**PROGRAMME DESIGN DOCUMENT FORM FOR SMALL-SCALE CDM PROGRAMMES OF ACTIVITIES (F-CDM-SSC-PoA-DD) Version 02.0**

# PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

## PART I. Programme of activities (PoA)

### SECTION A. General description of PoA

### A.1. Title of the PoA

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Title: Animal Manure Treatment Programme in Hubei Province

Version: 05

Date: 23/12/2012

| Version No. | Date | Description and reason of revision |
|---|---|---|
| 01 | 17/08/2011 | The first GSC Version, which is GSCed on 02/09/2012. |
| 02 | 03/04/2012 | The first revised version based on CAR&CL. |
| 03 | 13/11/2012 | The second revised version based on CAR&CL. |
| 04 | 21/11/2012 | The Second GSC version due to the change of Methodology (AMS-III.D and AMS-I.C are combined applied in the first GSC version. Only AMS-III.D is applied in version 04.) |
| 05 | 23/12/2012 | Revised based on CAR&CL. |

### A.2. Purpose and general description of the PoA

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1. General operating and implementing framework of PoA

Animal Manure Treatment Programme in Hubei Province (hereafter referred to as the PoA) is located in Hubei Province, P.R. China, which is coordinated and managed by Wuhan Tianying Environmental Engineering Co., Ltd. (hereafter referred to as the CME) The purpose of the PoA is to install animal manure treatment systems with recovery of biogas and then to utilize the generated biogas as fuel for energy generation across Hubei Province. Biogas storage tank will be used to achieve that in case of emergency all methane produced from anaerobic digestion can be stored but not emitted to atmosphere, and therefore ensure that all methane produced by the digester is destroyed. Besides, it is also possible that flaring system is installed in some activities and in this case, open flaring or closed flaring will be adopted based on each owner's opinion.

A contract will be signed between the CME and the biogas plant owner prior to the date the biogas plant is included in the PoA, to conform that:

(a) They are aware of and have agreed that their activity is being subscribed to the PoA.

(b) They have neither already been registered as a CDM project, nor as a CPA of another PoA.

In the absence of the PoA, animal manure would be left to decay anaerobically without methane recovery and destruction. The baseline scenario is the same as the scenario prior to the implementation of the project..

2. Policy measure or stated goal of the PoA

Stated goal of the proposed PoA is to establish a sustainable livestock waste management model that would significantly improve rural environment and reduce greenhouse gas emissions, through the use of a programmatic approach for biogas digester activities.

By recovery and utilization of biogas, the PoA can contribute to the reduction of greenhouse gases in 2 ways: 1) the biogas recovery system reduces methane emission into atmosphere; 2) the recovered biogas replaces conventional fossil fuels for energy generation, and therefore avoids $CO_2$ emissions from energy generation by the fossil fuel. However, for the sake of conservativeness and simplification, the proposed PoA will only claim emission reductions from the avoidance of methane emission. No CERs will be claimed for substituting fossil fuel by biogas for energy generation. The estimated annual emission reductions achieved by the first real case CPA is 3,663 $tCO_2e$.

As a waste treatment and renewable energy utilization Programme, it can contribute to sustainable development in the following aspects:

**Social benefits:**

- Provide working position during the Programme operation;
- Increase local financial revenue through energy supplying;

**Environmental benefits:**

- Improve the dung treatment system, avoid smoke in kitchens, which make the living environment in the region improved;
- Reduce GHG and pollutant emission by avoiding methane emission and replacing fossil fuel for energy generation;

**Economic benefits:**

- Reduce fuel and fertilizer expenses, and therefore increase local rural farmers income;
- move the development of animal raising industry forward, and furthermore increase the tax revenue ;

**Technological benefits:**

- Boost the development of application of biogas technology;

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

At Present, there is no mandatory law to enforce animal raising entity to install animal manure treatment system with recovery of biogas in China, the coordinating entity confirms that the proposed PoA is a voluntary action by the CME.

**A.3. CMEs and participants of PoA**

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The Coordinating / Managing Entity (CME) for the PoA is Wuhan Tianying Environmental Engineering Co., Ltd., which will be responsible for communicating with EB.

Participants of the PoA include two private entities as below:

1. Wuhan Tianying Environmental Engineering Co., Ltd.

2. A&T Carbon Asset Co., Limited

**A.4. Party(ies)**

| Name of Party involved (host) indicates a host Party | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| The People's Republic of China (Host Country) | Private Entity: Wuhan Tianying Environmental Engineering Co., Ltd. (CME) | No |
| United Kingdom of Great Britain and Northern Ireland | Private Entity: A&T Carbon Asset Co., Limited | No |

**A.5. Physical/ Geographical boundary of the PoA**

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The programme is implemented in Hubei Province, P.R. China, so the boundary of the whole Hubei Province administrative area delineates geographical boundary of the PoA. Detailed physical location is labelled in Figure 1.

**Figure 1. Location of the PoA**

## A.6. Technologies/measures

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All the CPAs under the PoA will introduce anaerobic manure treatment systems with biogas recovery to treat the manure collected from livestock farms, and then utilize the recovered biogas as fuel for energy generation.

The technology flow employed in the CPA includes manure treatment system, biogas recovery system and biogas utilization system.

The excrement from livestock farm will firstly enter into adjusting tank in order to meet a given proportioning for fermentation, and subsequently enter into anaerobic reactor. Under anaerobic condition and proper temperature in the reactor, organic matter included in manure from livestock farm will be converted into biogas by methanogenic bacteria. The generated biogas will be recovered and then utilized for energy generation after desulphurization and dehydration. The slurry from the reactor will be

reused in adjusting tank or be used for land application and the residue from the reactor will be used for land application.

Biogas storage tank will be used to achieve that in case of emergency all methane produced from anaerobic digestion can be stored but not emitted to atmosphere, and therefore ensure that all methane produced by the digester is destroyed. Besides, it is also possible that flaring system is installed in some activities and in this case, open flaring or closed flaring will be adopted based on each owner's opinion.

The details technology flow is shown in the following figure:

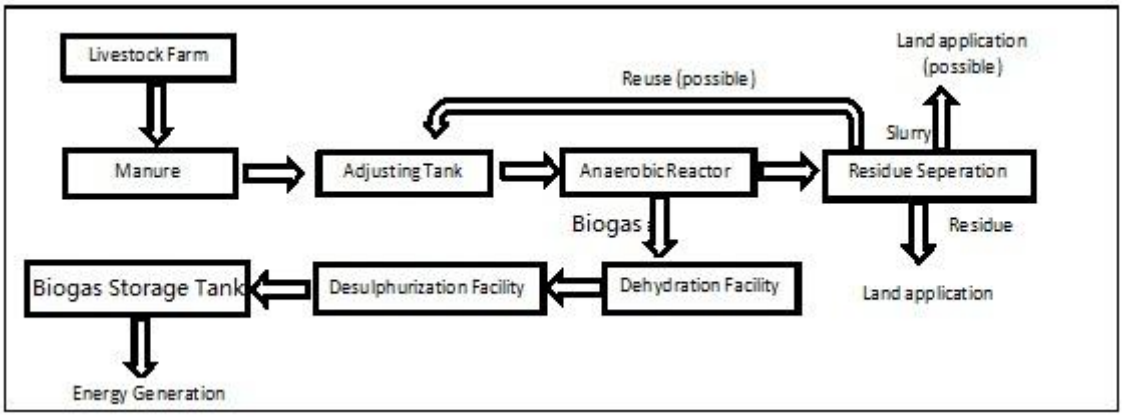


**Figure 2. Technology flow adopted in the PoA**

In the absence of the Programme, animal manure would be left to decay anaerobically in uncovered anaerobic lagoons without methane recovery. The baseline scenario is the same as the scenario prior to the implementation of the project..

By recovery and utilization of biogas, the PoA can contribute to the reduction of greenhouse gases in 2 ways: 1) the biogas recovery system reduces methane emission into atmosphere; 2) the recovered biogas replaces conventional fossil fuels for energy generation, and therefore avoids $CO_2$ emissions from energy generation by the fossil fuel; For the sake of conservativeness and simplification the emission reductions from energy generation will not be accounted for in the baseline of the PoA.

All main equipments in the Programme will be domestically produced. The PoA does not require any technology transfer from Annex-I countries to the host country.

### A.7. Public funding of PoA

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There is no public funding from Annex-I parties for the PoA.

## SECTION B. Demonstration of additionality and development of eligibility criteria

### B.1. Demonstration of additionality for PoA

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According to paragraph 7 of EB 65 annex3, additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur which mean that the additionality of the proposed PoA will be demonstrated on the CPA level.

All CPAs under the PoA are additional, which means that none of the implemented CPAs would occur in the absence of CDM. The additionatlity of a CPA will be assessed as per any one of the three approaches (for details please see Eligibility Criteria 16 in Section B.2).

**B.2. Eligibility criteria for inclusion of a CPA in the PoA**

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According to Annex 3 of EB 65, the criteria for inclusion of a CPA in the PoA are as below:

| **Category** | **Eligibility criteria for inclusion of a SSC-CPA in the PoA:** | **The documents for the CME to check whether the features of potential CPAs meet the eligibility criteria before inclusion in the PoA.** |
|---|---|---|
| Geographical boundary | 1. All the project activities under the CPA should be located in the boundary of the PoA, i.e. within Hubei Province; | --Hubei Province administrative area map |
| To avoid double counting | 2. The CPA should pass the procedure of avoiding double counting described in Section C (ii) of the PoA-DD; | --conduct the avoiding double counting procedure |
| The start date of the CPA | 3. The start date of the CPA is not prior to 02/09/2011(the first GSC date of the PoA). | --Equipment purchasing contract<br>--Construction contract or construction start record |
| The applicability and other requirements of AMS-III.D | **Criteria Related to Applicability Conditions of AMS-III.D** | |
| | 4. All activities under a CPA are to install anaerobic animal manure management systems to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered biogas; | --Technical flow figure<br>--FSR<br>--Approval of FSR |
| | 5. The livestock population in the farms included in each CPA under the PoA should be managed under confined conditions; | -- On-site photo |

| | | |
|---|---|---|
| | 6. Manure or the streams obtained after treatment are not discharged into natural water resources; | --FSR and approval of FSR; or<br><br>--technical specification |
| | 7. The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5 ℃; | --data from local meteorological station or FSR or internet web. |
| | 8. In the baseline scenario the retention time of manure waste in the anaerobic treatment system should be greater than one month; | --photo; or<br><br>--prove from local government; or<br><br>--other evidence |
| | 9. The baseline scenario for the manure treatment is that the manure waste from the livestock would be treated in anaerobic lagoons with the depth of at least 1m; | --prove from local government; or<br><br>--other evidence, e.g. building drawing of lagoon. |
| | 10. No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario; | --photo; or<br><br>--prove from local government; or<br><br>--other evidence |
| | 11. The residual waste from the animal manure management system must be handled aerobically, e.g. land application; | --FSR; |
| | 12. Only animal manure will be anaerobically treated but no other organic matters are involved in the CPA; | --FSR; or<br><br>--technical demonstration; |
| | 13. Technical measures will be used to ensure that all biogas produced by the digester is used or flared; | --Biogas storage tank; and/or<br><br>--Flaring system; |
| | 14. The storage time of the manure after removal from the animal barns, including transportation, should not exceed 45 days before being fed into the | --Technical flow demonstration |

| | | |
|---|---|---|
| | anaerobic digester. | |
| | 15. The emission reductions from type III components of the CPA should be less than or equal to 60,000t$CO_2$e/yr. | --ER Calculation worksheet |
| additionality | 16. A CPA should meet any one of following criteria for assessing additionality:<br><br>(a) Meets relevant requirement in "*Guidelines for demonstrating additionality of microscale project activities*", including:<br><br>• The geographic location of the project activity is in a special underdeveloped zone of the host country identified by the Government via any one of the following methods (paragraph 4(a)):<br><br>- The proportion of population with income less than USD 2 per day (PPP) in the region is greater than 50% calculated by using the most recent available data in official notifications for development assistance including for planning, management, and investment;<br><br>- The GNI per capita in the country is less than USD 3000 and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures which is calculated by using the most recent available data in official notifications for development assistance including for planning, management, and investment;<br><br>- Based on the recommendation of the designated national authority of the host country, the SUZ in the host country has been approved by EB of the CDM and publised on the UNFCCC website.<br><br>• The emission reduction of the CPA is no more | --evidence regarding undeveloped zone ;<br><br>--ER Calculation worksheet<br><br>--equipment brand or equipment purchase contract;<br><br>--IRR worksheet |

| | | |
|---|---|---|
| | than 20 kt$CO_2$e per year. (paragraph 8(c))<br><br>(b) Meets relevant requirement for the positive list of technologies and project activity types that are defined as automatically additional in *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*, including:<br><br>• Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs);<br><br>• The emission reductions of each unit included in the CPA is no more than 3,000 t$CO_2$e per year;<br><br>(c) According to Investment Barrier in the *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*, the project IRR (before tax) of the project included in the CPA is lower than the benchmark of 7%; | |
| local stakeholder consultations and environmental impact analysis | 17. Each activity included in the CPA must have obtained approval of EIA. | -EIA and Approval of EIA |
| Funding from Annex I parties | 18. The CPA has no public funding from Annex I Parties; | --Statement by biogas plant owner. |
| others | 19. The CPA is not a de-bundled component of a large scale activity. De-bundling check will be implemented according to *"Guidelines on assessment of debundling for SSC project activities"*. | --PoA database; and/or<br><br>--UNFCCC website |
| | 20. No fossil fuel is used in each activity included in the CPA other than for transportation; | --FSR; or<br><br>--Technical flow; |
| | 21. Each animal manure treatment system included in the CPA is a Greenfield one and not a retrofit or | -- FSR; |

| | | |
|---|---|---|
| | capacity addition project. | --or other evidence; |
| | 22. The CPA crediting period does not exceed 31/01/2041 (the PoA end date). | --CPA-DD |

**Items no need to be checked for inclusion of a CPA in the proposed PoA:**

| Category | Explanation |
|---|---|
| The specifications of technology/measure | It has been included in Eligibility Criteria 4. No further requirement is needed. |
| local stakeholder | As the stakeholder consultation conducted at the PoA level and no further requirements needed. |
| Target group | Not applicable |
| sampling requirements | Not applicable |
| small-scale or microscale threshold criteria | It has been included in criteria related to additionality. |

**B.3. Application of methodologies**

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***AMS-III.D.: "Methane recovery in animal manure management systems"*** (Ver 18.0) is applied in the PoA.

For more information, please refer to:

*http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html*

The methodology also refers to:

| |
|---|
| *AMS-III.AO.: Methane recovery through controlled anaerobic digestion (Ver 1.0)* |
| *Tool to calculate the emission factor for an electricity system (Ver 02.2.1);* |
| *Tool to determine project emissions from flaring gases containing methane (Ver 01)*; |
| *Tool for the Demonstration and Assessment of Additionality (Ver 06.0.0);* |

In addition, the PoA also refers to references below:

| |
|---|
| *Guidance on the Assessment of Investment Analysis (Ver 05);* |
| *Guidelines for demonstrating additionality of microscale project activities (Ver 04.0);* |
| *General Guidelines for SSC CDM methodologies (Ver 19.0);* |

| |
|---|
| *Standard for Demonstration of Additionality, Development of Eligibility Criteria and Application of Multiple Methodologies for Programme of Activities (Ver 02.0);* |
| *Guidelines on the Demonstration of Additionality of Small-scale Project Activities (Ver 09.0)* |

For more information, please refer to:
*http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html*.

As per AMS-III.D., it is approved for use in a PoA.

**SECTION C. Management system**
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In order to implement the PoA smoothly, an operational and management plan was established by the CME, as below:

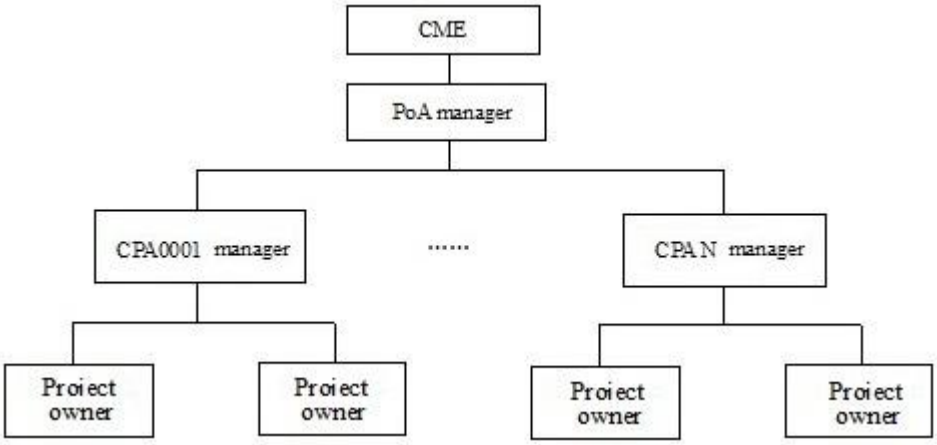



**Figure 3. Operational and Management Structure**

The responsibility of each entity involved in the PoA is described as the below table:

| Entity | Responsibility description |
|---|---|
| CME | CME is in full charge of overall management and coordination of the PoA. The details responsibility of CME mainly includes:<br>(1) Track the development of PoA; keep communication with EB, DNA and related agencies;<br>(2) Establish the monitoring plan and training plan;<br>(3) Manage the contracts between CME and project owner, and other documents;<br>(4) Take charge of the PoA database establishing and updating and managing;<br>(5) Conduct the double counting checking;<br>(6) Conduct CPA inclusion as well as database updating and management;<br>(7) Taking in charge of monitoring data analysis and archiving, and monitoring report;<br>(8) Furthermore, to manage the PoA more efficiently and smoothly, a specialized team will be designated by the CME |

| | |
|---|---|
| | for improvement of operation and management of the PoA. This specialized team will mainly take charge of the following matters:<br>- Termly on-site check regarding operation of biogas systems;<br>- Based on on-site check, identify the opportunity to improve the operation and management plan;<br>- Discuss with CME and farm owner and related technical staff about feasibility of improvement action;<br>- Implement improvement plan; |
| PoA manager | PoA manager who is designated by CME will carry out the CME's responsibility for the PoA on behalf of CME. |
| CPA Manager | CPA manager assists the CME to manage the CPA, and collect the data and information related to the CPA, and then termly report to the CME. Organize training for the related staff.<br>Furthermore, the CPA manager will take charge of monitoring implementation and collect the monitoring data. |
| Project owner | Take charge of operation and management of project activity, as well as assist CPA manager to conduct monitoring plan according to monitoring manual. |

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

The CME will establish a database for recording the CPAs included in the PoA. Each CPA has exclusive information, including CPA number and title and etc. The information will be inputted and recorded by the CME.

