imported from North Power Grid (MWh)	C	2,233,290
OM of North Power Grid	D	0.96418
Emission of Central China Power Grid (tCO_2)	E=391,590,892+C*D	408,757,899
Total electricity supply of Central China Power Grid	F=422,723,060+5,495300	428,218,360

$EF_{OM,2007}$ (tCO_2/MWh)	G=E/F	0.95455

Three years weighted average EF_{OM} from 2007 to 2009:

$EF_{OM,CCPG}$ = 1.0279

EF_{BM} calculations for the Central China Power Grid

Fuel type	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Sum G=A+…+F	Heat value H	Emission factor I	Oxidation rate J	Emissions K=G×H×I×J/100,000
Raw coal	10^4t	2,184.31	9,339.64	2,888.29	2,810.69	1,413.64	2,817.31	21,453.88	20,908	87,300	1	391,590,892
Clean coal	10^4t	0	3.35	0	0	0	0	3.35	26,344	87,300	1	77,044
Other washed coal	10^4t	0	59.93	0	0	136.75	97.94	294.62	8,363	87,300	1	2,150,991
Moulded coal	10^4t	0	0	0	2.63	0	0	2.63	20,908	87,300	1	48,005
Coke	10^4t	0	1.08	0.06	0.09	0	0	1.23	28,435	95,700	1	33,471
Other coke product	10^4t	0	0	0	0	0	0	0.00	28,435	95,700	1	0
Total												393,900,403
Crude oil	10^4t	0	0.1	0	0	0	0	0.1	41,816	71,100	1	2,973
Gasoline	10^4t	0	0	0	0	0	0	0	43,070	67,500	1	0
Diesel oil	10^4t	0.69	4.28	1.23	1.55	1.19	0	8.94	42,652	72,600	1	276,830
Fuel oil	10^4t	0.02	1.44	0.48	1.27	0.06	4	7.27	41,816	75,500	1	229,522
Other petroleum product	10^4t	0	0	0.29	0	0	0	0.29	41,816	72,200	1	8,755
Total								0				518,081
Natural gas	10^7m^3	0	76.9	2.7	0	1.4	218.4	299.4	38,931	54,300	1	6,329,176
Coke oven gas	10^7m^3	0.9	60.4	12	0	10.3	0	83.6	16,726	37,300	1	521,564
Other coal gas	10^7m^3	307.6	566.4	0	42.3	75.7	0	992	5,227	37,300	1	1,934,074

LPG	10^4t	0	0	0	0	0	0	0	50,179	61,600	1	0
Refinery gas	10^4t	0.25	2.18	0.82	1.91	0	0	5.16	46,055	48,200	1	114,544
Total												8,899,358
Sum												403,317,841

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Thus $\lambda_{Coal,y}$ =97.66%， $\lambda_{Oil,y}$ =0.13%， $\lambda_{Gas,y}$ =2.21%.

Emission factor of best efficiency technology commercially used in domestic power plants in China

		Efficiency of power supply	**Emission factor of fuel ($kgCO_2/TJ$)**	**Oxidation rate**	**Emission factor (tCO_2/MWh)**
		A	**B**	**C**	**D=3.6/A/1000000*B*C**
Coal-fired power plant	$EF_{coal,adv}$	39.45	87,300	1	0.7967
Oil-fired power plant	$EF_{oil,adv}$	51.77	75,500	1	0.5250
Gas-fired power plant	$EF_{gas,adv}$	51.77	54,300	1	0.3776

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.7871 \text{ tCO}_2\text{/MWh}$$

Installed capacity of CCPG in 2008

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power	MW	11, 500	43, 100	15, 670	15, 900	6, 800	12, 270	105, 240
Hydro power	MW	3, 770	3, 650	30, 010	11, 460	4, 530	25, 810	79, 230
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and others	MW	60	50	10	2	10	0	132
Total	MW	15, 330	46, 800	45, 690	27, 362	11, 340	38, 080	184, 602

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Installed capacity of CCPG in 2008

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power	MW	9,340	42,680	14,210	14,430	6,660	12,770	100,090
Hydro power	MW	3,710	3,020	29,050	10,650	4,060	22,240	72,730
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and others	MW	30	30	10	0	0	0	70
Total	MW	13,080	45,720	43,280	25,080	10,730	35,010	172,890

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Installed capacity of CCPG in 2007

Installed capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal power	MW	9,270	38,540	13,040	13,360	6,370	12,000	92,580
Hydro power	MW	3,570	2,740	24,020	9,220	2,240	19,860	61,650
Nuclear power	MW	0	0	0	0	0	0	0
Wind power and others	MW	0	0	10	17	24	0	51
Total	MW	12,840	41,280	37,070	22,597	8,634	31,860	154,281

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$EF_{BM, CCPG}$ Calculation

	2007 installed capacity	2008 installed capacity	2009 installed capacity	2007-2009 increased capacity	2008-2009 increased capacity	The percentage of increased capacity against total increased capacity of all power type
	A	B	C	D=C-A	E=C-B	F
Thermal power	92,580	100,090	192, 670	20, 280. 4	10, 467. 5	53.25%
Hydro power	61,650	72,730	134, 380	17, 726. 9	6, 500	46.54%
Nuclear power	0	0	0	0	0	0.00%
Wind power and others	51	70	121	81	62	0.21%
Total	**154,281**	**172,890**	**327,171**	**38,088.3**	**17,029.5**	**100.00%**
Percentage against 2008's installed capacity				20.63%	9.23%	

$EF_{BM,y}$=0.7871×53.25%=0.4191 tCO_2/MWh

Annex 4

MONITORING INFORMATION

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