COMPONENT PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE COMPONENT PROJECT ACTIVITIES (F-CDM-SSC-CPA-DD) Version 02.0

COMPONENT PROJECT ACTIVITIES DESIGN DOCUMENT (CPA-DD)

SECTION A. General description of CPA

A.1. Title of the proposed or registered PoA

>>

Title: Henan BCCY New Power Industry Co., Ltd. LFG recovery to power Programme of Activities
Version: 3.2
Issuance date: 24/12/2012

A.2. Title of the CPA

>>

Title: CPA-XX: XX (the location) MSW landfill site LFG recovery to power project
Version: XX
Issuance date: XX/XX/20XX

A.3. Description of the CPA

>>

XX (Title of the CPA), implemented by Name of the CPA implementer, will collect the landfill gas from the Name of the landfill site landfill site and utilize it to generate electricity (and possibly flare part of it).

The landfill site was commissioned in mm/yyyy with a total design capacity of XX m^3 and the landfill is envisaged to be filled in by yyyy. Since landfill commissioning, LFG has been directly released to the atmosphere without recovery and utilization. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

The CPA plans to install XX engines with each capacity of XX MW, and total capacity is XX MW. The CPA will combust the LFG, which contains nearly 50% of methane, to produce electricity and export it to Name of Grid the CPA is connected to (hereinafter as to "the Grid"). The operation hour of the CPA is XXh per year, then the plant load factor (PLF) is XX%.The emission reduction is from both the methane destroyed and the grid electricity displaced. An annual average of XX tCO_2e/y is estimated and a total of XX tCO_2e for a 10-year crediting period.

The CPA will reduce the greenhouse gas (GHG) emissions by destroying methane in the LFG generated from landfills and replacing the equivalent amount of electricity from the Grid dominated by fossil fuel power plant.

The CPA will contribute to the sustainable development in the host country, not only it because of avoiding global warming, but also because it increases the availability of electricity from renewable sources. The CPA will minimize the explosion risk at the landfill site, remove the terrible odours and improve the air quality of local area by destroying LFG. In addition, the CPA will create job opportunities through the construction and operation of the LFG capture system and the power units.

A.4. Entity/individual responsible for CPA

>>

The CPA is implemented by Name of CPA implementer.

Henan BCCY New Power Industry Co., Ltd. ("BCCY") is the coordinating/managing entity ("CME").

A.5. Technical description of the CPA

>>

The types and categories of the CPA are Type III – Other project activities, sectoral scope 13: Waste handling and disposal and Type I – Renewable energy projects, sectoral scope 01: Energy Industries (renewable / non-renewable sources), which are the same as that of the PoA.

This CPA is a greenfield plant which consists of LFG collection, transmission and pre-treatment system, with subsequent electricity generation and delivery to the grid and LFG flaring system (if there is).

LFG collection system

LFG is extracted from solid waste disposal site (SWDS) under negative pressure by blower pumps and moved through wells, then collected by gas collection stations and transferred by sub-pipes and a main pipe to LFG treatment equipment. Flow rate of the LFG is regulated at the collection points in order to always fit with the consumption capacity of the generation engines.

LFG pre-treatment system

Prior to electricity generation, LFG is treated to remove impurities and moisture, to avoid corrosion in the engines. The treatment consists of filtration, demoisturing, cooling and pressurization.

Electricity generation and grid connection system

Gas engines are fed with the LFG and generate electricity, which is then delivered to the grid.

LFG Flare system (optional)

Excess LFG which can not be utilized by the engines is delivered to an open or enclosed flare.

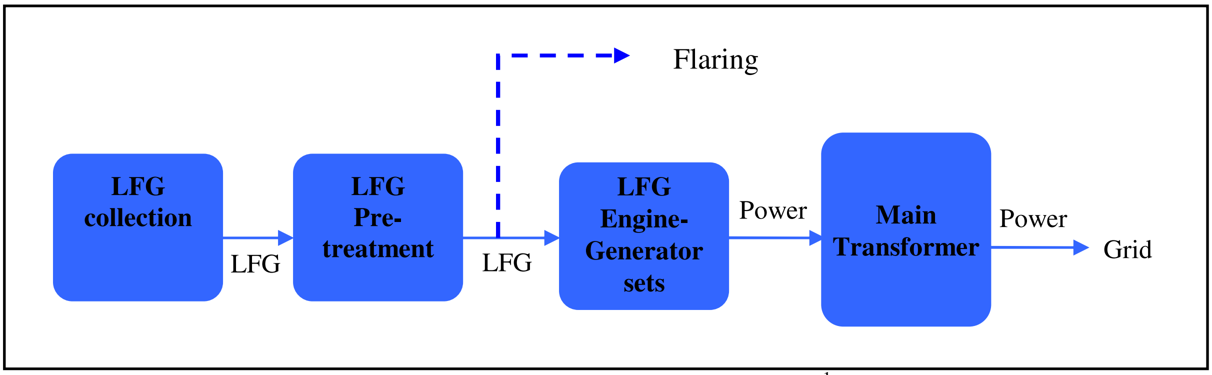

Figure 1 Project technical scheme[1]

Table A.1 Equipment technical parameters

Main Equipment	Parameter	Value
Biogas Gensets	Type	
	Unit	
	Rated capacity	
	Rated Voltage	
	Rated rotation speed	
Flare (if no flare involved, delete this part)	Range of gas flow	
	Pressure at the inlet	

[1] Monitoring points refer to Figure 5 of Monitoring System.

	Temperature of flare	

Data source: XX

The existing scenario prior to the start of implementation of the project activity is that LFG would have been directly released to the atmosphere without recovery and utilization and the equivalent electricity would have been supplied by the Grid. The baseline scenario is the same as the existing scenario.

A.6. Party(ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) CPA implementer(s) (as applicable)	Indicate if the Party involved wishes to be considered as CPA implementer (Yes/No)
China (host)	Name of CPA implementer (Private/Public entity)	No

A.7. Geographic reference or other means of identification

>>

This CPA is located in city, province, People's Republic of China. The geographical coordinates are longitude XX°XX′XX″E and latitude XX°XX′XX″N. Figure A.2 shows the location of the CPA.