The PoA involves a range of operational activities in order to effectively implement and manage each SSC-CPA. The CME has divided the technical and data operations into 3 steps and has defined the management responsibilities for each as detailed in the table below:

| **Procedure** | **Management Responsibilities & Arrangements** |
|---|---|
| Material and data collection | - Searching for the pre-qualification activities;<br>- Collecting the information and materials of potential activities according to the request list;<br>- Collecting the monitoring data and materials of the activities which have been included already according to the request list;<br>- Submit the information and materials collected to technical manager |
| Technical review | - Completeness check of the information and materials collected;<br>- Conduct the double counting check; |

| | |
|---|---|
| | - Implement the inclusion check according to the inclusion criteria list<br>- Roughly calculate the ER |
| Filing and database management | - Rutinely update the PoA database;<br>- Document filing and backup;<br>- Report the findings and feedback from the database and filing management. |

The above steps could also be illustrated as the following figure:

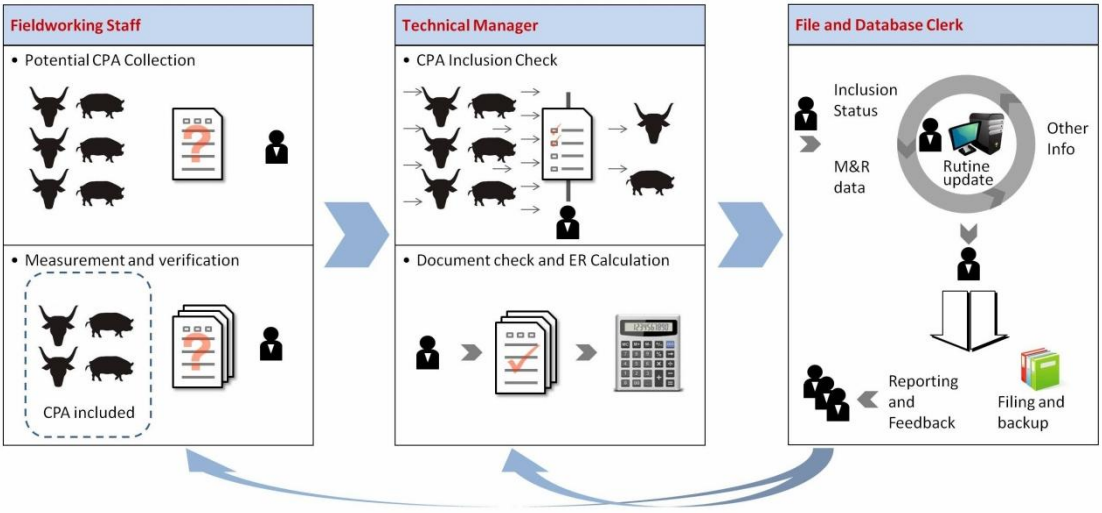



**Figure 4. Management system of the PoA**

All the staffs involved in the PoA will be trained by the CME according to the training manual before start working, and the training record and compatency evaluation is made available to relevant PPs and the DOE. Besides, the CME will continuously train the staff during the PoA crediting period.

In addition to the above management tasks, the coordinating entity will implement the following operational elements to ensure proper management and oversight of the proposed PoA.

A comprehensive database including all activities in each CPA is set up. All the essential activity information mainly including the following variables is required:

- Activity name;
- Project activity owner name;
- Detailed location;
- Installed capacity;
- CDM monitoring and verification record.

The CME will be responsible for the management of records and data associated with each CPA: The potential activity will be numbered with geo-coordination uniquely and registered in the database only if it would pass the eligible criteria checking; The activity status and information will be recorded and updated continuously and periodically during the PoA crediting period; The database will be made available to relevant PPs and the DOE; All the paper and electronic documents obtained by the CME will be filed and registered in the library system during the PoA crediting period plus 2 years.

(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

As demonstrated above, all animal manure treatment units registered in one CPA will be uniquely defined with geo-coordination and recorded, thus each CPA is uniquely identified. In addition, two measures are taken to avoid double counting of emission reductions:

1. Declaration by the owner of activity is used to confirm that there will not be any double counting between this PoA and any other PoA/CDM project.

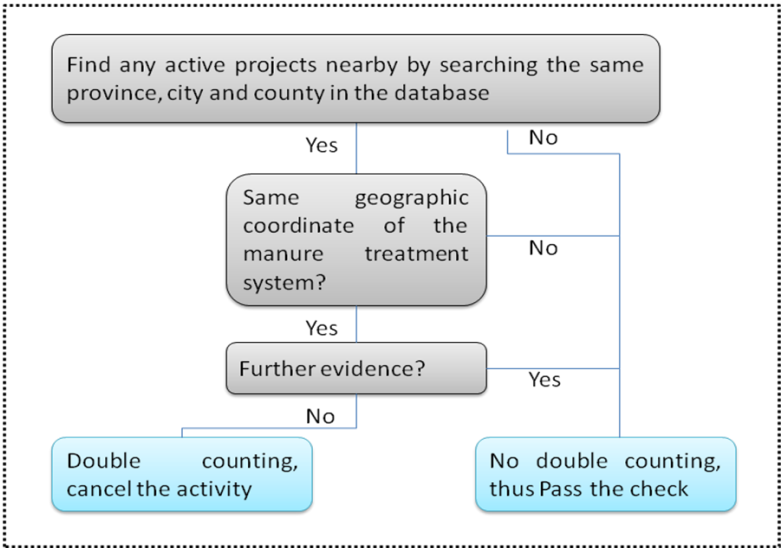
   Each of the owner included in the proposed CPA should sign a contract with the CME to confirm that：

   (a) They are aware of and have agreed that their activity is being subscribed to the PoA.

   (b) They have neither already been registered as a CDM project, nor as a CPA of another PoA.

2. Database checking will be applied to ensure that no activity could be double added into this PoA.

Before the activity registered in the database, a regular check is required to avoid double counting by the following steps:



Thus, only the activity neither registered as a CDM, nor as a CPA of this or another PoA could be added in the PoA.

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

According to the *Guidelines on assessment of debundling for SSC project activities (Version 03)*, for the purposes of registration of a Programme of Activities (PoA)[1], 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[2], 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.

| No. | Detailed criteria for de-bundled check | Real situation of the CPA | Applicable? (Y/N) |
|---|---|---|---|
| (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. | | |
| (b) | The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point. | | |

(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;

Contracts will be signed between the CME and the owner of the project included in each CPA before inclusion of the CPA in the PoA. This is to ensure that all entities involved in the CPA operation are agreed that their activities are being subscribed to the PoA.

**SECTION D. Duration of PoA**
**D.1. Start date of PoA**
>>
02/09/2011(the first GSC date of the PoA)

[1] Only those PoAs need to be considered in determining de-bundling that are: (i) in the same geographical area; and (ii) use the same methodology; as the PoA to which proposed CPA is being added.
[2] Which may be a (i) registered small-scale CPA of a PoA, (ii) an application to register another small-scale CPA of a PoA or (iii) another registered CDM project activity.

01/02/2013(crediting period starting date)

**D.2. Length of the PoA**
>>
28 years

**SECTION E. Environmental impacts**
**E.1. Level at which environmental analysis is undertaken**
>>
Environmental Analysis is conducted based on each specific project. Thus, the Environmental Analysis is done at SSC-CPA level based on all EIAs of project activities included in that CPA.

**E.2. Analysis of the environmental impacts**
>>
Environmental Analysis will be done at CPA level.

The EIA will be carried out and approved by local environmental protection bureau before the each CPA inclusion into the PoA. Therefore, CPAs included in the PoA is in accordance with the national laws/regulations. The environment impacts possibly caused by the project potentially included in a CPA, and the corresponding measures may be adopted by the project owner will be analyzed at each specific CPA-DD.

**SECTION F. Local stakeholder comments**
**F.1. Solicitation of comments from local stakeholders**
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The PoA is set up to develop all the eligible manure treatment and biogas utilization projects within Hubei Province, and the corresponding stakeholder consultation campaign is aimed to collect the comments and suggestions of local residents in the PoA boundary on the environmental impact of this project category, the PoA development and so on. In addition, similar technology is adopted in each CPA under the PoA, and similar influences will be therefore produced.

Therefore, local stakeholder consultation is done at PoA level.

To ensure the sustainability of the PoA, the CME carried out a stakeholder consultation process across the Hubei Province during 07/2011 and 08/2011. The whole process is summarized as below:

The project information and comments invitation were delivered posted near the residents' living areas and some public places on mid 07/2011 by local rural energy service centres in 17 city of Hubei Province respectively. The notification contained the brief introduction of the projects based on manure treatment and biogas recovery system, the social impact of these projects, the introduction of CDM/PCDM, and the contact way for raising comments and getting the questionnaire.

**F.2. Summary of comments received**
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85 questionnaires (5 copies for each county/city) were distributed among 17 county/city of Hubei Province during early 08/2011. 85 of them were returned, giving a response rate of 100%. The table below summarized the basic detail of the respondents from the questionnaires returned.

| Basic information | Classification | Number of respondents |
|---|---|---|
| Gender | Male | 65 |
| | Female | 20 |
| Age | ≤30 | 21 |
| | 31~45 | 43 |
| | ≥45 | 21 |
| Occupation | Rural people | 41 |
| | Workers | 9 |
| | Officials | 31 |
| | Teacher | 2 |
| | Student | 2 |
| Education | Primary school and below | 13 |
| | Middle school | 48 |
| | College and University and above | 24 |

The respondents are representative in terms of gender, age, occupation and education, so their attitude towards the impacts of the PoA can therefore be seen as a comprehensive reflection of the attitudes of the residents possibly affected by the project.

The questions in the questionnaires include:

1) Local economic impact of the project;

2) Local ecological impact of the project;

3) Local job impact of the project;

4) The possible negative impact to the local area;

5) The overall attitudes to the project;

6) Other comments and/or suggestions.

Based on the returned questionnaires, the comments are summarized as below:

- 80 respondents (94%) believe the projects under the PoA can bring positive impacts to local

economical development; 5 respondents (6%) believe the PoA have no impact on local economic.

- 85 respondents (100%) think the projects under the PoA will do not put negative impact on local ecological environment;
- 82 respondents (96%) believe the projects under the PoA will bring positive impacts on local job opportunity; 3 respondents (4%) believe the PoA have no impact on local job opportunity;
- 82 respondents (96%) believe the projects under the PoA will bring positive impacts on local area; 3 respondents (4%) believe the PoA have no impact on local area;
- All respondents are in favor of the PoA, no respondent stated objection;
- No respondent offers any suggestion regarding the negative impacts of the projects under the PoA; 2 of them expressed the opinion, that implementing and promoting the PoA as soon as possible, which helps eliminate the current negative impacts on the environment brought by the farms.

The returned questionnaires show that the PoA is supported by local residents and will bring various positive impacts to the local area.

**F.3. Report on consideration of comments received**

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As shown in the questionnaires, the Project obtained support from local residents and government thus modification and adjustment on design and operation of the PoA are unnecessary.

**SECTION G. Approval and authorization**

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The LoA from China Development and Reform Commission (China DNA) was issued on 18/04/2012, in which Wuhan Tianying Environment Engineering Co., Ltd. is authorized as China's participant to voluntarily participate in and carry out the PoA as the Coordinating/Managing Entity.

The LoA from United Kingdom Environment Agency (UK DNA) was issued on 27/06/2012, in which it is clearly indicated that A&T Carbon Asset Co., Limited is Project Participant from United Kingdom.

The LoAs mentioned above had been submitted to DoE by means of scan copy.

## PART II. Generic component project activity (CPA)

**SECTION A. General description of a generic CPA**

**A.1. Purpose and general description of generic CPAs**

>>

The PoA only includes one type generic CPA.

Project Scenario: the generic CPA is to recover methane from manure treatment in livestock farms by changing the manure management practice from uncovered anaerobic lagoon to biogas digester and then

to utilize the recovered biogas to generate energy.

The Scenario prior to the implementation of the project: In the absence of the PoA, animal manure would be left to decay anaerobically without methane recovery and destruction.

The baseline scenario is the same as the scenario prior to the implementation of the project.

By recovery and utilization of biogas, the CPA can contribute to the reduction of greenhouse gases in 2 ways: 1) the biogas recovery system reduces methane emission into atmosphere; 2) the recovered biogas replaces conventional fossil fuels for energy generation, and therefore avoids $CO_2$ emissions from energy generation by the fossil fuel. However, for the sake of conservativeness and simplification, the CPA will only claim emission reductions from the avoidance of methane emission due to the existing AWMS. No CERs will be claimed for substituting fossil fuel by biogas for energy generation (electricity generation and/or thermal generation).

This meets the framework of the PoA.

**SECTION B. Application of a baseline and monitoring methodology**
**B.1. Reference of the approved baseline and monitoring methodology(ies) selected**
>>

***AMS-III.D.: "Methane recovery in animal manure management systems"*** (Ver 18.0) is applied in the PoA.

For more information, please refer to:

*http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html*

The methodology also refers to the following tools:

| |
|---|
| *Tool to calculate the emission factor for an electricity system (Ver 02.2.1);* |
| *Tool to determine project emissions from flaring gases containing methane (Ver 01)*; |
| *Tool for the Demonstration and Assessment of Additionality (Ver 06.0.0);* |

The generic CPA also refers to references below:

| |
|---|
| *Guidance on the Assessment of Investment Analysis (Ver 05);* |
| *Guidelines for demonstrating additionality of microscale project activities (Ver 04.0);* |
| *General Guidelines for SSC CDM methodologies (Ver 19.0);* |
| *Standard for Demonstration of Additionality, Development of Eligibility Criteria and Application of Multiple Methodologies for Programme of Activities (Ver 02.0);* |
| *Guidelines on the Demonstration of Additionality of Small-scale Project Activities (Ver 09.0)* |

For more information, please refer to:
*http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html*.

According to AMS-III.D, it is approved for use in a PoA.

**B.2. Application of methodology(ies)**
>>

Each CPA under the PoA meets the applicability criteria of Methodology AMS-III.D.

The details analysis on the applicability criteria of Methodology AMS-III.D is as the following table:

| No. | Applicability Conditions as per AMS-III.D (Ver. 18.0) | Situation of a CPA under the PoA |
|---|---|---|
| **1** | The livestock population in the farm is managed under confined conditions; | As per eligibility criteria (5) for inclusion of a CPA in the PoA described in the Section A.4.2.2, the livestock population in the farms included in each CPA under the PoA is managed under confined conditions; |
| **2** | Manure or the streams obtained after treatment are not discharged into natural water resources (e.g. river or estuaries), otherwise AMS-III.H "Methane recovery in wastewater treatment" shall be applied; | As per eligibility criteria (6) for inclusion of a CPA in the PoA described in the Section A.4.2.2, manure or the streams obtained after treatment will not be discharged into natural water resources. |
| **3** | The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5° C; | As per eligibility criteria (7) for inclusion of a CPA in the PoA described in the Section A.4.2.2, it can be met. |
| **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; | According to eligibility criteria (8) and (9) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, it can be met. |
| **5** | No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario. | According to eligibility criteria (10) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, it can be met. |
| **6** | The residual waste from the animal manure management system shall 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, proper conditions and procedures (not resulting in methane emissions) must be ensured; | According to eligibility criteria (11) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, the residual waste from the animal manure management system will be |

| | | |
|---|---|---|
| | | handled aerobically in each CPA under the PoA. |
| **7** | Technical measures shall be used (including a flare for exigencies) to ensure that all biogas produced by the digester is used or flared; | According to eligibility criteria (13) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, it is ensured that all biogas produced by the digester is used or flared; |
| **8** | 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. | According to eligibility criteria (14) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, the storage time of the manure after removal from the animal barns, including transportation, will not exceed 45 days before being fed into the anaerobic digester. |
| **9** | Projects that recover methane from landfills shall use AMS-III.G "Landfill methane recovery" 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 digestion". | According to eligibility criteria (12) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, each CPA under the PoA will introduce anaerobic manure treatments with biogas recovery to treat only animal manure. |
| **10** | Different options to utilise 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. | According to eligibility criteria (4) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, the recovered biogas will be utilized for generation of heat and/or electricity. |
| **11** | 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 for SSC CDM methodologies". | According to eligibility criteria (4) for inclusion of a SSC-CPA in the PoA described in the Section A.4.2.2, each CPA under the PoA is a new built animal manure treatment system. And they can meet the related and relevant requirements in the "*General Guidelines for SSC CDM methodologies*". |

| | | |
|---|---|---|
| **12** | The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General Guidelines for SSC CDM methodologies". | This criterion is not relevant as replacement of equipment is not involved in a CPA under the PoA. |
| **13** | Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt $CO_2$ equivalent annually from all Type III components of the project activity. | According to eligibility criteria (15) for inclusion of a CPA in the PoA described in the Section A.4.2.2, it can be met. |

Based on analysis above, AMS-III.D is applicable to all CPAs under the PoA.

**B.3. Sources and GHGs**

>>

As per Methodology AMS-III.D (Ver 18.0), the boundary of the CPA includes: the physical, geographical site(s) of the livestock, animal manure management systems, facilities which recover and flare/combust or use methane.

Furthermore, as the CPA needs to purchase electricity from Central China Power Grid (hereafter referred to as CCPG), the project boundary also includes power plants connected to CCPG. Emissions sources included in or excluded from the project boundary are shown in the following Table.

**Table 1. The emission source and the category of GHG**

| | Source | Gas | Included ? | Justification/Explanation |
|---|---|---|---|---|
| **Baseline** | Direct emissions from the waste treatment processes | $CH_4$ | Included | The major source of emissions in the baseline. |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| | | $CO_2$ | Excluded | $CO_2$ emissions from the decomposition of organic waste are not accounted. |
| | Emissions from electricity consumption /generation | $CO_2$ | Excluded | Excluded for simplification. This is conservative. |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative. |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| | Emissions from thermal energy generation | $CO_2$ | Excluded | Excluded for simplification. This is conservative. |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative. |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| **Project activity** | Emissions from physical leakage of biogas in the manure management systems | $CH_4$ | Included | The major source of emissions |
| | | $CO_2$ | Excluded | $CO_2$ emissions from the decomposition of organic waste are not accounted |
| | | $N_2O$ | Excluded | Excluded for simplification. |
| | Emissions from flaring or combustion of the gas stream | $CO_2$ | Excluded | Excluded for simplification. |
| | | $CH_4$ | Included | The major source of emissions in case flaring is involved. |
| | | $N_2O$ | Excluded | Excluded for simplification. |
| | Emissions from on-site electricity use | $CO_2$ | Included | The major source of emissions |
| | | $CH_4$ | Excluded | Excluded for simplification. |
| | | $N_2O$ | Excluded | Excluded for simplification. |
| | Emissions from | $CH_4$ | Included | This source of emissions shall be accounted for if |

| | | | | |
|---|---|---|---|---|
| | incremental transportation distances | | | transportation distance increases after implementation of the CPA |
| | | $CO_2$ | Excluded | Excluded for simplification. |
| | | $N_2O$ | Excluded | Excluded for simplification. |
| | Emissions from the storage of manure before being fed into the anaerobic digester | $CH_4$ | Included | This source of emissions shall be accounted for if both condition (a) and condition (b) below are satisfied:<br>(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<br>(b) The dry matter content of the manure when removed from the animal barns is less than 20%. |
| | | $CO_2$ | Excluded | Excluded for simplification. |
| | | $N_2O$ | Excluded | Excluded for simplification. |

A general schematic view of the boundaries for each project under the PoA is shown in the figure below.

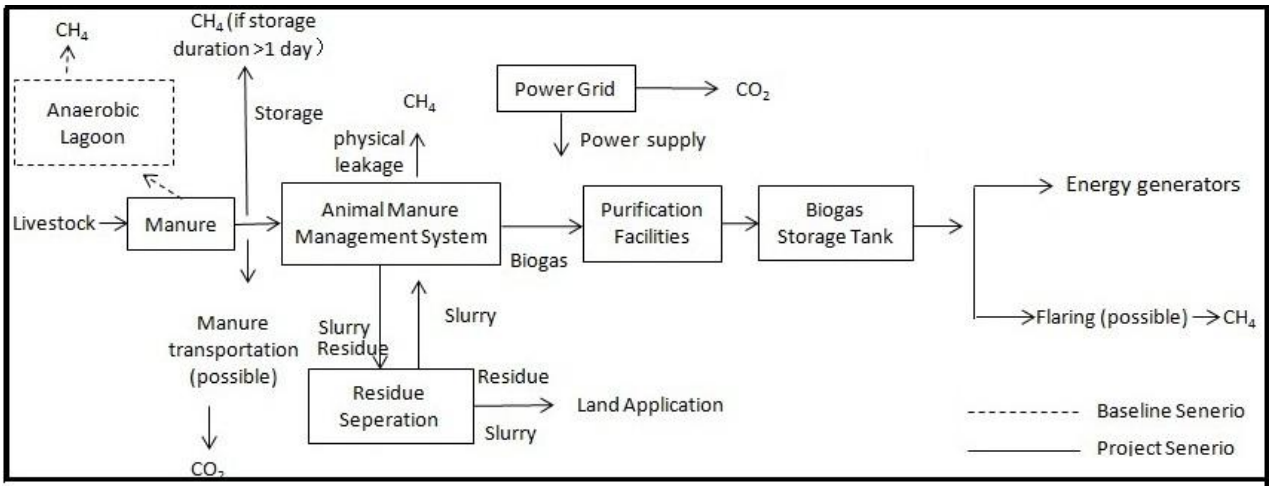


**Figure 5. project boundary**

**B.4. Description of baseline scenario**

>>

According to AMS-III.D., the baseline scenario is the situation where, 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. In the absence of the PoA, animal manure would be left to decay anaerobically without methane recovery and destruction. The baseline scenario is the same as the scenario prior to the implementation of the PoA.

**B.5. Demonstration of eligibility for a generic CPA**

>>

The CPA is eligible for inclusion in the PoA because it meets all of the criteria outlined in the PoA-DD:

| Category | Eligibility criteria for inclusion of a SSC-CPA in the PoA: | Situation of the CPA | The documents for the CME to check whether the features of potential CPAs meet the eligibility criteria before inclusion in the PoA. | Satisfied the criteria? Y/N |
|---|---|---|---|---|
| Geographical boundary | 1. All the project activities under the CPA should be located in the boundary of the PoA, i.e. within Hubei Province. | Documents listed in the right column will be used to ensure that all the project activities under the generic CPA are located in the boundary of the PoA, i.e. within Hubei Province. | --Hubei Province administrative area map | Y |
| To avoid double counting | 2. The CPA should pass the procedure of avoiding double counting described in Section C (ii) of the PoA-DD. | The CPA passed the procedure of avoiding double counting. | --conduct the avoiding double counting procedure as per Section C (ii). of PoA-DD. | Y |
| The start date of the CPA | 3. The start date of the CPA is not prior to 02/09/2011(the first GSC date of the PoA). | Documents listed in the right column will be used to ensure that the start date of each CPA is not prior to the first GSC date of the PoA of 02/09/2011. | --Equipment purchasing contract<br>--Construction contract or construction start record | Y |
| The applicability | **Criteria Related to Applicability** | | | |

| | | | | |
|---|---|---|---|---|
| and other requirements of AMS-III.D | **Conditions of AMS-III.D** | | | |
| | 4. All activities under a CPA are to install anaerobic animal manure management systems to achieve methane recovery and destruction by flaring/combustion or gainful use of the recovered biogas; | Documents listed in the right column will be used to ensure that all activities under a CPA are to install anaerobic animal manure management systems to achieve methane recovery and destruction. | --Technical flow figure;<br>--FSR; and<br>--Approval of FSR | Y |
| | 5. The livestock population in the farms included in each CPA under the PoA should be managed under confined conditions; | Documents listed in the right column will be used to ensure that the livestock population in the farms included in the CPA is managed under confined conditions. | -- On-site photo | Y |
| | 6. Manure or the streams obtained after treatment are not discharged into natural water resources; | Documents listed in the right column will be used to ensure that manure or the streams obtained after treatment are not discharged into natural water resources. | --FSR; or<br>--technical demonstration | Y |
| | 7. The annual average temperature of baseline site where anaerobic manure treatment facility is located is higher than 5 ℃; | Documents listed in the right column will be used to ensure that the annual average temperature of baseline site where anaerobic manure treatment facility locates are higher than 5 ℃. | --data from local meteorological station or FSR or internet web. | Y |
| | 8. In the baseline scenario the retention time of manure waste in the anaerobic treatment system should be greater than one month; | Documents listed in the right column will be used to ensure that In the baseline scenario the retention time of manure waste in the anaerobic treatment system is greater than one month. | --photo; or<br>--prove from local government; or<br>--other evidence | Y |

| | | | | |
|---|---|---|---|---|
| | 9. The baseline scenario for the manure treatment is that the manure waste from the livestock would be treated in anaerobic lagoons with the depth of at least 1m; | Documents listed in the right column will be used to ensure that the baseline lagoon depth of the activities are from is deeper than one meter. | --prove from local government; or<br><br>--other evidence, e.g. building drawing of lagoon. | Y |
| | 10. No methane recovery and destruction by flaring, combustion or gainful use takes place in the baseline scenario; | Documents listed in the right column will be used to ensure that in the baseline scenario, animal manure would be left to decay in uncovered anaerobic lagoons and the generated methane would be directly and fully emitted to atmosphere. | --photo; or<br><br>--prove from local government; or<br><br>--other evidence | Y |
| | 11. The residual waste from the animal manure management system must be handled aerobically, e.g. land application; | Documents listed in the right column will be used to ensure that the residual waste from the animal manure management system will be handled aerobically. | --FSR; | Y |
| | 12. Only animal manure will be anaerobically treated but no other organic matters are involved in the CPA; | According to FSR and technical flow, Only animal manure will be anaerobically treated but no other organic matters are involved in the CPA. | --FSR; or<br><br>--technical demonstration; | Y |
| | 13. Technical measures will be used to ensure that all biogas produced by the digester is used or flared; | Technical measures will be used to ensure that all biogas produced by the digester is used or flared. | --Biogas storage tank; and/or<br><br>--Flaring system; | Y |
| | 14. The storage time of the manure after removal from the animal barns, including | Documents listed in the right column will be used to ensure that the storage time of the manure after | --Technical flow demonstration | Y |

| | | | | |
|---|---|---|---|---|
| | transportation, should not exceed 45 days before being fed into the anaerobic digester. | removal from the animal barns of the activities is shorter than 45 days. | | |
| | 15. The emission reductions from type III components of the CPA should be less than or equal to 60,000t$CO_2$e/yr. | Documents listed in the right column will be used to ensure that in the generic CPA, the emission reductions from type III components is below 60,000t$CO_2$ e/yr; | --ER Calculation worksheet | Y |
| additionality | 16. A CPA should meet any one of following criteria for assessing additionality:<br><br>(a) Meets relevant requirement in "*Guidelines for demonstrating additionality of microscale project activities*", including:<br><br>• The geographic location of the project activity is in a special underdeveloped zone of the host country identified by the Government via any one of the following methods:<br><br>- The proportion of population with income less than USD 2 per day (PPP) in the region is greater than 50% calculated by using the most recent available data in official notifications for | The CPA meets the criterion (a/b/c) | --evidence regarding undeveloped zone;<br><br>--ER Calculation worksheet<br><br>--equipment brand or equipment purchase contract;<br><br>--IRR worksheet | Y |

| | | | | |
|---|---|---|---|---|
| | development assistance including for planning, management, and investment;<br>- The GNI per capita in the country is less than USD 3000 and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures which is calculated by using the most recent available data in official notifications for development assistance including for planning, management, and investment;<br>- Based on the recommendation of the designated national authority of the host country, the SUZ in the host country has been approved by EB of the CDM and published on the UNFCCC website.<br>• The emission reductions from type III components of the CPA is no more than 20 kt$CO_2$e per year<br>(b) Meets relevant requirement for the | | | |

| | | | | |
|---|---|---|---|---|
| | positive list of technologies and project activity types that are defined as automatically additional in *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*, including:<br>• Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs);<br>• The emission reductions of each unit included in the CPA is no more than 3,000 $tCO_2e$ per year;<br>(c) According to Investment Barrier in the *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*, the project IRR (before tax) of the project included in the CPA is lower than the benchmark of 7%; | | | |
| local stakeholder consultations and environmental impact analysis | 17. Each activity included in the CPA must have obtained approval of EIA. | Documents listed in the right column will be used to ensure that each activity included in the generic CPA has obtained approval of EIA. | -Approval of EIA | Y |
| Funding from | 18. The CPA has no public funding from | The CPA has no public funding from Annex I | --Statement by | Y |

| | | | | |
|---|---|---|---|---|
| Annex I parties | Annex I Parties; | Parties. | biogas plant owner. | |
| others | 19. The CPA is not a de-bundled component of a large scale activity. De-bundling check will be implemented according to *"Guidelines on assessment of debundling for SSC project activities"*. | Documents listed in the right column will be used to ensure that the CPA is not a de-bundled component of a large scale activity. | --PoA database; and/or<br><br>--Unfccc web net | Y |
| | 20. No fossil fuel is used in each activity included in the CPA other than for transportation; | Documents listed in the right column will be used to ensure that no fossil fuel is used in each activity included in the CPA other than for transportation. | --FSR; or<br><br>--Technical flow; | Y |
| | 21. Each animal manure treatment system included in the CPA is a Greenfield one and not a retrofit or capacity addition project. | Documents listed in the right column will be used to ensure that each animal manure treatment system included in the CPA is a newly built one. | -- FSR;<br><br>--or other evidence; | Y |
| | 22. The CPA crediting period does not exceed the PoA end date. | Documents listed in the right column will be used to ensure that the CPA crediting period does not exceed the PoA end date. | --CPA-DD | Y |

The following EB guidance and tool are referred to for demonstration of the CPA additionality:

***"Guidelines for demonstrating additionality of microscale project activities"*** (Ver. 04.0) in annex 26 of EB68, *and*

***"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*** (Ver.09.0) in annex 27 of EB68

The additionatlity of a CPA will be assessed as per any one of the three approaches as below:

**Approach 1**

The criteria o*f* "Microscale Project Activity"related to this PoA could be summarized as the following table.

| No. | Criteria in the guideline | Detailed criteria for the CPA under the PoA | Real situation of the CPA | Applicable? (Y/N) |
|---|---|---|---|---|
| 1 | The emission reductions from type III components of the project is no more than 20 kt$CO_2$e per year | The emission reductions from type III components of the CPA is no more than 20 kt$CO_2$e per year | | |
| 2 | The geographic location of the project activity is in one of the Least Developed Countries or the Small Island Countries (LDCs/SIDs) or in a special underdeveloped zone of the host country identified by the Government via any one of the following methods:<br>- The proportion of population with income less than USD 2 per day (PPP) in the region is greater than 50% calculated by using the | The geographic location of the projects in the CPA is in a special underdeveloped zone of the P.R. China identified by the Government via any one of the following methods:<br>- The proportion of population with income less than USD 2 per day (PPP) in the region is greater than 50% calculated by using the most | | |

| | | | | |
|---|---|---|---|---|
| | most recent available data in official notifications for development assistance including for planning, management, and investment;<br>- The GNI per capita in the country is less than USD 3000 and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures which is calculated by using the most recent available data in official notifications for development assistance including for planning, management, and investment;<br>- Based on the recommendation of the designated national authority of the host country, the SUZ in the host country has been approved by EB of the CDM and publised on the UNFCCC website. | recent available data in official notifications for development assistance including for planning, management, and investment;<br>- The GNI per capita in the country is less than USD 3000 and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures which is calculated by using the most recent available data in official notifications for development assistance including for planning, management, and investment;<br>- Based on the recommendation of the designated national authority of the host country, the SUZ in the host country has been approved | | |

| | | | | |
|---|---|---|---|---|
| | | by EB of the CDM and published on the UNFCCC website. | | |

According to the "*Guidelines for demonstrating additionality of microscale project activities*", project activities are additional if the conditions above are satisfied.

**Approach 2**

According to *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*, project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size of each unit is no larger than 5% of the small-scale CDM are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds.

The following table is applied to check whether or not the activities in the proposed CPA are applicable for this Approach on the additionality demonstration.

| No. | Criteria in the guideline | Detailed criteria for the activity in the CPA under the PoA | Real situation of the activity in the CPA | Applicable? (Y/N) |
|---|---|---|---|---|
| 1 | Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) | All the equipment units in the activity is solely isolated where the users are households or communities or Small and Medium Enterprises (SMEs) | | |
| 2 | the size of each unit is no larger than 5% of the small-scale CDM | - The annual emission reduction of each unit for the Type III measure is no larger than 3,000 $tCO_2e$. | | |

The activity in the proposed CPA is additional if all the requirements are met.

**Approach 3**

The CPA is additional only if all the projects under the CPA are proved to be additional according to the *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*

According to the *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"*, following methods could be used for the demonstration of additionality:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Investment barrier analysis will be applied for all the projects under the CPA. The following steps in the "*Tool for the Demonstration and Assessment of Additionality*" will be applied:

***Step 1 Determine appropriate analysis method***

***Step 2 Determine the benchmark***

***Step 3 Calculation and comparison of financial indicators***

***Step 4 Sensitivity analysis***

***Step 1 Determine appropriate analysis method***

The "Tool for the Demonstration and Assessment of Additionality" suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

Since each project under the CPA will earn revenues not only from the CERs sales but also from biogas sales, the simple cost analysis method is not appropriate.

Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. However, the project scenario of each project in the CPA has more output service than the baseline scenario (mainly includes the energy supply), thus they are not comparable. Therefore, the investment comparison analysis is not preferable.

Each project in the CPA will use benchmark analysis method (Option III) and demonstrate that it is not likely to be the most financially attractive option.

***Step 2 Determine the benchmark***

The project IRR (before tax) of 7% is suggested for the livestock industry in the *Economic Evaluation Code for Construction of Project* (ver.03), which is selected as the financial benchmark for the project under the CPA. Only if the project IRR of the project is higher than or equivalent to the benchmark, the project is financially feasible.

***Step 3 Calculation and comparison of financial indicators***

Basic parameters for calculation of financial indicators of each project will be shown as the table below.