Figure 2 Location of the Project

A.8. Duration of the CPA

A.8.1. Start date of the CPA

>>

dd/mm/yyyy (the start date must be indicated as the earliest date at which of a real action, such as the main equipment purchase contract, construction contract and construction start report, etc.), which is after the start date of the PoA.

A.8.2. Expected operational lifetime of the CPA

>>

XX years

A.9. Choice of the crediting period and related information

>>

10-year fixed Crediting period

A.9.1. Start date of the crediting period

>>

dd/mm/yyyy, date when this CPA starts operation, or inclusion of this CPA into registration PoA, whichever is later.

A.9.2. Length of the crediting period

>>

Fixed crediting period of XX years within the PoA validity period

A.10. Estimated amount of GHG emission reductions

Emission reductions during the crediting period	
Years	**Annual GHG emission reductions (in tonnes of CO_2e) for each year**
Year A	
Year B	
Year C	
Year …	
Total number of crediting years	
Annual average GHG emission reductions over the crediting period	
Total estimated reductions (tonnes of CO_2e)	

A.11. Public funding of the CPA
>>
There is no public funding from Annex I parties utilized in this CPA or that in case such public funding is involved, it dose not result in diversion of Official Development Assistance (ODA).

A.12. Debundling of small-scale component project activities
>>
According to *"Guidelines on Assessment of Debundling for SSC Project Activities"*, for the purposes of registration of a Programme of Activities (PoA), a proposed small-scale CPA of a PoA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity, which satisfies both conditions (a) and (b) below:

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

The project is not a debundled component of a larger project activity, since the implementer of CPA XX.

A.13. Confirmation for CPA
>>
This CPA is neither registered as an individual CDM project activity nor is part of another registered PoA, nor is identical with another CPA already included in this PoA. The implementer is aware that this CPA will be subscribed to the PoA "LFG recovery to power Programme of Activities in China", documented by a specific statement from CPA implementer.

SECTION B. Environmental analysis
B.1. Analysis of the environmental impacts
>>

In mm/yyyy, an environmental impact assessment (EIA) was completed in accordance with Chinese regulation and was/will be approved by the Environmental Protection Bureau of XX on dd/mm/yyyy. The objective of this EIA was to identify the effects of the CPA on both the biophysical components of the environment and socio-economical aspects of local community and to provide measures and procedures to mitigate the possible effects.

During the construction period, wastewater, waste gas and dust, noise and solid waste pollution, etc. caused by the CPA will be treated according to the measures in the EIA, and there will be no significant impact on the environment. XX

During the operation period, the mitigation measures proposed by the EIA will be implemented and the following key aspects will be addressed:

Wastewater

Information will be provided for each CPA.

Waste Gas

Information will be provided for each CPA.

Noise pollution

Information will be provided for each CPA.

Other outcomes of the EIA ....

SECTION C. Local stakeholder comments

C.1. Solicitation of comments from local stakeholders

>>

The CPA implementer distributed questionnaires to local residents who may be impacted by the CPA in order to collect advice for the CPA. The aim of these questionnaires was to collect opinions concerning the influence the CPA would have on the local society, environment, economy, daily life etc.

The following questions are from the questionnaires and stakeholder consultancy meeting:

1. What do you think about the environment of surrounding areas?
2. Has the electricity supply to your house often been cut off?
3. Do you hope the construction of a LFG power generation plant near your house?
4. Do you know a LFG power generation plant will be build near you house?
5. Do you support the construction of this LFG power station?
6. Do you think the implementation of the CPA will cause positive effect on living of local residents?
7. Do you think the implementation of the CPA will cause negative effect?
8. Do you support the construction of LFG power project?
9. any comments and suggestion?

The stakeholders were informed about the stakeholder meeting through posters on dd/mm/yyyy. In the bulletin, the company invited the potential stakeholders to get to know their opinions and/or suggestions about the implementation of the CPA and CDM application of the CPA. The stakeholder consultancy meeting for the parties interested in the CPA was organized at the meeting room of XX on dd/mm/yyyy to collect opinions from all stakeholders, such as representatives of Name of the village residents, entity responsible for the operation of the landfill, the CPA implementer and so on. Meeting minutes were taken.

C.2. Summary of comments received

>>

XX questionnaires were distributed to the villagers lived in Name of the village, and XX questionnaires were returned, so response rate is XX%. Among the questioned people, about XX% are women, the education level of about XX% is lower than high school and range of ages is about XX years old.

1. About XX% of questioned people think the environment of surrounding areas is bad, and others think it is acceptable and good.
2. About XX% of questioned people said the electricity often been cut off.
3. XX% question people hope the construction of a LFG power generation plant near their house.
4. XX% question people know the CPA will be build near their house.
5. About XX% and about XX% of questioned people think the implementation of the CPA will mitigate air pollution and lack of electricity, respectively.
6. XX% of questioned people thinks the negative effect will be caused by the implementation of the CPA.
7. About XX% of questioned people think the advantages of the construction of LFG power project outweigh its disadvantages
8. About XX% of questioned people support the construction of the CPA, and the others abstained.
9. further comments and suggestions

There are XX stakeholders who attended the stakeholder consultation meeting and the CPA implementer had taken meeting minute. To summarise

C.3. Report on consideration of comments received
>>
Reponses to the comments from the stakeholders for the CPA.

SECTION D. Eligibility of CPA and Estimation of emissions reductions
D.1. Title and reference of the approved baseline and monitoring methodology(ies) selected:
>>
Applied methodology:
AMS-III.G: Landfill Methane Recovery - Version 7.0
AMS-I.D: Grid connected renewable electricity generation - Version 17.0

Both selected methodologies are approved for application to CPAs under PoAs.

Cited tools:
- AMS-III.H: Methane recovery in wastewater treatment" – version 16.0
- Methodological tool "Emission from solid waste disposal sites" – Version 06.0.1
- Tool to determine project emissions from flaring gases containing methane – Version 01
- Tool to calculate the emission factor for an electricity system - Version 02.2.1
- "Guidelines on the Demonstration of Additionality of Small-scale Project Activities" - Version 09.0
- Standard for Demonstration of Additionality, Development of Eligibility Criteria and Application of Multiple Methodologies for Programme of Activities - Version 02.1

Reference: cdm.unfccc.int/methodologies/PAmethodologies/approved.html

D.2. Application of methodology(ies)
>>
The CPA collects and utilizes LFG from the landfill for power generation, which would otherwise be released into the atmosphere. Therefore the project avoids methane emissions and, at the same time, electricity is generated from a renewable energy source and it is delivered to the grid. No heat will be

supplied by the CPA. The CPA complies with the applicability conditions of small scale methodologies AMS-III.G and AMS-I.D, as shown in the following tables:

Applicability conditions for AMS-III.G	*Check*
1. This project category comprises measures to capture and combust methane from landfills (i.e., solid waste disposal sites) used for disposal of residues from human activities including municipal, industrial, and other solid wastes containing biodegradable organic matter.	The CPA consists of capturing and combusting LFG (which contains methane) from a landfill site, which is used for disposal of residues from human activities. Therefore this condition is fulfilled.
2. Different options to utilise the recovered landfill gas as detailed in paragraph 3 of AMS-III.H "Methane recovery in wastewater treatment" (version 16) are eligible for use under this methodology. The relevant procedures in AMS-III.H shall be followed in this regard. The recovered methane from the above measures may also be utilized for the following applications instead of flaring or combustion: (a) Thermal or mechanical, electrical energy generation directly; (b) Thermal or mechanical, electrical energy generation after bottling of upgraded biogas, in this case additional guidance provided in Annex I shall be followed; or (c) Thermal or mechanical, electrical energy generation after upgrading and distribution, in this casa additional guidance provided in Annex I shall be followed: i. Upgrading and injection of biogas into a natural gas distribution grid with no significant transmission constraints; ii. Upgrading and transportation of biogas via a dedicated piped network to a group of end users; or iii. Upgrading and transportation of biogas (e.g. by trucks) to distribution points for end users. (d) Hydrogen production. (e) Use as fuel in transportation applications after upgrading.	The recovered methane is utilized for electrical generation directly (i.e. by gas engines included in the project boundary) – option (a). Therefore it is satisfied with the application (a).
3. According to paragraph 3 of AMS-III.H. "If the recovered biogas methane is used for project activities covered under paragraph 2 (a), that component of the project activity shall use a corresponding category under type I.	The CPA uses methodology AMS-I.D. for the power generation component. Therefore this condition is fulfilled.
4. Measures are limited to those that result in aggregate emission reductions of less than or equal to 60 kt CO2 equivalent annually from all type III components of the project activity.	The CPA results in aggregate emission reduction of less than 60 kt CO_2 equivalent annually from all type III components. Therefore this condition is fulfilled.

Applicability conditions for AMS-I.D	*Check*
1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) supplying electricity to a national or a regional grid;	The CPA generates electricity from a renewable biomass (biogas) and supplies it to corresponding regional grid. Therefore this condition is

(b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling	fulfilled.
2. Illustration of situations under the methodology AMS-I.D as follows: • Project supplies electricity to a national/regional grid; • Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)	The CPA plans to supply electricity to corresponding regional grid. Therefore this condition is fulfilled.
3. This methodology is applicable to project activities that (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition1; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	The CPA installs a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant). Therefore this condition of (a) is fulfilled.
4. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir (A reservoir is to be considered as an "existing reservoir" if it has been in operation for at least three years before the implementation of the project activity.), where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	Not applicable (the CPA is not a hydro power plant).
5. If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable (the CPA does not use non-renewable components nor co-fires fossil fuels).
6. Combined heat and power (co-generation) systems are not eligible under this category	The CPA does not co-generate heat and power (only power). Therefore this condition is fulfilled.
7. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct6 from the existing units.	Not applicable (the CPA does not involve addition of renewable energy generation units at an existing renewable power generation facility).
8. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable (the CPA project is not a retrofit or replacement)

D.3. Sources and GHGs

>>

According to AMS-III.G *"the project boundary is the physical, geographical site of the landfill where the gas is captured and destroyed/used."* and AMS-I.D *"The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to."* Therefore, the boundary of the CPA includes the site where the LFG is captured and, as applicable:

- Sites where the LFG is flared or used (e.g. flare, power plant);
- Captive power plant(s) or power generation sources connected to the grid, which are supplying electricity to the CPA;
- Captive power plant(s) or power generation sources connected to the grid, which are supplying electricity in the baseline that is displaced by electricity generated by the CPA.
- The CPA is located in the name of city, thus the CPA boundary is within the geographical boundary of China.

Each CPA utilizes the LFG generated from a SWDS to generate and supply electricity to the grid with possible partial flaring. The CPA plant site and the landfill site, where the LFG is captured and used for electricity generation, are in the boundary of the CPA. The boundary of CPA also includes the LFG collection system, the LFG pre-treatment system, the gas-generator sets, flaring system (if any), and also includes all the power sources connected physically to the Name of Grid the CPA connects to and other regional power grids connected to the grid, if any.

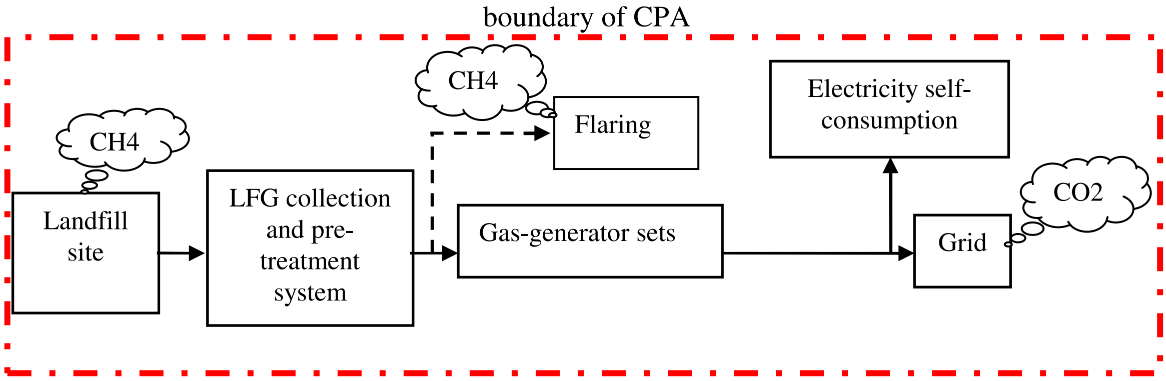

Figure 3 the Diagram of Boundary of Each CPA[2]

Table B.1 Emission sources included or excluded from the boundary of CPA

[2] Monitoring points refer to Figure 5 of Monitoring System.