Table 2. Financial Parameters of a project in the CPA

| **Parameter** | **Value** | **Units** | **Source** |
|---|---|---|---|
| Fixed asset investment | | | |
| Annual biogas output | | | |
| Biogas sale price (VAT Incl.) | | | |
| Coal saving | | | |
| Coal price (VAT Incl.) | | | |
| Annual power output | | | |
| Electricity tariff (VAT Incl.) | | | |
| Annual self-consumption electricity | | | |
| Electricity purchase price (VAT Incl.) | | | |
| Project lifetime (include construction period) | | | |
| Annual O&M cost | | | |
| Value added tax rate | | | |
| Income tax rate | | | |
| Expense for city maintenance and construction | | | |
| Education fee addition | | | |
| CER price | EU 8 /t$CO_2$e | | |

The tool states that: *If the CDM project activity has a less favorable indicator (e.g. lower FIRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.*

Therefore, it is not considered this CPA is financially attractive if the project IRR without additional revenue is lower than 7% (benchmark IRR).

***Step 4 Sensitivity analysis***

According to *"Guidance on the Assessment of Investment Analysis"***,** only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation.

A sensitivity analysis should be carried out to estimate whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variation in the critical assumptions. An

assessment is conducted assuming the above three indicators varied in the range of -10%-+10%.

If the project IRR of a typical SSC-CPA could not reach the benchmark even the variation range of the factor reaches 10%, then the CPA is additional.

**B.6. Estimation of emission reductions of a generic CPA**
**B.6.1. Explanation of methodological choices**
>>

**Ⅰ. Calculate baseline emissions**

According to AMS-III.D (Ver 18.0), $BE_y$ are calculated by using one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (*VS*) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure ($B_o$);

(b) Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (*SVS*) content.

Option (a) is adopted in a CPA, which is as below:

$$BE_y = GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j} \quad (1)$$

Where:

| | |
|---|---|
| $BE_y$ | Baseline emissions in year *y* ($tCO_2e$) |
| $GWP_{CH4}$ | Global Warming Potential (GWP) of $CH_4$ (21) |
| $D_{CH4}$ | $CH_4$ density (0.00067 t/m$^3$ at room temperature (20 ℃) and 1 atm pressure) |
| $LT$ | Index for all types of livestock |
| $j$ | Index for animal manure management system |
| $MCF_j$ | Annual methane conversion factor (MCF) for the baseline animal manure management system *j* |
| $B_{0,LT}$ | Maximum methane producing potential of the volatile solid generated for animal type *LT* (m$^3$ $CH_4$/kg dm) |
| $N_{LT,y}$ | Annual average number of animals of type *LT* in year *y* (numbers) |
| $VS_{LT,y}$ | Volatile solids for livestock *LT* entering the animal manure management system in |

year $y$ (on a dry matter weight basis, kg dm/animal/year)

$MS\%_{Bl,j}$ Fraction of manure handled in baseline animal manure management system $j$

$UF_b$ Model correction factor to account for model uncertainties (0.94)[3]

***Determination of*** $B_{0,LT}$

According to AMS-III.D (Ver 18.0), the maximum methane-producing capacity of the manure ($B_o$) varies by species and diet. Since country specific $B_o$ values are not available, default values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 can be used.

***Determination of*** $VS_{LT,y}$

Volatile solids (*VS*) are the organic material in livestock manure and consist of both biodegradable and non-biodegradable fractions. For the calculations the total *VS* excreted by each animal species is required. The preferred method to obtain *VS* is to use data from nationally published sources. These values shall be compared with IPCC default values and any significant differences shall be explained. If data from nationally published sources are not available, country-specific *VS* excretion rates can be estimated from feed intake levels, via the enhanced characterisation method (tier 2) described in section 10.2 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10. If country specific VS values are not available IPCC default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A-4 to 10 A-9 can be used provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to feed intake levels;

In case default IPCC values for *VS* are adjusted for a site-specific average animal weight, it shall be well explained and documented. The following equation shall be used:

$$VS_{LT,y} = \left( \frac{W_{site}}{W_{default}} \right) * VS_{default} * nd_y \qquad \text{(B1-1)}$$

Where:

$W_{site}$ Average animal weight of a defined livestock population at the project site (kg)

$W_{default}$ Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg)

$VS_{default}$ Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day)

$nd_y$ Number of days in year $y$ where the animal manure management system is operational

[3] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

***Determination of*** $MCF_j$

Methane Conversion Factors (*MCF*) values are determined for a specific manure management system and represent the degree to which $B_o$ is achieved. Where available country-specific *MCF* values that reflect the specific management systems used in particular countries or regions shall be used. Alternatively, the IPCC default values provided in table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 can be used.

Country-specific *MCF* is unavailable, the IPCC default values will therefore be adopted in a typical SSC-CPA.

***Determination of*** $N_{LT,y}$

According to AMS-III.D (Ver 18.0), the annual average number of animals ($N_{LT,y}$) are determined as follows:

$$N_{LT,y} = N_{da,y} * \left( \frac{N_{p,y}}{365} \right) \qquad \text{(B1-2)}$$

Where:

$N_{da,y}$ Number of days animal is alive in the farm in the year *y* (numbers)

$N_{p,y}$ Number of animals produced annually of type *LT* for the year *y* (numbers)

## Ⅱ. Calculate project emissions

According to AMS-III.D, 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 fossil fuels or electricity 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 ($PE_{storage,y}$)

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y} \qquad (2)$$

Where:

| | |
|---|---|
| $PE_y$ | Project emissions in year *y* ($tCO_2e$) |
| $PE_{PL,y}$ | Emissions due to physical leakage of biogas in year *y* ($tCO_2e$) |
| $PE_{flare,y}$ | Emissions from flaring or combustion of the biogas stream in the year *y* ($tCO_2e$) |
| $PE_{power,y}$ | Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* ($tCO_2e$) |
| $PE_{transp,y}$ | Emissions from incremental transportation in the year *y* ($tCO_2e$), as per relevant paragraph in AMS-III.AO |
| $PE_{storage,y}$ | Emissions from the storage of manure ($tCO_2e$) |

**1. Determination of $PE_{PL,y}$**

Two methods are proposed to calculate $PE_{PL,y}$ in AMS-III.D (Ver 18.0). Method (a) will be employed in the PoA. As option in paragraph 9(a) mentioned in AMS-III.D. is chosen for baseline calculation, option (i) will be used for calculation of $PE_{PL,y}$ and the formulae is as follows:

$$PE_{PL,y} = 0.10 * GWP_{CH4} * D_{CH4} * \sum_{i,LT} B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{i,y} \quad \text{(P1-1)}$$

Where:

| | |
|---|---|
| $MS\%_{i,y}$ | Fraction of manure handled in system *i* in year *y* |

**2. Determination of $PE_{flare,y}$**

In case of flaring/combustion of biogas, project emissions are estimated using the procedures described in the "Tool to determine project emissions from flaring gases containing methane".

According to the tool above, $PE_{flare,y}$ is calculated as per the formulae below:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times \left(1 - \eta_{flare,h}\right) \times \frac{GWP_{CH4}}{1000} \quad \text{(P2-1)}$$

Where:

| | |
|---|---|
| $PE_{flare,y}$ | Project emissions from flaring of the residual gas stream in year y ($tCO_2e$) |
| $TM_{RG,h}$ | Mass flow rate of methane in the residual gas in the hour h (kg/h) |
| $\eta_{flare,h}$ | Flare efficiency in hour h; 0 is used for this parameter. This is conservative. |
| $GWP_{CH4}$ | Global Warming Potential of methane valid for the commitment period ($tCO_2e/tCH_4$) |

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \quad \text{(P2-2)}$$

Where:

| | |
|---|---|
| $TM_{RG,h}$ | Mass flow rate of methane in the residual gas in the hour h; (kg/h) |
| $FV_{RG,h}$ | Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h;($m^3$/h) |
| $fv_{CH4,RG,h}$ | Volumetric fraction of methane in the residual gas on dry basis in hour h (NB: this corresponds to $fv_{i,RG,h}$ where i refers to methane) |
| $\rho_{CH4,n}$ | Density of methane at normal conditions (0.716); (kg/$m^3$) |

In case the measured $FV_{RG,h}$ is not in normal conditions, $\rho_{CH4,n}$ will be corrected as per formulae (E1-3).

**3. Determination of $PE_{power,y}$**

As fossil fuel is not involved in a typical SSC-CPA, $PE_{power,y}$ is equivalent to project emissions from electricity consumption. According to AMS-III.D, project emissions from electricity consumption are determined as per the procedures described in AMS-I.D "Grid connected renewable electricity generation", which is calculated as below:

$$PE_{power,y} = EC_{PJ,y} \times EF_{grid,CM,y} \quad \text{(P3-1)}$$

Where:

| | |
|---|---|
| $EC_{PJ,y}$ | Quantity of net electricity consumed by the Project in year *y* (MWh/yr) |
| $EF_{grid,CM,y}$ | Combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "*Tool to calculate the emission factor for an electricity system*"; |

***Calculation of $EF_{grid,CM,y}$***

According to the *"Tool to calculate the emission factor for an electricity system",* The $CO_2$ emission factor for the displacement of electricity generated by power plants in an electricity system is determined by calculating the "operating margin"(OM) and "build margin"(BM) as well as the "combined margin"(CM).

The tool provides procedures to determine the following parameters:

| Parameter | SI Unit | Description |
|---|---|---|
| $EF_{grid,CM,y}$ | $tCO_2$/MWh | Combined margin $CO_2$ emission factor for the project electricity system in year y |
| $EF_{grid,BM,y}$ | $tCO_2$/MWh | Build margin $CO_2$ emission factor for the project electricity system in year y |
| $EF_{grid,OM,y}$ | $tCO_2$/MWh | Operating margin $CO_2$ emission factor for the project electricity system in year y |

The following is the detailed process of calculating the baseline $CO_2$ emission factor of the grid which

the Project connected to according to the steps provided by the *Tool to calculate the emission factor for an electricity system (*hereafter referred to as the *Tool).*

***Sub-step 1. Identify the relevant electricity system.***

Chinese DNA has published a delineation of the project electricity system and connected electricity system. The project physically connects through transmission and distribution lines to the CCPG. It is composed of the local power grids covering Henan, Hubei, Hunan, Jiangxi, Sichuan Province and Chongqing City. Therefore, the project selects the CCPG for the calculation of baseline emission factor.

***Sub-step 2. Choose whether to include off-grid power plants in the project electricity system (optional)***

According to the *Tool*, 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.

Since the data of the off-grid power plants is not available, Option I is applied to calculate the operating margin and build margin emission factor.

***Sub-step 3. Select a method to determine operating margin (OM).***

According to the *Tool*, four methods compute the Operating Margin Emission factor can be used as follows:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total amount of grid generating output 1) in the recent five years, or 2) by taking into account long-term normal for hydroelectricity generation. If the dispatch data is available the (c) Dispatch Data Analysis OM method should be the first methodological choice, while in case of the Project, the (a) Simple OM method is adapted with two reasons as follows:

(1) In cases where China presently the power grid dispatch and load data are unavailable as business secrets, so (b) and (c) cannot apply in the Project for calculating the Operating Margin Emission Factor ($EF_{grid,OM,y}$).

(2) During the most recent 5 years, from 2006 to 2010 the hydroelectricity, nuclear-electricity and other

low-cost/must run resources annual proportion in CCPG is 35.12%, 35.46%, 39.43%, 37.87% and 35.96% from year 2006 to year 2010 respectively, which are much less than 50%.

For simple OM, the emission factor can be calculated using either of the two following data vintages:

- Ex ante option: A 3-year generation weighted average, based on the most recent data available at the time of submission of the CDM-PDD for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: The year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring. If the data required calculating the emission factor for year y usually only available later than six months after the end of year y.

Project participant employs "ex-ante" for its operation margin calculation with two reasons as follows:

1) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission; and
2) the calculation adopt *Notification on Determining Baseline Emission Factor of China's Grid (17/10/2012)*, which is published by Chinese DNA, therefore it is considered as authoritative data. In this notification, the OM is calculated *ex-ants*.

***Sub-step 4. Calculate the operating margin emission factor according to the selected method.***

From the *Tool to calculate the emission factor for an electricity system*, ($EF_{grid,simple,OM}$) may be calculated:

**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.

Because the fuel consumption data is unavailable for each power plant / unit, Operation A cannot be used. At the same time 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 so Option B was the only operation can be used.

Where Option C is used, the simple OM method formula of $EF_{Grid,OM,Simple,y}$ calculation is:

$$EF_{Grid,OM,simple,y} = \frac{\sum_i FC_{i,y} \bullet NCV_{i,y} \bullet EF_{CO2,i,y}}{\sum EG_y} \qquad \text{(B3-2)}$$

where:

$EF_{grid,OMsimply,y,}$ simple operating margin $CO_2$ emission factor in year y($tCO_2$/MWh);

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

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

$EF_{CO2,i,y}$ $CO_2$ emission factor of fossil fuel type i in year y ($tCO_2$/GJ) and

$EG_y$ net electricity generated and delivered to the grid by power plant / unit m 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) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2.

When there exists net electricity imports from a connected electricity system within the same host country(ies):

(1) the emission factor(s) of the specific power plant(s) from which electricity is imported, if and only if the specific plants are clearly known, or

(2) the emission factor of the exporting grid, if the specific plants are not clearly known.

The data on electricity generation and auxiliary electricity consumption are obtained from the *China Electric Power Yearbook* from 2009 to 2011 (published annually). The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2009 to 2011 (published annually after 2003). The emission factors of the fuels adopted are obtained from *Table 1.3* and *Table 1.4* of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Volume 2, Chap 1, Page 1.21-1.24.

The detailed calculation can be find in Annex 3, the $EF_{grid,OM,y}$ = **0.9944** $tCO_2$/MWh

***Sub-step 5. Calculate the build margin (BM) emission factor.***

In terms of vintage of data, project participants can choose between one of the following two options: 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 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.

The PDD choose Option 1.

According to the *Tool*, the following equation (11) is adopted to calculate $EF_{grid,BM,y}$.

$$EF_{Grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \text{(B3-3)}$$

where:

$EF_{grid,BM,y}$ build margin $CO_2$ emission factor in year y ($tCO_2/MWh$);
$EG_{m,y}$ 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 generation data is available;

Consider of data availability, The Project adopted the following deviation method which was published by Chinese DNA and accepted by CDM EB[4]:

1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.

2) Use of weights estimated using installed capacity in place of annual electricity generation.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor use the efficiency level of the best technology commercially available in China.

Since data of installed capacities cannot be separated to coal based, oil based and gas based at present, BM is calculated with following steps and formula:

(1) Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year

[4] http://cdm.unfccc.int/Projects/Deviations ; DNV deviation request, "Request for clarification on use of approved methodology AM0005 for several projects in China"

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times NCV_{iy} \times EF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{iy} \times EF_{i,j,y}} \quad \text{(B3-4)}$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times NCV_{iy} \times EF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{iy} \times EF_{i,j,y}} \quad \text{(B3-5)}$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times NCV_{iy} \times EF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{iy} \times EF_{i,j,y}} \quad \text{(B3-6)}$$

where:

$F_{i,j,y}$ the amount of fuel i (in a mass or volume unit) consumed by power j in year(s) y;

$NCV_{ij}$ Net calorific value (energy content) per mass or volume unit of a fuel *i* in year *y*;

$EF_{i,j,y}$ the $CO_2$ emission coefficient of fuel i ($tCO_2/GJ$);

(2) Calculate emission factor for thermal power of the grid based on the result of Step a and the efficiency level of the best technology commercially available in China

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas} \times EF_{Gas,Adv,y} \quad \text{(B3-7)}$$

Where $EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$ and $EF_{Gas.Adv,y}$ represents the efficiency level of the best coal-fired, oil-based and gas-based power generation technology commercially available in China.

Step c. Calculate BM of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad \text{(B3-8)}$$

Where $CAP_{Total,y}$ is total capacity additions while $CAP_{Thermal,y}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2009 to 2011 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

With reference to the *Notification on Determining Baseline Emission Factors of China Power Grid,* the weighted average fuel consumption for power generation of 600-1000 MW sub-critical coal-fired power

generators built in 2010 (309.9gCe/kWh) and the 390 MW oil/gas based combined cycle power generators (236.6gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

The detailed calculation can be find in Annex 3, the $EF_{grid,BM,y}$ = **0.4733** $tCO_2$/MWh.

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

Based on the *Tool*, the baseline emission factor ($EF_{grid,CM,y}$) is calculated as the weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$), as

$$EF_{grid,CM,y} = \omega_{OM} \cdot EF_{grid,OM,y} + \omega_{BM} \cdot EF_{grid,BM,y} \quad \text{(B3-9)}$$

According to the *Tool*, 0.5 was taken for both the weight $w_{OM}$ and the weight $w_{BM}$ as default. Therefore the combined baseline emission factor

$EF_{grid,CM,y}$ =0.5 × 0.9944+ 0.5 × 0.4733 = **0.73385 $tCO_2e$/MWh** ($tCO_2e$/MWh).

**4. Determination of** $PE_{transp,y}$

According to number 12 in Table AMS-III.D.1 of AMS-III.D, $PE_{transp,y}$. is calculated as per the relevant procedure in AMS-III.AO. According to AMS-III.AO (Ver.01), this parameter is calculated as below:

$$PE_{y,transp} = (Q_y / CT_y) * DAF_w * EF_{CO2} + (Q_{y,treatment} / CT_{y,treatment}) * DAF_{treatment} * EF_{CO2} \quad \text{(P4-1)}$$

Where:

| | |
|---|---|
| $Q_y$ | Quantity of raw waste/manure treated and/or wastewater co-treated in the year *y* (tonnes) |
| $CT_y$ | Average truck capacity for transportation (tonnes/truck) |
| $DAF_w$ | Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck) |
| $EF_{CO2}$ | $CO_2$ emission factor from fuel use due to transportation ($kgCO_2$/km, IPCC default values or local values may be used) |
| $Q_{y,treatment}$ | Quantity of compost produced in year *y* (tonnes) |
| $CT_{y,treatment}$ | Average truck capacity for compost transportation (tonnes/truck) |
| $DAF_{treatment}$ | Average distance for compost transportation (km/truck) |

**5. Determination of** $PE_{storage,y}$

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 method shall be used to calculate project emissions from manure storage:

$$PE_{storage,y} = GWP_{CH_4} * D_{CH_4} * \sum_{LT,l} \left[ \frac{365}{AI_l} \sum_{d=1}^{AI} (N_{LT,y} * VS_{LT,d} * MS\%_l * (1 - e^{-k\ (AI_l - d)}) * MCF_l * B_{0_{LT}}) \right] \quad \text{(P5-1)}$$

Where:

| | |
|---|---|
| $PE_{storage,y}$ | Project emissions on account of manure storage in year *y* ($tCO_2e$) |
| $AI_l$ | Annual average interval between manure collection and delivery for treatment at a given storage device *l* (days) |
| $VS_{LT,d}$ | 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 $AI_l$ |
| $MCF_l$ | Annual methane conversion factor for the project manure storage device l from Table 10.17, Chapter 10, Volume 4 |

## Ⅲ. Calculate Leakage emissions

As per AMS-III.D., no leakage calculation is required.