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from decomposition of waste at the SWDS site	CH_4	Yes	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions. Exclusion of this gas is conservative.
		CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted
	Emissions from electricity generation	CO_2	Yes	The major source of emissions because the electricity is consumed from the grid in the baseline.
		CH_4	No	Excluded for simplification, this is conservative.
		N_2O	No	Excluded for simplification, this is conservative.
	Emissions from heat generation	CO_2	No	No heat generation is involved.
		CH_4	No	No heat generation is involved.
		N_2O	No	No heat generation is involved.
	Emissions from the use of natural gas	CO_2	No	No use of natural gas is involved.
		CH_4	No	No use of natural gas is involved.
		N_2O	No	No use of natural gas is involved.
Project Activity	Emissions from fossil fuel consumption for the purposes other than electricity generation or transportation due to the project activity	CO_2	No	Excluded because there is no fossil fuel consumption.
		CH_4	No	Excluded because there is no fossil fuel consumption.
		N_2O	No	Excluded because there is no fossil fuel consumption.
	Emissions from electricity consumption due to the project activity	CO_2	Yes	Possible emission source.
		CH_4	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
		N_2O	No	Excluded for simplification. This emission source is very small compared to CO_2 emissions.
	Emission from LFG flaring	CH_4	Yes	Possible emission source.
		CO_2	Yes	Not covered by the “Tool to determine project emissions from flaring gases containing methane”
		N_2O	No	Not covered by the “Tool to determine project emissions from flaring gases containing methane”

D.4. Description of the baseline scenario

>>

Describe how the baseline scenario is identified for the CPA in accordance with the PoA.

D.5. Demonstration of eligibility for a CPA

>>

No.	*Eligibility criteria of the PoA*	*Demonstrate how each generic CPA meets the eligibility criteria of the PoA*
1	The CPA takes place in China.	The geographical coordinates of the CPA are XXX, within China.
2	The CPA is not already registered as a single CDM project or part of another registered CDM PoA or identical with another CPA already included in this PoA (geographical coordinates are used to check this criterion)	The CPA is not already registered as a single CDM project or part of another registered CDM PoA or identical with another CPA already included in this PoA (geographical coordinates are used to check this criterion).
3	The CPA consists in the installation of a LFG	In CPA-DD, the description of CPA shows that

	capture and usage system, including electricity generation system to utilize the captured LFG and/or partial flaring.	the CPA consists in the installation of a LFG capture and usage system, including electricity generation system to utilize the captured LFG and extra part flaring. And the Feasibility Study Report (FSR) of the CPA should support such description.
4	The CPA start date is not before the start of the PoA GSC. The start date of CPA must be indicated as the earliest date at which of a real action, such as the main equipment purchase contract, construction contract and construction start report, etc.	In CPA-DD, the start date must be indicated as the earliest date at which of a real action, such as the main equipment purchase contract, construction contract and construction start report, etc. And then comparing the start date of CPA and the start date of GSC of the PoA.
5	The CPA complies with applicability and other requirements of methodologies AMS-III.G and AMS-I.D.	In CPA-DD, it shall be demonstrated that the CPA can comply with applicability and other requirements of methodologies AMS-III.G and AMS-I.D.
6	The CPA meets all the relevant requirements of "Guidelines on the Demonstration of Additionality of Small-scale Project Activities" for the demonstration of additionality.	The additionality of the PoA shall be demonstrated in CPA level. In CPA-DD, the demonstration of additionality of the CPA shall be undertaken as specified in Section "B.1 Demonstration of additionality for PoA" of Part I of PoA-DD as below: FSR of the CPA and IRR calculation spreadsheet should be provided.
7	Local stakeholder consultations and environmental impact analysis for each CPA should be undertaken.	In CPA-DD, details pertaining to the local stakeholder consultation and environmental impact analysis for the CPA shall be available. Documents of minutes and attendant list of stakeholder consultations meeting and Environmental Impact Assessment compiled by qualified entity should be checked.
8	The CPA exports electricity to the grid or to identified consumer via grid which would have bought electricity from the grid, for which it is possible to determine the CO_2 emission factor per unit of electricity distributed (tCO_2e/MWh). If this is not possible, no emission reduction can be claimed for the electricity displacement (but only for the methane emission avoidance part).	In CPA-DD, it shall clear indicate that the electricity generated by the CPA is delivered to the grid or to consumer which would have bought electricity from the grid. The electricity purchase agreement or other support evidence should be checked.
9	Sampling requirements are not applicable.	Not applicable.
10	As the PoA adopts the combination of AMS-I.D and AMS-III.G., the CPAs shall meet the thresholds of a maximum output of 15MW for type I and emission reduction not exceeding 60kt CO2e per year for type III throughout the crediting period of the CPAs.	The total capacity in CPA-DD shall be no more than 15MW and the estimated maximum emission reduction does not exceed 60kt CO2e per year for the component of AMS-III.G. throughout the crediting period of each CPA The technical agreement of generators and Emission Reduction Calculation Spreadsheet should be provided.
11	The CPA is not a debundled component of a large project activity.	In CPA-DD, explain that the CPA shall not be a debundled component of a large project activity,

		according to "Guidelines on Assessment of Debundling for SSC Project Activities".
12	Provide an affirmation that CPA under the PoA does not receive any public funding from Parties included in Annex I, or that in case such public funding is involved, it dose not result in diversion of Official Development Assistance (ODA).	In CPA-DD, such affirmation should be included.

Demonstration of additionality for the CPA

According to "Standard for Demonstration of Additionality, Development of Eligibility Criteria and Application of Multiple Methodologies for Programme of Activities", *PoAs that consist of one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of "Guidelines on the Demonstration of Additionality of Small-scale Project Activities".*

In the absence of the PoA, which means in the absence of the CDM financial support, LFG projects would not happen, because of their low profitability. This is demonstrated by means of an investment barrier of *"Guidelines on the Demonstration of Additionality of Small-scale Project Activities"* (refer to the attached Excel spreadsheet), which shows that for the set of inputs of each CPA (total investment, electricity tariff, expected electricity production, O&M costs, etc.), without the CDM revenue, the project IRR would be below the applicable benchmark and thanks to the PoA which will significantly increase the project IRR.
CPAs additionality implies PoA additionality, because, if CPAs were feasible without CDM, then the implementer of the CPAs would not need to participate in the PoA, and there would be no scope for it.