## Ⅳ. Calculate Emission Reductions

Emission reductions achieved by a typical SSC-CPA during a given year can be estimated ex-ante as below:

$$ER_y = BE_y - PE_y \quad \text{(E1-1)}$$

Where:

| | |
|---|---|
| $ER_y$ | Emission reductions in year *y* ($tCO_2e$) |

According to AMS-III.D (Ver 18.0), the emission reductions achieved by avoiding methane emissions 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 ($N_{LT,y}$, $MS\%_{i,y}$, $MS\%_{l}$, $AI_l$, and in case adjusted values for animal weight are used as defined in paragraph 10 (c): $VS_{LT,y}$). The emission reductions achieved in any year are the lowest value of the following:

$$ER_{y,ex\,post} = \min[(BE_{y,ex\,post} - PE_{y,ex\,post}),(MD_y - PE_{power,y,ex\,post})] \quad \text{(E1-2)}$$

Where:

| | |
|---|---|
| $ER_{y,ex\,post}$ | Emission reductions achieved from methane recovery based on monitored values for year *y* ($tCO_2e$) |
| $BE_{y,ex\,post}$ | Baseline emissions calculated using equation 1 of AMS-III.D (for projects using option in paragraph 9 (a)) using *ex post* monitored values of $N_{LT,y}$ |
| $PE_{y,ex\,post}$ | Project emissions calculated using equation 5 of AMS-III.D using *ex-post* monitored values of $N_{LT,y}$, $MS\%_{i,y}$, $MS\%_{l}$, $AI_l$, $Q_{res\,waste,y}$ and if applicable $VS_{LT,y}$ |
| $MD_y$ | Methane captured and used gainfully by the project activity in year *y* ($tCO_2e$) |
| $PE_{power,y,ex\,post}$ | Emissions from the use of fossil fuel or electricity for the operation of the installed facilities based on monitored values in the year *y* ($tCO_2e$) |

In case of flaring/combustion $MD_y$ will be measured using the conditions of the flaring process:

$$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4} \quad \text{(E1-3)}$$

Where:

| | |
|---|---|
| $BG_{burnt,y}$ | The amount of biogas utilized in year y ($m^3$) |
| $w_{CH4,y}$ | Methane content in biogas in the year *y* (volume fraction) |
| $FE$ | Flare efficiency in the year *y* (fraction); |

According to AMS-III.D., when the amount of methane that is combusted for energy and that is flared is separately monitored, a destruction efficiency of 100% can be used for the amount that is combusted for energy. Therefore, 100% will be used for ***FE***.

At room temperature (20 ℃) and 1 atm pressure i.e. normal condition, $CH_4$ density is 0.00067 $t/m^3$. If the measured volume of biogas is not in normalized cubic meters, this parameter will be corrected by using actual temperature and pressure of biogas based on state equation of ideal gas, as below:

$$D_{CH4,PJ} = 0.00067 \times \frac{293 \times P_{PJ}}{1 \times (273 + T_{PJ})} \quad \text{(E1-4)}$$

Where:

| | |
|---|---|
| $T_{PJ}$ | Temperature of the biogas at the flow measurement site; (℃) |
| $P_{PJ}$ | Pressure of the biogas at the flow measurement site; (atm) |
| 0.00067 | $CH_4$ density at room temperature and 1 atm pressure; ($t/m^3$) |
| 293 | Thermodynamic temperature corresponding to normal condition; (K) |
| 273 | The parameter for unit conversion from celsius temperature to thermodynamic temperature; (K) |
| 1 | Pressure corresponding to normal condition; (atm) |

**B.6.2. Data and parameters that are to be reported ex-ante**
*(Copy this table for each data and parameter.)*

| **Data / Parameter** | $MCF_j$ |
|---|---|
| **Unit** | % |
| **Description** | Annual methane conversion factor (MCF) for the baseline animal waste management system "j" |
| **Source of data** | IPCC 2006 table10.17 |
| **Value(s) applied** | Please see individual CPA-DD |
| **Choice of data or Measurement methods and procedures** | According to the Methodology AMS III.D., when national special value is unavailable, IPCC default value is used. |
| **Purpose of data** | Calculation of baseline emissions. |
| **Additional comment** | - |

| **Data / Parameter** | $B_{O,LT}$ |
|---|---|
| **Unit** | $m^3/CH_4$/kg dm |
| **Description** | Maximum methane producing potential of the volatile solid generated for animal type "LT" |
| **Source of data** | IPCC 2006 table10A-7 and 10A-8 |
| **Value(s) applied** | Please see individual CPA-DD |
| **Choice of data or Measurement methods and procedures** | According to the Methodology AMS III.D.(Ver 18.0), when national special value is unavailable, IPCC default value is used. |
| **Purpose of data** | Calculation of baseline emissions. |
| **Additional comment** | - |

| Data / Parameter | $MS\%_{Bl,j}$ |
|---|---|
| Unit | % |
| Description | Fraction of manure handled in baseline animal manure management system "j" |
| Source of data | The CPA principal |
| Value(s) applied | Please see individual CPA-DD |
| Choice of data or Measurement methods and procedures | All manure handled in baseline animal manure management. |
| Purpose of data | Calculation of baseline emissions. |
| Additional comment | - |

| Data / Parameter | $W_{default}$ |
|---|---|
| Unit | kg |
| Description | Default average animal weight of a defined population |
| Source of data | Table10A-7 and 10A-8 in IPCC 2006 |
| Value(s) applied | Please see individual CPA-DD |
| Choice of data or Measurement methods and procedures | IPCC default value is credible data source. |
| Purpose of data | Calculation of baseline emissions. |
| Additional comment | - |

| Data / Parameter | $VS_{default}$ |
|---|---|
| Unit | kg dm/animal/day |
| Description | Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population |
| Source of data | Table10A-7 and 10A-8 in IPCC 2006 |
| Value(s) applied | Please see individual CPA-DD |
| Choice of data or Measurement methods and procedures | IPCC default value is credible data source. |
| Purpose of data | Calculation of baseline emissions. |
| Additional comment | - |

| | |
|---|---|
| **Data / Parameter** | $EG_y$ |
| **Unit** | MWh |
| **Description** | net electricity generated and delivered to the grid by power plant / unit m in year y |
| **Source of data** | *China Electric Statistical Yearbook, 2009-2011* |
| **Value(s) applied** | Values depend on specifically fuel, referring to Appendix 4. |
| **Choice of data or Measurement methods and procedures** | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | Reasonable |

| | |
|---|---|
| **Data / Parameter** | $FC_{i,y}$ |
| **Unit** | mass or volume unit |
| **Description** | Amount of fossil fuel type i consumed in the project electricity system in year y |
| **Source of data** | *China Energy Statistical Yearbook, 2009-2011* |
| **Value(s) applied** | Values depend on specifically fuel, referring to Appendix 4. |
| **Choice of data or Measurement methods and procedures** | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | Reasonable |

| | |
|---|---|
| **Data / Parameter** | $F_{i,j,y}$ |
| **Unit** | Mass or volume |
| **Description** | The fuel consumption of fuel i in power plant j during year y |
| **Source of data** | *China Energy Statistical Yearbook, 2009-2011* |
| **Value(s) applied** | Values depend on specifically fuel, referring to Appendix 4. |
| **Choice of data or Measurement methods and procedures** | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | Reasonable |

| | |
|---|---|
| **Data / Parameter** | $NCV_{i,y}$ |
| **Unit** | TJ/t, TJ/km$^3$ |
| **Description** | Net calorific value (energy content) per mass or volume unit of a fuel *i* in year *y* |
| **Source of data** | *China Energy Statistical Yearbook, 2009-2011* |
| **Value(s) applied** | Values depend on specifically fuel, referring to Appendix 4. |
| **Choice of data or Measurement methods and procedures** | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | Reasonable |

| | |
|---|---|
| **Data / Parameter** | $EF_{CO2,i,y}$ |
| **Unit** | tC/TJ ($tCO_2e$/TJ) |
| **Description** | $CO_2$ emission factor of fossil fuel type i in year y ($tCO_2$/GJ) |
| **Source of data** | *IPCC 2006 Revised Guidelines* |
| **Value(s) applied** | Values depend on specifically fuel, referring to Appendix 4. |
| **Choice of data or Measurement methods and procedures** | According to the *Tool to calculate the emission factor for an electricity system* requirement, use IPCC default value. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | Reasonable |

| | |
|---|---|
| **Data / Parameter** | $OXID_{i,y}$ |
| **Unit** | % |
| **Description** | Oxidation factor of the fuel *i* in year *y* |
| **Source of data** | *IPCC 2006 Revised Guidelines* |
| **Value(s) applied** | Values depend on specifically fuel, referring to Appendix 4. |
| **Choice of data or Measurement methods and procedures** | According to the *Tool to calculate the emission factor for an electricity system* requirement, use IPCC default value. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | Reasonable |

| Data / Parameter | **Internal use rate of power plant** |
|---|---|
| **Unit** | % |
| **Description** | The internal power consumption of power plants in year(s) *y* |
| **Source of data** | *China Electric Power Yearbook 2009-2011* |
| **Value(s) applied** | See Appendix 4 for details. |
| **Choice of data or Measurement methods and procedures** | Data used are from Chinese authorities. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | - |

| Data / Parameter | $CAP_{i,j,y}$ |
|---|---|
| **Unit** | MW |
| **Description** | Installed capacities of power plant category *i* of province *j* in years *y*. |
| **Source of data** | *China Electric Power Yearbook 2009-2011* |
| **Value(s) applied** | See Appendix 4 for details. |
| **Choice of data or Measurement methods and procedures** | Data used are from Chinese authorities. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | - |

| Data / Parameter | $w_{CH4,y}/fv_{CH4,RG,h}$ |
|---|---|
| **Unit** | - |
| **Description** | Methane fraction of biogas |
| **Source of data** | AMS-III.D. （Ver 18.0） |
| **Value(s) applied** | 60% |
| **Choice of data or Measurement methods and procedures** | According to AMS-III.D. (Ver 18.0), a default value of 60% methane content can be used. |
| **Purpose of data** | Calculation of project emissions. |
| **Additional comment** | Reasonable |

| Data / Parameter | $MCF_l$ |
|---|---|
| Unit | - |
| Description | Annual methane conversion factor for the project manure storage device *l* |
| Source of data | Table 10.17, Chapter 10, Volume 4, 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Value(s) applied | See individual CPA-DD |
| Choice of data or Measurement methods and procedures | According to the Methodology AMS III.D.(Ver 18.0), IPCC default value should be used. |
| Purpose of data | Calculation of project emissions. |
| Additional comment | - |

| Data / Parameter | $\eta_{flare,h}$ |
|---|---|
| Unit | - |
| Description | Flare efficiency of biogas flaring in the year y. |
| Source of data | - |
| Value(s) applied | 0% |
| Choice of data or Measurement methods and procedures | This is the most conservative way. |
| Purpose of data | Calculation of project emissions. |
| Additional comment | - |

| Data / Parameter | $EF_{CO2}$ |
|---|---|
| Unit | $tCO_2$/km |
| Description | $CO_2$ emission factor from fuel use due to transportation |
| Source of data | Since there is no such parameter in IPCC 2006 Guidelines, thus the value in IPCC 1996 is applied |
| Value(s) applied | 0.001011 |
| Choice of data or Measurement methods and procedures | Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, Moderate Control index for US Heavy Duty Diesel Vehicles in Table 1-32, page 1.75 |
| Purpose of data | Calculation of project emissions. |
| Additional comment | Only applied for the CPAs in which the material transportation is involved |

| Data / Parameter | $\rho_{CH4,n}$ |
|---|---|
| Unit | kg/m$^3$ |
| Description | Density of methane at normal conditions |
| Source of data | Tool to determine project emissions from flaring gases containing methane |
| Value(s) applied | 0.716 |
| Choice of data or Measurement methods and procedures | Tool to determine project emissions from flaring gases containing methane |
| Purpose of data | Calculation of project emissions |
| Additional comment | - |

**B.6.3. Ex-ante calculations of emission reductions**

>>

**Ⅰ. Calculate baseline emissions**

According to AMS-III.D, $BE_y$ are calculated by using one of the following two options:

(a) Using the amount of the waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter 'Emissions from Livestock and Manure Management' under the volume 'Agriculture, Forestry and other Land use' of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). For this calculation, information about the characteristics of the manure and of the management systems in the baseline is required. Manure characteristics include the amount of volatile solids (*VS*) produced by the livestock and the maximum amount of methane that can be potentially produced from that manure ($B_o$);

(b) Using the amount of manure that would decay anaerobically in the absence of the project activity based on direct measurement of the quantity of manure treated together with its specific volatile solids (*SVS*) content.

Option (a) is adopted in the generic CPA.

***Determination of*** $N_{LT,y}$

According to AMS-III.D, the annual average number of animals ($N_{LT,y}$) are determined as follows:

$$N_{LT,y} = N_{da,y} * \left( \frac{N_{p,y}}{365} \right) \qquad \text{(B1-1)}$$

Where:

$N_{da,y}$ Number of days animal is alive in the farm in the year *y* (numbers)

$N_{p,y}$ Number of animals produced annually of type *LT* for the year *y* (numbers)

The first real case CPA is used for sample calculation as the following table:

| $N_{da,y}$ | | $N_{p,y}$ | | $N_{LT,y}$ | |
|---|---|---|---|---|---|
| Market swine | Breeding swine | Market swine | Breeding swine | Market swine | Breeding swine |
| 180 days | 365 days | 13,000 | 700 | 180*13000/365=6,411 | 365*700/365=700 |

***Determination of*** $MCF_j$

Methane Conversion Factors (*MCF*) values are determined for a specific manure management system and represent the degree to which $B_o$ is achieved. Where available country-specific *MCF* values that reflect the specific management systems used in particular countries or regions shall be used. Alternatively, the IPCC default values provided in table 10.17 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 can be used.

Country-specific *MCF* is unavailable, the IPCC default values will therefore be adopted in a CPA.

For the first real case CPA, annual average temperature at the project site is 15$^o$C, MCF value is 0.74 for uncovered anaerobic lagoon at 15$^o$C according to table 10.17 of 2006 IPCC.

***Determination of*** $VS_{LT,y}$

Volatile solids (*VS*) are the organic material in livestock manure and consist of both biodegradable and non-biodegradable fractions. For the calculations the total *VS* excreted by each animal species is required. The preferred method to obtain *VS* is to use data from nationally published sources. These values shall be compared with IPCC default values and any significant differences shall be explained. If data from nationally published sources are not available, country-specific *VS* excretion rates can be estimated from feed intake levels, via the enhanced characterisation method (tier 2) described in section 10.2 in 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10. If country specific VS values are not available IPCC default values from 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 chapter 10 table 10 A-4 to 10 A-9 can be used provided that the project participants assess the suitability of those data to the specific situation of the treatment site particularly with reference to feed intake levels;

In case default IPCC values for *VS* are adjusted for a site-specific average animal weight, it shall be well explained and documented. The following equation shall be used:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}}\right) * VS_{default} * nd_y \quad \text{(B1-2)}$$

Where:

| | |
|---|---|
| $W_{site}$ | Average animal weight of a defined livestock population at the project site (kg) |
| $W_{default}$ | Default average animal weight of a defined population, this data is sourced from IPCC 2006 (kg) |
| $VS_{default}$ | Default value for the volatile solid excretion rate per day on a dry-matter basis for a defined livestock population (kg dm/animal/day) |
| $nd_y$ | Number of days in year $y$ where the animal manure management system is operational |

The first real case CPA is used for sample calculation as below.

| **$W_{site}$ (kg)** | |
|---|---|
| **Market swine** | **Breeding swine** |
| 55 | 100 |

| **$W_{default}$ (kg)** | |
|---|---|
| **Market swine** | **Breeding swine** |
| 28 | 28 |

| **$VS_{default}$ (kg dm/animal/day)** | |
|---|---|
| **Market swine** | **Breeding swine** |
| 0.3 | 0.3 |

| **$nd_y$ (days)** | **$VS_{LT,y}$ (kg dm/animal/years)** | |
|---|---|---|
| **-** | **Market swine** | **Breeding swine** |
| 365 | 55/28*0.3*365=215 | 100/28*0.3*365=391 |

***Determination of*** $B_{0,LT}$

According to AMS-III.D (Ver 18.0), the maximum methane-producing capacity of the manure ($B_o$) varies

by species and diet. Since country specific $B_o$ values are not available, default values from tables 10 A-4 to 10 A-9 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4 Chapter 10 can be used.

For the first real case CPA, $B_{O,LT}$ is as below:

| **$B_{O,LT}$ ($m^3$ $CH_4$/kg dm)** | |
|---|---|
| **Market swine** | **Breeding swine** |
| 0.29 | 0.29 |

***Determination of*** $BE_y$

$$BE_y = GWP_{CH4} * D_{CH4} * UF_b * \sum_{j,LT} MCF_j * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j} \quad \text{(B1-3)}$$

Where:

| | |
|---|---|
| $BE_y$ | Baseline emissions duet to biogas recovery in year *y* ($tCO_2e$) |
| $GWP_{CH4}$ | Global Warming Potential (GWP) of $CH_4$ (21) |
| $D_{CH4}$ | $CH_4$ density (0.00067 t/$m^3$ at room temperature (20 ℃) and 1 atm pressure) |
| $LT$ | Index for all types of livestock |
| $j$ | Index for animal manure management system |
| $MCF_j$ | Annual methane conversion factor (MCF) for the baseline animal manure management system *j* |
| $B_{0,LT}$ | Maximum methane producing potential of the volatile solid generated for animal type *LT* ($m^3$ $CH_4$/kg dm) |
| $N_{LT,y}$ | Annual average number of animals of type *LT* in year *y* (numbers) |
| $VS_{LT,y}$ | Volatile solids for livestock *LT* entering the animal manure management system in year *y* (on a dry matter weight basis, kg dm/animal/year) |
| $MS\%_{Bl,j}$ | Fraction of manure handled in baseline animal manure management system *j* |
| $UF_b$ | Model correction factor to account for model uncertainties (0.94)[5] |

The first real case CPA is used for sample calculation as below.

| **Farm 1** | | **Market swine** | **Breeding swine** |
|---|---|---|---|

[5] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

| | | | |
|---|---|---|---|
| $MCF_j$ | - | 0.74 | 0.74 |
| $B_{0,LT}$ | $m^3$ $CH_4$/kg dm | 0.29 | 0.29 |
| $N_{LT,y}$ | - | 6,411 | 700 |
| $VS_{LT,y}$ | kg dm/animal/year | 215 | 391 |
| $MS\%_{Bl,j}$ | - | 100% | 100% |
| $UF_b$ | - | 0.94 | |
| $D_{CH4}$ | $t/m^3$ | 0.00067 | |
| $GWP_{CH4}$ | $tCO_2e/tCH_4$ | 21 | |
| $BE_y$ | **$tCO_2e$** | **21*0.00067*0.94*(0.74*0.29*6411*215*100%+ 0.74*0.29*700*391*100%)=4,691** | |

## Ⅱ. Calculate project emissions

According to AMS-III.D (Ver 18.0), 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 fossil fuels or electricity 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 ($PE_{storage,y}$)

### 1. Determination of $PE_{PL,y}$

According to AMS-III.D, $PE_{PL,y}$ is calculated as follows:

$$PE_{PL,y} = 0.10 * GWP_{CH4} * D_{CH4} * \sum_{i,LT} B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{i,y} \qquad \text{(P1-1)}$$

Where:

$MS\%_{i,y}$ Fraction of manure handled in system *i* in year *y*

The first real case CPA is used for sample calculation.

| | | **Market swine** | **Breeding swine** |
|---|---|---|---|
| $B_{0,LT}$ | $m^3$ $CH_4$/kg dm | 0.29 | 0.29 |
| $N_{LT,y}$ | - | 6,411 | 700 |
| $VS_{LT,y}$ | kg dm/animal/year | 215 | 391 |
| $MS\%_{Bl,j}$ | - | 100% | 100% |
| $UF_b$ | - | 0.94 | |
| $D_{CH4}$ | $t/m^3$ | 0.00067 | |

| | | |
|---|---|---|
| $GWP_{CH4}$ | $tCO_2e/tCH_4$ | 21 |
| $PE_{PL,y}$ | **$tCO_2e$** | **0.1*21*0.00067*(0.29*6411*215*100%+ 0.29*700*391*100%)=674.34** |

2. **Determination of** $PE_{flare,y}$

In case of flaring/combustion of biogas, project emissions are estimated using the procedures described in the "Tool to determine project emissions from flaring gases containing methane".

According to the tool above, $PE_{flare,y}$ is calculated as per the formulae below:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times \left(1 - \eta_{flare,h}\right) \times \frac{GWP_{CH4}}{1000} \qquad \text{(P2-1)}$$

Where:

| | |
|---|---|
| $PE_{flare,y}$ | Project emissions from flaring of the residual gas stream in year y ($tCO_2e$) |
| $TM_{RG,h}$ | Mass flow rate of methane in the residual gas in the hour h (kg/h) |
| $\eta_{flare,h}$ | Flare efficiency in hour h; 0 is used for this parameter. This is conservative. |
| $GWP_{CH4}$ | Global Warming Potential of methane valid for the commitment period ($tCO_2e/tCH_4$) |

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \qquad \text{(P2-2)}$$

Where:

| | |
|---|---|
| $TM_{RG,h}$ | Mass flow rate of methane in the residual gas in the hour h; (kg/h) |
| $FV_{RG,h}$ | Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h;($m^3$/h) |
| $fv_{CH4,RG,h}$ | Volumetric fraction of methane in the residual gas on dry basis in hour h (NB: this corresponds to $fv_{i,RG,h}$ where i refers to methane) |
| $\rho_{CH4,n}$ | Density of methane at normal conditions (0.716); (kg/$m^3$) |

The first real case is used for sample calculation. All the biogas recovered in the first real case CPA will be utilized for energy generation at normal conditions, thus, $PE_{flare,y}$ is ex-ante calculated as zero.

3. **Determination of** $PE_{power,y}$

As fossil fuel is not involved in the CPA, $PE_{power,y}$ is equivalent to project emissions from electricity consumption. According to AMS-III.D (Ver 18.0), which is calculated as below:

$$PE_{power,y} = EC_{PJ,y} \times EF_{grid,CM,y} \qquad \text{(P3-1)}$$

Where:

$EC_{PJ,y}$ Quantity of net electricity consumed by the Project in year *y* (MWh/yr)

$EF_{grid,CM,y}$ Combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "*Tool to calculate the emission factor for an electricity system*" ver. 02.2.0; please see PoA-DD

The first real case is used for sample calculation as below:

| $EC_{PJ,y}$ | $EF_{grid,CM,y}$ | $PE_{power,y}$ |
|---|---|---|
| MWh | $tCO_2e$/MWh | $tCO_2e$ |
| 482 | 0.73385 | 482*0.73385=353.72 |

## 4. Determination of $PE_{transp,y}$

According to number 12 in Table AMS-III.D.1 of AMS-III.D, $PE_{transp,y}$. is calculated as per the relevant procedure in AMS-III.AO. According to AMS-III.AO (Ver.01), this parameter is calculated as below:

$$PE_{y,transp} = (Q_y / CT_y) * DAF_w * EF_{CO2} + (Q_{y,treatment} / CT_{y,treatment}) * DAF_{treatment} * EF_{CO2} \qquad \text{(P4-1)}$$

Where:

$Q_y$ Quantity of raw waste/manure treated and/or wastewater co-treated in the year *y* (tonnes)

$CT_y$ Average truck capacity for transportation (tonnes/truck)

$DAF_w$ Average incremental distance for raw solid waste/manure and/or wastewater transportation (km/truck)

$EF_{CO2}$ $CO_2$ emission factor from fuel use due to transportation ($kgCO_2$/km, IPCC default values or local values may be used)

$Q_{y,treatment}$ Quantity of compost produced in year *y* (tonnes)

$CT_{y,treatment}$ Average truck capacity for compost transportation (tonnes/truck)

$DAF_{treatment}$ Average distance for compost transportation (km/truck)

The first real case CPA is used for sample calculation. As the CPA is located within Hubei Chuyue Breeding Farm, transportation distance is not increased in the CPA. Therefore,

$$PE_{transp,y}=0$$

**5. Determination of $PE_{storage,y}$**

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 method shall be used to calculate project emissions from manure storage:

$$PE_{storage,y} = GWP_{CH_4} * D_{CH_4} * \sum_{LT,l}\left[\frac{365}{AI_l}\sum_{d=1}^{AI}(N_{LT,y} * VS_{LT,d} * MS\%_l * (1-e^{-k\ (AI_l - d)}) * MCF_l * B_{0_{LT}})\right] \quad \text{(P5-1)}$$

Where:

| | |
|---|---|
| $PE_{storage,y}$ | Project emissions on account of manure storage in year *y* ($tCO_2e$) |
| $AI_l$ | Annual average interval between manure collection and delivery for treatment at a given storage device *l* (days) |
| $VS_{LT,d}$ | 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 $AI_l$ |
| $MCF_l$ | Annual methane conversion factor for the project manure storage device l from Table 10.17, Chapter 10, Volume 4 |

The first real case CPA is used for sample calculation. For the first real case CPA, the storage time of the manure after removal from the animal barns is 12 hours, which does not exceed 24 hours. Therefore,

$$PE_{storage,y}=0$$

**Calculation of $PE_y$**

$$PE_y = PE_{PL,y} + PE_{flare,y} + PE_{power,y} + PE_{transp,y} + PE_{storage,y} \quad (2)$$

Where:

| | |
|---|---|
| $PE_y$ | Project emissions in year *y* ($tCO_2e$) |
| $PE_{PL,y}$ | Emissions due to physical leakage of biogas in year *y* ($tCO_2e$) |

$PE_{flare,y}$ Emissions from flaring or combustion of the biogas stream in the year *y* ($tCO_2e$)

$PE_{power,y}$ Emissions from the use of fossil fuel or electricity for the operation of the installed facilities in the year *y* ($tCO_2e$)

$PE_{transp,y}$ Emissions from incremental transportation in the year *y* ($tCO_2e$), as per relevant paragraph in AMS-III.AO

$PE_{storage,y}$ Emissions from the storage of manure ($tCO_2e$)

The first real case CPA is used for sample calculation as below:

| $PE_{PL,y}$ | $PE_{flare,,y}$ | $PE_{Power,y}$ | $PE_{transp,y}$ | $PE_{storage,y}$ | $PE_y$ |
|---|---|---|---|---|---|
| $tCO_2e$ | $tCO_2e$ | $tCO_2e$ | $tCO_2e$ | $tCO_2e$ | $tCO_2e$ |
| 674.34 | 0 | 353.72 | 0 | 0 | 674.34+0+353.72+0+0 =1,028 |

## Ⅲ. Calculate Leakage emissions

As per AMS-III.D., no leakage calculation is required.

## Ⅳ. Calculate Emission Reductions

Emission reductions achieved by the CPA during a given year can be estimated ex-ante as below:

$$ER_y = BE_y - PE_y \qquad (3)$$

Where:

$ER_y$ Emission reductions in year *y* ($tCO_2e$)

The first real case is used for sample calculation as below:

| $BE_y$ | $PE_y$ | $ER_y$ |
|---|---|---|
| $tCO_2e$ | $tCO_2e$ | $tCO_2e$ |
| 4,691 | 1,028 | 4691-1028=3,663 |

**B.7. Application of the monitoring methodology and description of the monitoring plan**

**B.7.1. Data and parameters to be monitored by each generic CPA**

*(Copy this table for each data and parameter)*

| **Data / Parameter** | $W_{site}$ |
|---|---|
| **Unit** | kg |
| **Description** | Average animal weight of a defined livestock population at the CPA site |
| **Source of data** | Measurement. |
| **Value(s) applied** | Please see individual CPA-DD |
| **Measurement methods and procedures** | Farm owners will measure weight of a defined livestock with mass scale and calculate the average in a project year. |
| **Monitoring frequency** | annually |
| **QA/QC procedures** | The mass scale will be calibrated periodically. |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comments** | - |

| **Data / Parameter** | $nd_y$ |
|---|---|
| **Unit** | day |
| **Description** | Number of days in year “y” where the treatment plant was operational. |
| **Source of data** | Measured. |
| **Value(s) applied** | Please see individual CPA-DD |
| **Measurement methods and procedures** | The data is obtained from the operation records of the treatment plant. |
| **Monitoring frequency** | annually |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comments** | - |

| | |
|---|---|
| **Data / Parameter** | $N_{da,y}$ |
| **Unit** | - |
| **Description** | Number of days animal is alive in the farm in the year *y* |
| **Source of data** | The data used in a typical SSC-CPA is from the farm owners, the actual data should be monitored monthly. |
| **Value(s) applied** | Please see individual CPA-DD |
| **Measurement methods and procedures** | Record feed days |
| **Monitoring frequency** | Annually, based on monthly records. |
| **QA/QC procedures** | The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed. |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comments** | - |

| | |
|---|---|
| **Data / Parameter** | $N_{p,y}$ |
| **Unit** | - |
| **Description** | Number of animals produced annually of type *LT* for the year *y* |
| **Source of data** | The data used in a typical SSC-CPA is from the farm owners, the actual data should be monitored monthly. |
| **Value(s) applied** | Please see individual CPA-DD |
| **Measurement methods and procedures** | Records |
| **Monitoring frequency** | Annually, based on monthly records. |
| **QA/QC procedures** | The consistency between the value and indirect information (records of sales, records of food purchases) should be assessed. |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comments** | - |

| | |
|---|---|
| **Data / Parameter** | $MS\%_{i,y}$ |
| **Unit** | % |
| **Description** | Fraction of manure handled in system *i in year y*. |
| **Source of data** | The farm owners, all manure handled in CPA animal manure management. |
| **Value(s) applied** | Please see individual CPA-DD |
| **Measurement methods and procedures** | Records |
| **Monitoring frequency** | Annually. |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of project emissions |
| **Additional comments** | - |

| Data / Parameter | $BG_{burnt,y}$ |
|---|---|
| Unit | $m^3$ |
| Description | The amount of biogas utilized in year y |
| Source of data | measurement |
| Value(s) applied | NA |
| Measurement methods and procedures | Monitoring by biogas flow meter. |
| Monitoring frequency | continuously. |
| QA/QC procedures | The manometer will undergo maintenance/calibration subject to appropriate industry standards. |
| Purpose of data | Calculation of baseline emissions |
| Additional comments | - |

| Data / Parameter | $Q_y$ |
|---|---|
| Unit | ton |
| Description | Quantity of manure transported |
| Source of data | measurement |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | On-site data sheets recorded monthly using weighbridge. |
| Monitoring frequency | monthly |
| QA/QC procedures | Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier), also cross check with sales of compost |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of transportation shall be accounted for. |

| Data / Parameter | $Q_{y,treatment}$ |
|---|---|
| Unit | ton |
| Description | Quantity of product transported |
| Source of data | measurement |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | On-site data sheets recorded monthly using weighbridge. |
| Monitoring frequency | monthly |
| QA/QC procedures | Weighbridge will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier), also cross check with sales of compost |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of transportation shall be accounted for. |

| Data / Parameter | $CT_y$ |
|---|---|
| Unit | ton/truck |
| Description | Average truck capacity for manure transportation |
| Source of data | FSR and the information provided by the farm |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | On-site measurement. |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of transportation shall be accounted for. |

| Data / Parameter | $CT_{y,treatment}$ |
|---|---|
| Unit | ton/truck |
| Description | Average truck capacity for product transportation |
| Source of data | FSR and the information provided by the farm |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | On-site measurement. |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of transportation shall be accounted for. |

| Data / Parameter | $DAF_w$ |
|---|---|
| Unit | km/truck |
| Description | Average incremental distance for manure transportation |
| Source of data | FSR and the information provided by the farm |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | On-site measurement. |
| Monitoring frequency | Annually |
| QA/QC procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of transportation shall be accounted for. |

| Data / Parameter | $DAF_{treatment}$ |
|---|---|
| Unit | km/truck |
| Description | Average incremental distance for product transportation |
| Source of data | FSR and the information provided by the farm |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | On-site measurement. |
| Monitoring frequency | Annually |
| QA/QC procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of transportation shall be accounted for. |

| Data / Parameter | $T_{PJ}$ |
|---|---|
| Unit | ℃ |
| Description | Temperature of the biogas at the flow measurement site |
| Source of data | measured |
| Value(s) applied | NA |
| Measurement methods and procedures | The temperature of the biogas will be recorded daily using thermometer and monthly averaged. |
| Monitoring frequency | - |
| QA/QC procedures | The thermometer will undergo maintenance/calibration subject to appropriate industry standards. |
| Purpose of data | Calculation of baseline emissions and project emissions |
| Additional comments | - |

| Data / Parameter | $P_{PJ}$ |
|---|---|
| Unit | Pa |
| Description | Pressure of the biogas at the flow measurement site |
| Source of data | measured |
| Value(s) applied | NA |
| Measurement methods and procedures | The pressure of the biogas will be recorded daily using manometer and monthly averaged. |
| Monitoring frequency | - |
| QA/QC procedures | The manometer will undergo maintenance/calibration subject to appropriate industry standards. |
| Purpose of data | Calculation of baseline emissions and project emissions |
| Additional comments | - |

| Data / Parameter | $EC_{PJ,y}$ |
|---|---|
| Unit | MWh/yr |
| Description | Quantity of net electricity consumed by the SSC-CPA in year *y* |
| Source of data | measured |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | Electricity meters should be installed to measure the quantity of the electricity consumed by the SSC-CPA in year y. |
| Monitoring frequency | continuously |
| QA/QC procedures | The manometer will undergo maintenance/calibration subject to appropriate industry standards. |
| Purpose of data | Calculation of baseline emissions and project emissions |
| Additional comments | - |

| Data / Parameter | $FV_{RG,h}$ |
|---|---|
| Unit | $m^3/h$ |
| Description | Volumetric flow rate of the biogas sent to the flare in hour h |
| Source of data | measurement |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | Biogas sent to the flare will be monitored through the use of biogas flow meter continuously and reported cumulatively on weekly basis. |
| Monitoring frequency | continuously |
| QA/QC procedures | The flow meter will undergo maintenance/calibration annually subject to appropriate industry standards by qualified entity. |
| Purpose of data | Calculation of project emissions |
| Additional comments | - |

| Data / Parameter | $MS\%_l$ |
|---|---|
| Unit | - |
| Description | Fraction of volatile solids (%) handled by storage device *l* |
| Source of data | measurement |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | Monitored annually. Archive electronically during project plus 2 years. |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of storage of manure before being fed into the anaerobic digester shall be accounted for. |

| Data / Parameter | $T_i$ |
|---|---|
| Unit | ℃ |
| Description | Annual Average ambient temperature at weather station nearby project site. |
| Source of data | weather station nearby project site |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | Monitoring frequency will be monthly. Archive electronically during the crediting period plus 2 years. |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | Calculation of baseline emissions |
| Additional comments | - |

| Data / Parameter | $AI_l$ |
|---|---|
| Unit | days |
| Description | Annual average interval between manure collection and delivery for treatment at a given storage device *l* |
| Source of data | measurement |
| Value(s) applied | Please see individual CPA-DD |
| Measurement methods and procedures | Monitored by daily operation record. |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | Calculation of project emissions |
| Additional comments | Applicable only if project emissions on account of storage of manure before being fed into the anaerobic digester shall be accounted for. |

| Data / Parameter | On site inspections |
|---|---|
| Unit | - |
| Description | On site inspections for each individual farm included in the project boundary where the project activity is implemented for each verification period. |
| Source of data | Measured |
| Value(s) applied | NA |
| Measurement methods and procedures | - |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | - |
| Additional comments | - |

| Data / Parameter | Soil application |
|---|---|
| Unit | - |
| Description | The proper soil application (not resulting in methane emissions) of the residual waste |
| Source of data | - |
| Value(s) applied | - |
| Measurement methods and procedures | Monitor the soil application when the final sludge be used and clarify the soil application is proper. |
| Monitoring frequency | - |
| QA/QC procedures | - |
| Purpose of data | - |

| Additional comments | - |
|---|---|

**B.7.2. Description of the monitoring plan for a generic CPA**

>>

In order to implement the monitoring plan effectively, the specific person in charge of the Programme is designated by CME to make sure the implementation of monitoring plan and keep in touch with EB, DNA and other relevant parties. The monitoring structure is clearly shown in the following figure.