<u>CDM consideration</u>

Table B.1 presents the schedule of the CPA, which illustrates the main events leading to its successful implementation.

Table B.1 Overview of key events in the CDM development of the CPA

Date	Key Events
24/01/2012	Start date of the PoA
	CDM notification to China DNA (NDRC)
	CDM notification to UNFCCC
	[(expected) first main equipment supply contract or (expected) first main construction contract, which is earlier.] (starting date of the CPA)
	The CPA is expected to start commissioning.

According to above list, the CPA implementer considered CDM before the starting date of the CPA [If the first contract is signed later than the notifications.].

Assessment and demonstration of additionality is carried out through the following steps:
Step 1: Select applicable benchmark
Step 2: Calculate the post-tax project IRR with and without CDM revenue using reasonable inputs
Step 3: Conduct sensitivity analysis
Step 4: Summarize conclusions

Step 1: Select applicable benchmark

The after-tax project IRRs of the proposed CPA including and excluding CDM revenues are compared with the industry benchmark. With reference to the *Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects*[3], the benchmark (after-tax project IRR) to be applied to the project is 8%, which is not a company's internal benchmark.

Step 2: Calculate the post-tax project IRR with and without CDM revenue using reasonable inputs

The parameters for the calculation of the after-tax project IRR are provided below.

Table B.2 Main parameters used in the calculation of the after-tax project IRR

No.	Parameters	Value	Data Source
1	Installed capacity		
2	Annual net power supplied to the grid		
3	Total investment		
4	Total static investment		
5	Working capital		
6	Percentage of bank loan		
7	Electricity Tariff (with VAT)		
8	VAT for electricity		
9	Additional urban construction tax		
10	Education surcharge		
11	Corporate income tax		
12	Operation period		
13	Depreciation period		
14	Residual value rate of fixed assets		
15	Annual average Operation & Maintenance Costs		
16	CER price		
17	Annual average emission reduction		

The benchmark analysis compares the after-tax project IRR of the CPA with the benchmark. The main results of the financial analysis are presented in Table B.3, where the Project IRR with and without CDM revenues is compared to the benchmark.

Table B.3 Comparison of Project IRR and the benchmark

Analyzed scenario	Project IRR (%)
IRR without CDM revenues	
IRR with CDM revenues	
Benchmark	**8%**

[3] "Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects", issued by State Power Corporation on 10/09/2002.

As per the benchmark analysis (Option III), if the after-tax project IRR of the CPA is lower than the benchmark, the CPA is not financial attractive. In the above analysis, the after-tax project IRR without considering CDM revenue is lower than the 8.0% benchmark in this industry, which means the CPA is not financial attractive.

Step 3: Conduct sensitivity analysis

A sensitivity analysis was conducted to check whether the results of the above analysis remain unaltered under reasonable variations in the key parameters[4]. The following key parameters have been modified:

- Total static investment
- Annual O&M cost
- Annual net electricity supplied to the grid
- Electricity tariff

Variations of ±10% have been considered for the key parameters. Table B.4 summarizes the results of the sensitivity analysis.

Table B.4 Impact of variations in key parameters on after-tax project IRR without CDM revenue

	-10%	-5%	0	5%	10%
Total static investment					
Annual O&M cost					
Annual net electricity supplied to the grid					
Electricity tariff					

[Figure 4 of Sensitivity Analysis]

Table B.4 and Figure B.1 show that even if the total static investment, annual O&M cost, annual net electricity supplied to the grid and electricity tariff decrease or increase of 10%, the after-tax project IRR still cannot be higher than 8.0%.

Total static investment: When the total static investment decreases to [XX] RMB, the after-tax Project IRR of the CPA reach benchmark of 8.0%. However, XX

Annual O&M cost: When the after-tax Project IRR cannot reach benchmark of 8.0%, the annual O&M cost decreases by [XX]%, the IRR can reach benchmark of 8%. However, such great decrease is unlikely to happen due to XX. Therefore, it is impossible to improve the economic attractiveness of the CPA by a decrease in annual O&M cost.

Annual net electricity supplied to the grid: When net electricity supplied to the grid increases by [XX]% the after-tax Project IRR can reach benchmark of 8.0%. Even if the capture efficiency is [XX]%, which is a comparatively conservative value among those of other similar projects on UNFCCC, the IRR is still lower than 8%. Even when the generators will supply all generated electricity to the grid (Rate of electricity consumption by plant is assumed to be 0%) during the crediting period, the IRR is still lower than 8%. Moreover, the net electricity supplied to the grid is

4 As per Guidance 20 in Guidelines on the Assessment of Investment Analysis (version 05), besides total static investment, net electricity supplied to the grid and electricity tariff are the two factors directly affect the project revenue. Moreover, annual O&M cost is one of main parameters analysed in the financial analysis of the FSR. Therefore, these four parameters are chosen for sensitivity analysis in the PDD.

calculated based on captured LFG, which is estimated on the amount and composition of the waste disposed, the meteorological condition and capture efficiency. Once the above mentioned factors was fixed, the net electricity supplied to the grid cannot increase by [XX]%.
Electricity tariff: When the after-tax project IRR reach the benchmark of 8.0%, the electricity tariff increases to [XX]RMB/kWh (including VAT), which is hardly to meet. However, according to subsidy policy XX, [XX]RMB/kWh (with VAT) is the indicated electricity tariff for similar projects in Province the CPA located. [add more analysis if necessary] Besides, XX. Therefore, it cannot be expected that the after-tax project IRR will improve due to an increase in the electricity tariff.

Step 4: Summarize conclusions

The sensitivity analysis confirms that the CPA faces a significant financial barrier without CDM revenues.

D.6. Estimation of emission reductions
D.6.1. Explanation of methodological choices
>>
Estimation of the Emission Reductions (ER) of a CPA is done according to the selected methodologies. Basically, amount of LFG destroyed and amount of electricity produced are provided by the technical study of the CPA.
Baseline emissions are determined from the amount of LFG destroyed and the net electricity delivered to the grid, according to the equations described below.
The emission factor of the electricity system to which electricity is delivered is determined according to the “Tool to calculate the emission factor for an electricity system”.
Project emissions and leakage are also calculated referring to the selected methodologies and referred tools, as indicated specifically below.

According to the selected methodologies, Emission Reductions are to be calculated as follows:

Baseline emissions (ex-ante estimation)

According to the adopted methodologies, baseline emissions are to be calculated (ex-ante) as:

For AMS-III.G: $$BE_{y,1} = BE_{CH4,SWDS,y} - MD_{reg,y} \cdot GWP_{CH4} \quad (1)$$

For AMS-I.D: $$BE_{y,2} = EG_{BL,y} \cdot EF_{CO2,grid,y} \quad (2)$$

According to the Feasibility Study Report, it is estimated that not all potential methane emissions of a solid waste disposal site ($BE_{CH4,SWDS,y}$) can be captured from the landfill, but just a portion can be captured and utilised by the project. Therefore formula (1) is revised as:

$$BE_{y,1} = p_{captured} * BE_{CH4,SWDS,y} - MD_{reg,y} * GWP_{CH4} \quad (3)$$

Where:

BE_y	Baseline emissions in year y (tCO_2e)
$BE_{y,1}$	Baseline emissions due to methane destroyed in year y (tCO_2e)
$BE_{y,2}$	Baseline emissions due to electricity displacement in year y (tCO_2e)
$BE_{CH4,SWDS,y}$	Potential methane emissions of a solid waste disposal site in year y (tCO_2e), calculated using the methodological tool “Emissions from solid waste disposal sites”
$MD_{reg,y}$	Methane emissions that would be captured and destroyed to comply with national or

	local safety requirement or legal regulations in the year y (t_{CH4})
GWP_{CH4}	Global Warming Potential for methane (value of 21)
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CPA in year y (MWh)
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year y (tCO_2e/MWh), calculated using the “Tool to calculate the Emission Factor for an electricity system”
$p_{captured}$	Portion of the LFG captured by the collection system of the project

In summary, ex-ante baseline emissions are calculated as:

$$BE_y = p_{captured} \cdot BE_{CH4,SWDS,y} - MD_{reg,y} \cdot GWP_{CH4} + EG_{BL,y} \cdot EF_{CO2,grid,y} \quad (4)$$

Determination of $BE_{CH4,SWDS,y}$

According to the adopted methodology, $BE_{CH4,SWDS,y}$ is determined using the tool *“Emissions from solid waste disposal sites”*. CPAs will mitigate methane emissions by capturing and combusting the methane emitted by an existing landfill. Therefore, CPAs belong to “Application A: The CDM project activity mitigates methane emissions from a specific existing SWDS”.
Also, since data about waste disposal are available on a yearly basis, the yearly model is chosen.
The amount of methane generated from disposal of waste at the SWDS is calculated for year y using the equation:

$$BE_{CH4,SWDS,y} = \varphi_y (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-kj(y-x)} (1 - e^{-kj}) \quad (5)$$

Where:

$BE_{CH4,SWDS,y}$	= Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (tCO_2e/yr)
x	= Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x=1) to the year (x=y)
y	= Year for the crediting period from which methane emissions are calculated (y is a consecutive period of 12 months)
$DOC_{f,y}$	= Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction)
$W_{j,x}$	= Amount of waste type j disposed or prevented from disposal in the SWDS in the year x
φ_y	= Model correction factor to account for model uncertainties for year y
f_y	= Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	= Global warming potential of methane
OX	= Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	= Fraction of methane in the SWDS gas (volume fraction)
MCF_y	= Methane Correction Factor for year y
DOC_j	= Fraction of degradable organic carbon in the waste type j (weight fraction)
k_j	= Decay rate for the waste type j
j	= Type of residual waste or types of waste in the MSW

Determining the parameters required to apply the first order decay (FOD) model

Overview of the option to determine parameters

<table>
<tr><th>Parameter</th><th>Application A</th><th>Value adopted for Application A</th></tr>
<tr><td>φ_y</td><td>Project or leakage emission: default values
Baseline emissions: default values or project specific value estimated yearly</td><td>Based on the application A, for the baseline emissions, the default value is as follow:
<table>
<tr><td>Humid/wet conditions</td><td>Dry conditions</td></tr>
<tr><td>0.75</td><td>0.75</td></tr>
</table></td></tr>
<tr><td>OX</td><td>Default value</td><td>0.1</td></tr>
<tr><td>F</td><td>Default value</td><td>0.5</td></tr>
<tr><td>$DOC_{f,y}$</td><td>Default value</td><td>0.5</td></tr>
<tr><td>MCF_y</td><td>Default value (based on SWDS type)</td><td>Use the following values for MCF:
• 1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste;
• 0.5 for semi-aerobic managed solid waste disposal sites. These must have controlled placement of waste and will include all of the following structures for introducing air to waste layers: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system;
• 0.8 for unmanaged solid waste disposal sites – deep. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters;
• 0.4 for unmanaged-shallow solid waste disposal sites. This comprises all SWDS. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres. This includes stockpiles of solid waste that are considered SWDS (according to the definition given for a SWDS)</td></tr>
<tr><td>k_j</td><td>Default value (based on waste type)</td><td>
<table>
<tr><td colspan="2" rowspan="2">Waste type j</td><td colspan="2">Boreal and temperate (MAT ≤ 20 °C)</td><td colspan="2">Tropical (MAT>20 °C)</td></tr>
<tr><td>Dry (MAP/PET < 1)</td><td>Wet (MAP/PET > 1)</td><td>Dry (MAP< 1000mm)</td><td>Wet (MAP> 1000mm)</td></tr>
<tr><td rowspan="2">Slow degrading</td><td>Pulp, paper and cardboard (other than sludge), textiles</td><td>0.04</td><td>0.06</td><td>0.045</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.02</td><td>0.03</td><td>0.025</td><td>0.035</td></tr>
<tr><td>Moderately degradi</td><td>Other (non food) organic putrescible</td><td>0.05</td><td>0.10</td><td>0.065</td><td>0.17</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td></td><td><table><tr><td>ng</td><td>garden and park waste</td><td></td><td></td><td></td><td></td></tr><tr><td>Rapidly degradi ng</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.06</td><td>0.185</td><td>0.085</td><td>0.40</td></tr></table></td></tr>
<tr><td>$W_{j,x}$</td><td>Estimated once</td><td>See section B.6.2 (value depends on CPA)</td></tr>
<tr><td>DOC_j</td><td>Default value (based on waste type)</td><td><table><tr><th>Waste type j</th><th>DOC_j (% wet waste)</th></tr><tr><td>W_1-Wood and wood products</td><td>43</td></tr><tr><td>W_2-Pulp, paper and cardboard (other than sludge)</td><td>40</td></tr><tr><td>W_3-Food, food waste, beverages and tobacco (other than sludge)</td><td>15</td></tr><tr><td>W_4-Textiles</td><td>24</td></tr><tr><td>W_5-Garden, yard and park waste</td><td>20</td></tr><tr><td>W_6-Glass, plastic, metal, other inert waste</td><td>0</td></tr></table>The percentages listed in the table above are based on a wet waste basis which are concentrations in the waste as it is delivered to the SWDS.</td></tr>
<tr><td>f_y</td><td>Estimated once</td><td>See section B.6.2 (value depends on CPA)</td></tr>
</table>