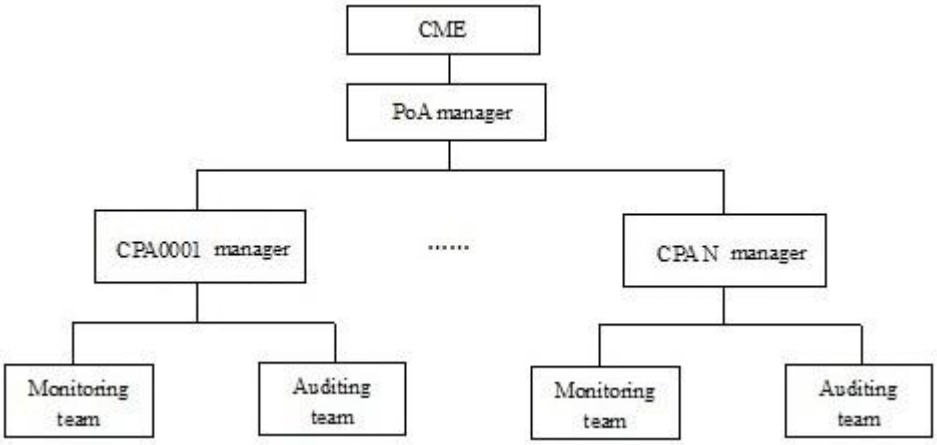


**Figure 6. Monitoring Structure**

| Position | Responsibility description |
|---|---|
| PoA manager | PoA manager is designated by CME and is in full charge of monitoring and issues related to PoA, in particular:<br>(1) Track the development of PCDM; keep communication with EB, DNA and related agencies;<br>(2) Establish the monitoring plan and training plan.<br>(3)Collect the data, and supervise implementation of the PoA.<br>(4) Complete Monitoring Report |
| CPA manager | Take charge of all monitoring matters related to this CPA, including managing monitoring team and auditing team and implementing training for monitoring team and auditing team. |
| Monitoring team | Take charge of monitoring implementation and the data collection according to the Monitoring Manual. |
| Auditing team | Audit the work regarding monitoring and conduct the QC/QA procedures as per the Monitoring Manual. |

All data will be bottom-up collected and reported as shown in monitoring structure and finally reported to CME.

**Monitoring Parameter**

For monitoring parameters, please refer to Section B.7.1.

**Installation of Monitoring Meters**

**Location of each meter can be shown in the following figure:**

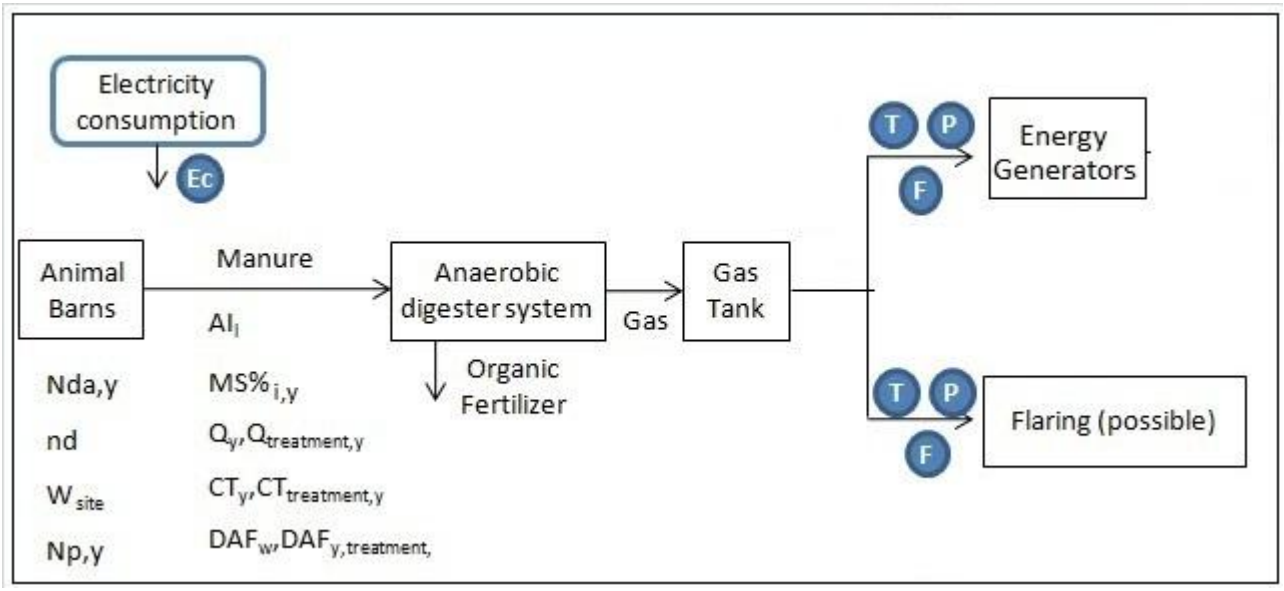


**Figure 7. Monitoring system**

The monitoring points and descriptions are as below:

$N_{p,y}$: Number of animals produced annually of type *LT* for the year *y*; the number of a defined livestock will be monthly recorded.

$N_{da,y}$, $n_d$, $MS\%_{i,y}$: a defined livestock alive day number, farm operation day number, and rate of waste handling are recorded as farm production records.

$W_{site}$: Average animal weight of a defined livestock population at the CPA site, will be measured by mass scale and then calculate the average in a project year.

F: flow meter; it will be used to measure the flow of biogas and will be installed at the main gas pipe to energy generators (including thermal energy generator and/or electricity generator).

T, P: manometer and thermometer; they will be used to measure pressure and temperature at the biogas flow measurement site.

f: flow meter of biogas; it will be installed in the inlet of biogas stove of each household.

Ts, Ps, Fs: flow meter, manometer and thermometer; they will be used to measure flow, pressure, temperature of heated water and/or steam and will be installed in the inlet of thermal consuming equipment.

$E_C$: electricity meter; It will be used to measure electricity consumption of the waste treatment system and will be installed in the inlet of the project.

**Data Collection and Management**

Monitoring team will implement monitoring and collect the monitoring data according to the Monitoring Manual. All data will be bottom-up collected as per monitoring structure and the regular summary should be made and reported to CME periodically. All data will be transmitted to the monitoring computer managed by CME. All the data after internal validation should be saved up to 2 years after the end of the crediting period.

**Measuring instrument fault/emergency treatment procedures**

Once a meter is in fault, it shall be replaced immediately with another calibrated meter by a professional engineer. During the period of erroneous measurement and replacement of the fault meter, a conservative method that can cause a lower CER value will be used.

**QA/QC**

In order to maintain high precision for meters, the calibration should be implemented according to state and/or sector standards and rules and certificated after calibration.

The meters should be calibrated periodically. Within 10 days on the date of:

(1) The error of duty meters and checking meters oversteps the permissible range;

(2) Repairs due to meters failure.

**Training**

Before the formal operation of each activity, the person in charge of the CPA will organize the relevant personals to participate the CDM training.

**Verification**

The verification of emission reduction is carried out based on CME's requirements. The CME should provide DOE documents and evident related to monitoring.

- - - - -

**Appendix 1: Contact information on entity/individual responsible for the PoA**

| | |
|---|---|
| **Organization** | Wuhan Tianying Environmental Engineering Co., Ltd. |
| **Street/P.O. Box** | Floor One, Building B, No. Te 1, Guanshan Yi Road, Donghu New Technological Development Zone, Wuhan 430074, Hubei, China |
| **Building** | Building B |
| **City** | Wuhan City |
| **State/Region** | Hubei Province |
| **Postcode** | 430074 |
| **Country** | People's Republic of China |
| **Telephone** | +86-27-87452592 |
| **Fax** | +86-27-87125856 |
| **E-mail** | - |
| **Website** | - |
| **Contact person** | Chijun DU |
| **Title** | Vice General Manager |
| **Salutation** | Mr |
| **Last name** | DU |
| **Middle name** | - |
| **First name** | Chijun |
| **Department** | - |
| **Mobile** | +86 134-1957-6269 |
| **Direct fax** | +86-27-87125856 |
| **Direct tel.** | +86-27-87452592 |
| **Personal e-mail** | duchijun@163.com |

| | |
|---|---|
| **Organization** | A&T Carbon Asset Co., Limited |
| **Street/P.O. Box** | Cedar House Breckland, Linford Wood, Milton Keynes, Buckinghamshire, United Kingdom, MK14 6EX |
| **Building** | Linford Wood |
| **City** | Milton Keynes |
| **State/Region** | Buckinghamshire |
| **Postcode** | MK146EX |
| **Country** | United Kingdom |
| **Telephone** | +44-1908-577-450 |
| **Fax** | +44-1908-577-451 |
| **E-mail** | projects@atholdings.com |
| **Website** | www.atholdings.com |
| **Contact person** | Wang, Xia |
| **Title** | Chinese business director |
| **Salutation** | Mr. |
| **Last name** | Wang |
| **Middle name** | - |
| **First name** | Xia |
| **Department** | - |
| **Mobile** | +8613911538197 |
| **Direct fax** | +86-010-65833191 |
| **Direct tel.** | +86-010-65830366 |
| **Personal e-mail** | Xia.wang@atholdings.com |

## Appendix 2: Affirmation regarding public funding

The CME confirm that there is no public funding from Annex I countries.

## Appendix 3: Application of methodology(ies)

Please see Section B.3.

## Appendix 4: Further background information on ex ante calculation of emission reductions

The project refers to the *2012 Baseline Emission Factors for Regional Power Grids in China* that is published by the National Development and Reform Committee of China (Chinese DNA) on 17/10/2012 for the OM and BM emission factors of the Central China Power Grid (CCPG). In the reference, emission factors of CCPG are calculated based on the approved *"Tool to calculate the emission factor for an electricity system"*. The $EF_{grid,CM,y}$, $EF_{grid,OM,y}$, and $EF_{grid,BM,y}$ of Central China Power Grid (CCPG) could be calculated as following:

**Calculate OM**

**Table A1 Calculating $CO_2$ Emission of CCPG in 2008**

| Fuel | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total | $CO_2$ Emission（$tCO_2e$） |
|---|---|---|---|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D** | **E** | **F** | **G=A+B+…+F** | **H=G*I*J*K/100000(mass) H=G*I*J*K/10000(volume)** |
| Raw Coal | $10^4t$ | 2137.08 | 9480.74 | 2852.29 | 2620.44 | 1421.42 | 2727.61 | 21239.58 | 387,679,342 |
| Cleaned coal | $10^4t$ | | 1.68 | | | 3.27 | | 4.95 | 113,842 |
| Other Washed Coal | $10^4t$ | 0.04 | 80.54 | | 2.06 | 101.75 | | 184.39 | 1,346,213 |
| Briquettes | $10^4t$ | | | | 6.12 | | 0.01 | 6.13 | 111,889 |
| Coke | $10^4t$ | | 0.78 | | 0.92 | | | 1.7 | 46,261 |
| Coke Oven Gas | $10^8m^3$ | 0.1 | 4.19 | 0.37 | 0.24 | 6.66 | 0.01 | 11.57 | 721,829 |
| Other Gas | $10^8m^3$ | 23.67 | 41.36 | | 3.31 | 0.37 | 0.01 | 68.72 | 1,339,814 |
| Crude Oil | $10^4t$ | | 0.17 | | | | | 0.17 | 5,054 |
| Gasoline | $10^4t$ | | | | | | | 0 | 0 |
| Diesel Oil | $10^4t$ | 0.88 | 7.02 | 2.82 | 3.41 | 1.59 | | 15.72 | 486,775 |
| Fuel Oil | $10^4t$ | 0.07 | 1.45 | | 1.29 | | 3.14 | 5.95 | 187,848 |
| LPG | $10^4t$ | | | | | | | 0 | 0 |
| Refinery Gas | $10^4t$ | 0.21 | 3.91 | 2.78 | 0.71 | | 0.01 | 7.62 | 169,153 |
| Natural Gas | $10^8m^3$ | | 4.02 | 0.16 | | 0.05 | 12.92 | 17.15 | 3,625,430 |
| Other Petroleum Products | $10^4t$ | | | 0.59 | | | | 0.59 | 17,813 |
| Other Coking Products | $10^4t$ | | | | | | 0.01 | 0.01 | 272 |
| Other Energy | $10^4tce$ | 18.16 | 68.11 | 62.35 | 11.42 | 64.87 | | 224.91 | 0 |
| Total | | | | | | | | | **395,851,534** |

*Sources: China Energy Statistical Yearbook 2009*

**Table A2 Electricity Generation of CCPG in 2008**

| Province name | Electricity generation of fuel-fired power plants (MWh) | Auxiliary power ratio (%) | Total Electricity Supplied to the Grid (MWh) |
|---|---|---|---|
| Jiangxi | 40,500,000 | 6.5 | 37,867,500 |
| Henan | 189,000,000 | 7.22 | 175,354,200 |
| Hubei | 55,300,000 | 6.62 | 51,639,140 |
| Hunan | 53,700,000 | 6.46 | 50,230,980 |
| Chongqing | 28,600,000 | | 28,600,000 |
| Sichuan | 40,100,000 | 10.21 | 36,005,790 |
| **Total** | | | **379,697,610** |

| | | |
|---|---|---|
| Import electricity from NWPG | 3,144,070 | MWh |
| Emission Factor of NWPG | 0.9825 | $tCO_2e/MWh$ |
| Import electricity from NCPG | 33,200 | MWh |
| Emission Factor of NCPG | 1.00495 | $tCO_2e/MWh$ |
| Total Emission | 398,974,078 | $tCO_2e$ |
| Total Power supply | 382,874,880 | MWh |
| 2008 OM Emission Factor of CCPG | 1.04205 | $tCO_2e/MWh$ |

*Sources: China Electric Power Yearbook 2009*

**Table 3 Calculating $CO_2$ Emission of CCPG in 2009**

| Fuel | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total | $CO_2$ Emission（$tCO_2e$） |
|---|---|---|---|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D** | **E** | **F** | **G=A+B+…+F** | **H=G*I*J*K/100000(mass) H=G*I*J*K/10000(volume)** |
| Raw Coal | $10^4t$ | 2184.31 | 9339.64 | 2888.29 | 2810.69 | 1413.64 | 2817.31 | 21453.88 | 391,590,892 |
| Cleaned coal | $10^4t$ | | 3.35 | | | | | 3.35 | 77,044 |
| Other Washed Coal | $10^4t$ | | 59.93 | | | 136.75 | 97.94 | 294.62 | 2,150,991 |
| Briquettes | $10^4t$ | | | | 2.63 | | | 2.63 | 48,005 |
| Coke | $10^4t$ | | 1.08 | 0.06 | 0.09 | | | 1.23 | 33,471 |
| Coke Oven Gas | $10^8m^3$ | 0.09 | 6.04 | 1.2 | | 1.03 | | 8.36 | 521,564 |
| Other Gas | $10^8m^3$ | 30.76 | 56.64 | | 4.23 | 7.57 | | 99.2 | 1,934,074 |
| Crude Oil | $10^4t$ | | 0.1 | | | | | 0.1 | 2,973 |
| Gasoline | $10^4t$ | | | | | | | 0 | 0 |
| Diesel Oil | $10^4t$ | 0.69 | 4.28 | 1.23 | 1.55 | 1.19 | | 8.94 | 276,830 |
| Fuel Oil | $10^4t$ | 0.02 | 1.44 | 0.48 | 1.27 | 0.06 | 4 | 7.27 | 229,522 |
| LPG | $10^4t$ | | | | | | | 0 | 0 |
| Refinery Gas | $10^4t$ | 0.25 | 2.18 | 0.82 | 1.91 | | | 5.16 | 114,544 |
| Natural Gas | $10^8m^3$ | | 7.69 | 0.27 | | 0.14 | 21.84 | 29.94 | 6,329,176 |
| Other Petroleum Products | $10^4t$ | | | 0.29 | | | | 0.29 | 8,755 |
| Other Coking Products | $10^4t$ | | | | | | | 0 | 0 |
| Other Energy | $10^4tce$ | 12.47 | 76.3 | 26.69 | 14.96 | 84.8 | | 215.22 | 0 |
| Total | | | | | | | | | **403,317,841** |