Determining the model correction factor (φ_y)

The model correction factor (φ_y) depends on the uncertainty of the parameters used in the FOD model. As baseline emissions are being calculated, then project participants may choose between two options to calculate (φ_y). Option 1: Use a default value; Option 2: Determine φ_y based on specific situation of the project activity. There are many CPAs under PoA, so the specific situation of each CPA cannot be identified at PoA level, so Option 1 is chosen for all CPAs.

Option 1: Use a default value

Use a default value: $\varphi_y = \varphi_{default}$. Default values for different applications and climatic conditions are provided in the section "B.6.2 Data and parameters that are to be reported ex-ante".

Determining the amounts of waste types j disposed in the SWDS ($W_{j,x}$)

For Application A, calculate $W_{j,x}$ based on information from the SWDS owner and administration and from interviews with senior employees. The total amount of waste can be calculated from the SWDS surface area and average depth, assuming a specific weight of 1-1.2 t per cubic meter. If the SWDS has distinct compartments and if the amount of waste per compartment and the exploitation period of a compartment is known, then the amounts of waste for a specific series of years can be obtained. Further historic information on amounts, composition and origin of the waste might be found in SWDS administration documents (e.g. contracts with clients and invoices to clients) or obtained from old business plans or business evaluations.

The landfill provided the evaluations of total amount of solid waste disposed in every year of its lifetime and average fractions of different waste types in the waste, which are used to calculate $W_{j,x}$

$$W_{j,x} = W_x \cdot p_j \qquad (6)$$

W_x = Total amount of solid waste disposed or prevented from disposal in the SWDS in year x

p_j = Average fraction of the waste type j (weight fraction)
j = Types of solid waste
x = Years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x=1) to year y (x=y)

Determination of the emission factor for electricity generation ($EF_{CO2,grid,y}$)

According to the methodology AMS I.D., the emission factor ($EF_{CO2,grid,y}$) can be calculated as a combine margin (CM) ($EF_{grid,CM,y}$) according to the procedures prescribed in "*Tool to calculate the emission factor for an electricity system*"

The operating margin emission factor and the build margin emission factor used for calculating emission reduction of the project was updated 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 more information on the published OM and BM emission factors, please see details at http://cdm.ccchina.gov.cn

According to the latest version of the "Tool to calculate the emission factor for an electricity system", the grid emission factor is determined by calculating the "combined margin" emission factor (CM) of the electricity system. The CM is the weighted average of two emission factors pertaining to the electricity system: the "operating margin"(OM) and the "build margin"(BM). The operating margin is the emission factor that refers to the group of existing power plants whose current electricity generation would be affected by the proposed CDM project activity. The build margin is the emission factor that refers to the group of prospective power plants whose construction and future operation would be affected by the proposed CDM project activity.

The tool provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	tCO_2e/MWh	Combined margin CO_2 emission factor for the project electricity system in year y
$EF_{grid,BM,y}$	tCO_2e/MWh	Build margin CO_2 emission factor for the project electricity system in year y
$EF_{grid,OM,y}$	tCO_2e/MWh	Operating margin CO_2 emission factor for the project electricity system in year y

$EF_{grid,OM,y}$, $EF_{grid,BM,y}$ $EF_{grid,CM,y}$ are calculated by the following steps:

Step 1. Identify the relevant electricity systems;
Step 2. Choose whether to include off-grid power plants in the project electricity system (optional);
Step 3. Select a method to determine the operating margin (OM);
Step 4. Calculate the operating margin emission factor according to the selected method;
Step 5. Calculate the build margin (BM) emission factor;
Step 6. Calculate the combined margin (CM) emission factor.

The Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$) calculation for the Central China Power Grid is calculated as follows:

STEP 1. Identify the relevant electricity systems

Chinese DNA has published a delineation of the project electricity system and connected electricity systems, which is adopted by this project. The power generated by the project displaces the equivalent

electricity generated by the the name of the grid, which is the project electricity system. The Grid is a large regional grid, which covers: XX. reports the connects electricity system, if any

In addition, there is net imported power to the Grid from other Grids, which are connected electricity systems. According to the "*Tool to calculate the emission factor for an electricity system*", use one of the following options to determine the CO_2 emission factor for net electricity imports from a connected electricity system:
0tCO_2e/MWh, or
a) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in Step 4 (d) below; or
b) The simple operating margin emission rate of the exporting grid, determined as described in Step 4(a), if the conditions for this method, as described in Step 3 below, apply to the exporting grid; or
c) The simple adjusted operating margin emission rate of the exporting grid, determined as described in Step 4(b) below.

The CPA-DDs will choose option c) to calculate the CO_2 emission factor for net electricity imports from other Grids.

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

Option I: Only grid power plants are included in the calculation.
OptionII: Both grid power plants and off-grid power plants are included in the calculation.

Based on the actual situation of China, the Option I has been chosen for the calculation (because the option II aims to reflect that in some countries off-grid power generation is significant and can partially be replaced by CDM project activities). The Option II is not the situation of the CPA.