*Sources: China Energy Statistical Yearbook 2010*

**Table A4 Electricity Generation of CCPG in 2009**

| Province name | Electricity generation of fuel-fired power plants（MWh） | Auxiliary power ratio（%） | Total Electricity Supplied to the Grid（MWh） |
|---|---|---|---|
| Jiangxi | 44,500,000 | 5.8 | 41,919,000 |
| Henan | 198,500,000 | 6.62 | 185,359,300 |
| Hubei | 63,000,000 | 6.21 | 59,087,700 |
| Hunan | 63,400,000 | 6.39 | 59,348,740 |
| Chongqing | 30,600,000 | | 30,600,000 |
| Sichuan | 50,400,000 | 7.92 | 46,408,320 |
| **Total** | | | **422,723,060** |

| | | |
|---|---|---|
| Import electricity from NWPG | 3,262,010 | MWh |
| Emission Factor of NWPG | 1.00759 | $tCO_2e/MWh$ |
| Import electricity from NCPG | 2,233,290 | MWh |
| Emission Factor of NCPG | 0.96418 | $tCO_2e/MWh$ |
| Total Emission | 408,757,899 | $tCO_2e$ |
| Total Power supply | 428,218,360 | MWh |
| 2009 OM Emission Factor of CCPG | 0.95455 | $tCO_2e/MWh$ |

*Sources: China Electric Power Yearbook 2010*

**Table 5 Calculating $CO_2$ Emission of CCPG in 2010**

| Fuel | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total | $CO_2$ Emission（$tCO_2e$） |
|---|---|---|---|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D** | **E** | **F** | **G=A+B+…+F** | **H=G*I*J*K/100000(mass) H=G*I*J*K/10000(volume)** |
| Raw Coal | $10^4t$ | 2648.31 | 9925.73 | 3474.75 | 3318.57 | 1542.19 | 2667.82 | 23577.37 | 430,350,284 |
| Cleaned Coal | $10^4t$ | | 331.4 | | | | | 331.4 | 7,621,641 |
| Other Washed Coal | $10^4t$ | | 205.66 | | | 145.37 | 116.96 | 467.99 | 3,416,748 |
| Briquettes | $10^4t$ | | | | 1.82 | | | 1.82 | 33,220 |
| Coke | $10^4t$ | | | | | | | 0 | 0 |
| Coal Gangue | $10^4t$ | 48.8 | 256.37 | 78.86 | 36.85 | 237.58 | | 658.46 | 4,807,350 |
| Coke Oven Gas | $10^8m^3$ | 0.3 | 3.76 | 0.07 | 0.19 | 1.12 | | 5.44 | 339,391 |
| Blast Furnace Gas | $10^8m^3$ | 45.81 | 61.58 | 131.21 | 46.32 | 7.19 | | 292.11 | 24,072,697 |
| Converter Gas | $10^8m^3$ | 1.49 | | | 4.42 | 0.18 | | 6.09 | 701,583 |
| Other Gas | $10^8m^3$ | | 0.02 | | 0.13 | | | 0.15 | 2,925 |
| Crude Oil | $10^4t$ | | 0.08 | | | | | 0.08 | 2,378 |
| Gasoline | $10^4t$ | | | | | 0.01 | | 0.01 | 291 |
| Diesel Oil | $10^4t$ | 0.65 | 31.41 | 1.2 | 0.91 | 1.12 | | 35.29 | 1,092,767 |
| Fuel Oil | $10^4t$ | 0.06 | 1.14 | 0.27 | 1.86 | 0.05 | 1.51 | 4.89 | 154,383 |
| Naphtha | $10^4t$ | | | | | | | 0 | 0 |
| Lubricant | $10^4t$ | | | | | | | 0 | 0 |
| Paraffin | $10^4t$ | | | | | | | 0 | 0 |
| Solvent Oil | $10^4t$ | | | | | | | 0 | 0 |
| Asphalt | $10^4t$ | | | | | | | 0 | 0 |
| Petroleum coke | $10^4t$ | | 5.82 | | | | | 5.82 | 154,137 |
| LPG | $10^4t$ | | | | | | | 0 | 0 |
| Refinery Gas | $10^4t$ | 0.15 | 1.45 | 1.05 | 1.11 | | | 3.76 | 83,466 |
| Natural Gas | $10^8m^3$ | | 13.76 | 0.15 | | 0.05 | 11.97 | 25.93 | 5,481,481 |
| Other Petroleum Products | $10^4t$ | | | | 2.75 | | | 2.75 | 83,026 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Other Coking Products | $10^4$t | | | | | | | 0 | 0 |
| Other Energy | $10^4$tce | 41.43 | 266.07 | | 8.12 | 2.4 | | 318.02 | 0 |
| Total | | | | | | | | | **478,397,767** |

*Sources: China Energy Statistical Yearbook 2011*

**Table A6 Electricity Generation of CCPG in 2010**

| Province name | Electricity generation of fuel-fired power plants（MWh） | Auxiliary power ratio（%） | Total Electricity Supplied to the Grid（MWh） |
|---|---|---|---|
| Jiangxi | 53,700,000 | 6 | 50,478,000 |
| Henan | 219,800,000 | 6.23 | 206,106,460 |
| Hubei | 77,100,000 | 6.3 | 72,242,700 |
| Hunan | 72,500,000 | 6.27 | 67,954,250 |
| Chongqing | 33,100,000 | | 33,100,000 |
| Sichuan | 56,500,000 | 7.52 | 52,251,200 |
| **Total** | | | **482,132,610** |

| | | |
|---|---|---|
| Import electricity from NWPG | 12,386,810 | MWh |
| Emission Factor of NWPG | 0.98529 | $tCO_2e/MWh$ |
| Import electricity from NCPG | 2,684,680 | MWh |
| Emission Factor of NCPG | 1.00211 | $tCO_2e/MWh$ |
| Total Emission | 493,292,659 | $tCO_2e$ |
| Total Power supply | 497,204,100 | MWh |
| 2010 OM Emission Factor of CCPG | 0.99213 | $tCO_2e/MWh$ |

*Sources: China Electric Power Yearbook 2011*

**Therefore,** $EF_{grid,OM,simple}$ **= 0.9944 $tCO_2e/MWh$**

**<u>Calculate BM</u>**

The Emission Factor, Oxidation, Average Low Caloric Value applied in the calculation of the Operating Margin and Build Margin emission factor are listed in table A7.

**Table A7 Related Parameters**

| Fuel | Oxidation Rate I [1] | Average Low Caloric Value J[2,4] | Emission Factor($kgCO_2e/TJ$)[3] |
|---|---|---|---|
| Raw Coal | 100% | 20,908 kJ/kg | 87,300 |
| Cleaned Coal | 100% | 26,344 kJ/kg | 87,300 |
| Other Washed Coal | 100% | 8,363 kJ/kg | 87,300 |
| Briquettes | 100% | 20,908 kJ/kg | 87,300 |
| Coal Gangue | 100% | 8,363 kJ/kg | 87,300 |
| Coke | 100% | 28,435 kJ/kg | 95,700 |
| Other Coking Products | 100% | 28,435 kJ/kg | 95,700 |
| Crude Oil | 100% | 41,816 kJ/kg | 71,100 |
| Gasoline | 100% | 43,070 kJ/kg | 67,500 |
| Diesel Oil | 100% | 42,652 kJ/kg | 72,600 |
| Fuel Oil | 100% | 41,816 kJ/kg | 75,500 |
| Petroleum Coke | 100% | 31,947 kJ/kg | 82,900 |
| Other Petroleum Products | 100% | 41,816 kJ/kg | 75,500 |

| | | | |
|---|---|---|---|
| Natural Gas | 100% | 38,931 kJ/$m^3$ | 54,300 |
| LNG | 100% | 51,434 kJ/kg | 54,300 |
| Coke Oven Gas | 100% | 16,726 kJ/$m^3$ | 37,300 |
| Blast Furnace Gas | 100% | 219,000 kJ/$m^3$ | 3,763 |
| Converter Gas | 100% | 145,000 kJ/$m^3$ | 7,945 |
| Other Gas | 100% | 5,227 kJ/$m^3$ | 37,300 |
| LPG | 100% | 50,179 kJ/kg | 61,600 |
| Refinery Gas | 100% | 46,055 kJ/kg | 48,200 |

*Source 1,2,3,4: China Energy Statistical Yearbook 2010 p285; 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy；Public Institutions Energy Consumption Statistical System,* drafted by Bureau of Government Offices Administration, approved by National Bureau of Statistics in July 2011.

***Sub-step 1. Calculating the percentages of $CO_2$ emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired $CO_2$ emissions.***

**Table A8 The percentages of $CO_2$ emissions from the coal-fired, oil-fired and gas-fired power plants in total fuel-fired $CO_2$ emissions**

| Fuel | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Subtotal | $CO_2$ Emission（$tCO_2e$） |
|---|---|---|---|---|---|---|---|---|---|
| | | **A** | **B** | **C** | **D** | **E** | **F** | **G=A+…+F** | **K=G*H*I*J/100000** |
| Raw Coal | $10^4$ t | 2648.31 | 9925.73 | 3474.75 | 3318.57 | 1542.19 | 2667.82 | 23577.37 | 430,350,284 |
| Cleaned Coal | $10^4$ t | 0 | 331.4 | 0 | 0 | 0 | 0 | 331.40 | 7,621,641 |
| Other Washed Coal | $10^4$ t | 0 | 205.66 | 0 | 0 | 145.37 | 116.96 | 467.99 | 3,416,748 |
| Briquettes | $10^4$ t | 0 | 0 | 0 | 1.82 | 0 | 0 | 1.82 | 33,220 |
| Coal Gangue | $10^4$ t | 48.8 | 256.37 | 78.86 | 36.85 | 237.58 | 0 | 658.46 | 4,807,350 |
| Coke | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other Coking Products | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Subtotal** | | | | | | | | | **446,229,242** |
| Crude Oil | $10^4$ t | 0 | 0.08 | 0 | 0 | 0 | 0 | 0.08 | 2,378 |
| Gasoline | $10^4$ t | 0 | 0 | 0 | 0 | 0.01 | 0 | 0.01 | 291 |
| Diesel Oil | $10^4$ t | 0.65 | 31.41 | 1.2 | 0.91 | 1.12 | 0 | 35.29 | 1,092,767 |
| Fuel Oil | $10^4$ t | 0.06 | 1.14 | 0.27 | 1.86 | 0.05 | 1.51 | 4.89 | 154,383 |
| Petroleum Coke | $10^4$ t | 0 | 5.82 | 0 | 0 | 0 | 0 | 5.82 | 154,137 |
| Other Petroleum Products | $10^4$ t | 0 | 0 | 0 | 2.75 | 0 | 0 | 2.75 | 86,820 |
| **Subtotal** | | | | | | | | | **1,490,777** |
| Natural Gas | $10^7 m^3$ | 0 | 137.6 | 1.5 | 0 | 0.5 | 119.7 | 259.3 | 5,481,481 |
| LNG | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Coke Oven Gas | $10^7 m^3$ | 3 | 37.6 | 0.7 | 1.9 | 11.2 | 0 | 54.4 | 339,391 |
| Blast Furnace Gas | $10^7 m^3$ | 458.1 | 615.8 | 1312.1 | 463.2 | 71.9 | 0 | 2921.1 | 24,072,697 |
| Converter Gas | $10^7 m^3$ | 14.9 | 0 | 0 | 44.2 | 1.8 | 0 | 60.9 | 701,583 |
| Other Gas | $10^7 m^3$ | 0 | 0.2 | 0 | 1.3 | 0 | 0 | 1.5 | 2,925 |
| LPG | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Refinery Gas | $10^4$ t | 0.15 | 1.45 | 1.05 | 1.11 | 0 | 0 | 3.76 | 83,466 |
| **Subtotal** | | | | | | | | | **30,681,543** |
| Other Energy | $10^4$tce | 41.43 | 266.07 | 0 | 8.12 | 2.4 | 0 | 318.02 | 0 |
| **Total** | | | | | | | | | **478,401,462** |

*Sources: China Energy Statistical Yearbook 2011*

***Sub-step 2. Calculating the fuel-fired emission factor***

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

Where:
$EF_{Thermal}$ is the fuel-fired emission factor;
$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ are corresponding to the emission factors of coal, oil and gas fired power plants which are applied by the most advanced commercialized technologies.

According to the announcement "China's Regional Grid Baseline Emission Factors Renewed", the weighted average of 20 least coal consumption per kWh supplied of new built 600-1000 MW sub critical units in 2010 is adopted to determine the emission factor of the best advanced coal fired generation technology, which is 309.9 gce/kWh. In other word, the efficiency of best advanced coal fired generation technology is 39.65%.

The maximum electricity supplied efficiency of oil and gas fired generation plants are regarded as approximate estimation of commercially optimal efficiency technology. Similarly, the fuel consumption per kWh supplied of best advanced oil and gas fired generation technology is determined to be 236.6 gce/kWh, which means a generation efficiency of 51.93% .these data were show as below:

**Table A9 Emission factors of Coal, Oil and Gas with the most advanced commercialized technologies applied by the fuel-fired power plants**

| | Parameters | Fuel consumption rate (%) | Fuel Emission Factor ($kgCO_2e/TJ$) | Oxidation | Emission Factor ($tCO_2e/MWh$) |
|---|---|---|---|---|---|
| | | A | B | C | D=3.6/A/10000*B*C |
| Coal-fired plant | $EF_{Coal,Adv}$ | 39.65 | 87,300 | 1 | 0.7926 |
| Oil-fired plant | $EF_{Oil,Adv}$ | 51.93 | 75,500 | 1 | 0.5234 |
| Gas-fired plant | $EF_{Gas,Adv}$ | 51.93 | 54,300 | 1 | 0.3764 |

*Sources: The Baseline Emission Factors of Chinese Power Grids 2012, NDRC.*

Then, calculating

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.7651\ tCO_2e/MWh$$

***Sub-step 3. Calculating the Build Margin Emission Factor.***

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

Where:
$EF_{BM,y}$ = the Build Margin emission factor with advanced commercialized technologies for year *y*;
$CAP_{Total}$ = the new capacity additions;
$CAP_{Thermal}$ = the new fuel-fired capacity additions.

**Table A10 Installed Capacities of the CCPG 2010**

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 12,940 | 46,870 | 18,150 | 16,090 | 6,740 | 12,580 | 113,370 |
| Hydro | MW | 4,040 | 3,650 | 30,850 | 12,990 | 4,880 | 30,700 | 87,110 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind & Others | MW | 82 | 50 | 63 | 38 | 50 | 0 | 283 |
| Total | MW | 17,062 | 50,570 | 49,063 | 29,118 | 11,670 | 43,280 | 200,763 |

*Sources：China Electric Power Yearbook 2011*

**Table A11 Installed Capacities of the CCPG 2009**

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 11,500 | 43,100 | 15,670 | 15,900 | 6,800 | 12,270 | 105,240 |
| Hydro | MW | 3,770 | 3,650 | 30,010 | 11,460 | 4,530 | 25,810 | 79,230 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind & 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 |

*Sources：China Electric Power Yearbook 2010*

**Table A12 Installed Capacities of the CCPG 2008**

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 9,340 | 42,680 | 14,210 | 14,430 | 6,660 | 12,770 | 100,090 |
| Hydro | MW | 3,710 | 3,020 | 29,050 | 10,650 | 4,060 | 22,240 | 72,730 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind & 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 |

*Sources：China Electric Power Yearbook 2009*

**Table A13 Installed Capacities of the CCPG 2007**

| Installed Capacity | Unit | Jiangxi | Henan | Hubei | Hunan | Chongqing | Sichuan | Total |
|---|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 9,270 | 38,540 | 13,040 | 13,360 | 6,370 | 12,000 | 92,580 |
| Hydro | MW | 3,570 | 2,740 | 24,020 | 9,220 | 2,240 | 19,860 | 61,650 |
| Nuclear | MW | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Wind & 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 |

*Sources：China Electric Power Yearbook 2008*

**Table A14 Change Installed Capacity from 2007-2010**

| | Year 2007 | Year 2008 | Year 2009 | Year 2010 | 2007-2010 New Capacity | 2008-2010 New Capacity | Percentage of 2007-2010 New Capacity Additions |
|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G |
| Fuel-fired (MW) | 92,580 | 100,090 | 105,240 | 113,370 | 34,850 | 22,580 | 61.85% |
| Hydro (MW) | 61,650 | 72,730 | 79,230 | 87,110 | 21,260 | 10,180 | 37.73% |
| Nuclear (MW) | 0 | 0 | 0 | 0 | 0 | 0 | 0.00% |
| Wind(MW) | 51 | 70 | 132 | 283 | 232 | 213 | 0.41% |
| **Total** | **154,281** | **172,890** | **184,602** | **200,763** | **56,342** | **32,973** | **100.00%** |
| Percentage of Year 2010 | | | | | 28.06% | 16.42% | |

**Then, the result is**

$$EF_{BM,y} = EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} = 0.76514 \times 61.85\% = \mathbf{0.4733\ tCO_2e/MWh}$$

**Step 6. calculate the combined margin Emission Factor ($EF_y$)**

$$EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y} = 0.5 \times 0.9944 + 0.5 \times 0.4733 = \mathbf{0.73385\ tCO_2e/MWh}$$

## Appendix 5: Further background information on the monitoring plan

No additional information.

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**History of the document**

| Version | Date | Nature of revision(s) |
|---|---|---|
| 02.0 | EB 66<br>13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13). |
| 01 | EB33, Annex43<br>27 July 2007 | Initial adoption. |
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