STEP 3. Select a method to determine the operating margin (OM)

"Tool to calculate the emission factor for an electricity system" offers four methods for the calculation of the operating margin emission factor(s) ($EF_{grid,OM,y}$):

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

In the recent five years from yyyy to yyyy (data available), in the composition of gross annual generation power for the the name of the grid, the ratio of power generated by hydro-power and other low cost/must run resources is as follow: XXXX, obviously far lower than 50%. Based on these considerations, Simple OM is appropriate to be used for calculated OM, because low cost/ must run resources account for far less than 50% of the total power generation in the Grid in weighted average of the three most recent years.

For simple OM, the emission factor can be calculated using either of the two following data vintages:
- *Ex ante* option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the mission factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD for validation. For off-grid power plants, use a single calendar year within the five most recent calendar years prior to the time of submission of the CDM-PDD for validation;
- *Ex post* option: If the *ex post* option is chosen, the emission factor is determined for 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 is usually

only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods

Project participant employs *ex ante* option for its operation margin calculation. The data vintage chosen should be documented in the CDM-PDD and should not be changed during the crediting period.

STEP 4. Calculate the operating margin emission factor according to the selected method

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2e/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It 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.

Option B can only be used if:

a. The necessary data for Operation is not available: and
b. Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
c. Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

The Option B is chosen.

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

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}\right)}{EG_y} \quad (7)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2e/MWh);
$FC_{i,y}$ = Amount of fossil fuel type *i* consumed in the project electricity system in year y (mass or volume unit);
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit), National fixed value;
$EF_{CO_2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2e/GJ), IPCC Guidelines for default values;
EG_y = Net electricity generated and delivered to the grid by power plant / unit *m* in year *y* (MWh).

The electricity imports from other Grids to the Grid will be considered as power sources. Because it is impossible to identify the proposed power plants of the other Grid exporting electricity to the Grid, so the other Grids will be taken into account.

The operating margin emission factor of the baseline is calculated ex-ante and will not be renewed in the crediting period of the project activity. The operating margin emission factors for recent three years (data available) are calculated. The three-year average is calculated as a weighted average of the emission factors.

The data resources for calculating $EF_{grid,OM,y}$ are:

- Power generation and the rate of internal electricity consumption of thermal power plants
  Source: *China Electric Power Yearbook* (yyyy - yyyy); *China Energy Statistical Yearbook* (yyyy - yyyy) *and Compilation of China Electric Power Industry Statistics* (yyyy - yyyy)
- Fuel consumption and the net caloric value of thermal power plants
  Source: *China Energy Statistical Yearbook* (yyyy - yyyy)
- CO_2 emission factor of each fuel
  Source: yyyy *IPCC Guidelines for default values* (yyyy - yyyy)

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 CPA-DDs choose Option 1, which requires the project participant to calculate the build margin emission factor $EF_{grid,BM,y}$ *ex-ante* based on the most recent information available already built for sample group m at the time of PDD submission

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \tag{8}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2e/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_2e/MWh).

Project participants should use the set of power units that comprises the larger annual generation.

However, in China it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently. According to the guidance from the CDM Executive Board for a deviation of the baseline methodology of AM0005 (M-DEV0004: Application of AM0005 and AMS-I.D in China), the following deviation was adopted to calculate the Build Margin emission factor[5].

1) Capacity addition from one year to another is used as basis for determining the build margin, i.e. the capacity addition over 1-3 years, whichever results in a capacity addition that is closest to 20% of total installed capacity.
2) Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above, using plant efficiencies and emission factors of commercially available best practice technology in terms of efficiency. 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.

Since there is no way to separate the different generation technology capacities as fuel coal, fuel oil, fuel gas etc from thermal power based on the present statistical data, the following calculating measures will be taken:

- First, according to the statistical data of the most recent one year, determine the ratio of CO_2 emissions produced by coal, oil and gas fuels consumption for power generation;
- Second, multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency;
- Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the BM emission factor of the grid.

Sub-step 1: Calculate the proportion of CO_2 emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO_2 emissions from the total fossil fuelled electricity generation (sum of CO_2 emissions from coal, oil and gas).

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \qquad (9)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in gas,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \qquad (10)$$

$$\lambda_{oil,y} = \frac{\sum_{i \in oil,m} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}} \qquad (11)$$

[5] http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ

Where,

$FC_{i,m,y}$ = Amount of fuel i consumed by relevant power unit m in year y (Mass or Volume unit);

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i (coal, oil and gas) in year y (GJ/Mass or Volume unit);

$EF_{CO_2,i,y}$ = CO_2 emission factor of fossil fuel type i (coal, oil and gas) in year y(tCO_2e/GJ).

Coal, Oil and *Gas* is solid fuel, liquid fuel and gas fuel respectively.

Sub-step 2: Calculate the operating margin emission factor of fuel-based generation.

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (12)$$

Where,

$EF_{Coal,Adv,y}, EF_{Oil,Adv,y}, EF_{Gas,Adv,y}$ are the emission factors of coal, oil and gas-fired power generation with efficiency levels of the best commercially available technology in China in the previous three years.

Sub-step 3: Calculate the Building Margin emission factor

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (13)$$

Where,

$CAP_{Total,y}$ = Total capacity addition of the selected period in which approximately 20% capacity has been added to the grid

$CAP_{Thermal,y}$ = Total thermal power capacity addition of the selected period in which approximately 20% capacity has been added to the grid.

The data resources for calculating $EF_{grid,BM,y}$ are:

- Installed capacities of different power in the Central China Power Grid
  Source: *China Electric Power Yearbook* (yyyy - yyyy)
- Fuel consumption and the net caloric value of thermal power plants
  Source: *China Energy Statistical Yearbook* (yyyy - yyyy)
- CO_2 emission factor of coal-fired, oil-fired and gas-fired power
  Source: yyyy*Baseline Emission Factors for Regional Power Grids in China*

STEP 6. Calculate the combined margin emissions factor

According to the latest version of the "Tool to calculate the emission factor for an electricity system", the weighted average CM method (option A) is used. The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \quad (14)$$

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

Project emissions

According to the adopted methodologies, project emissions are to be calculated as:

$$PE_y = PE_{power,y} + PE_{flare,y} + PE_{process,y} \quad (15)$$

PE_y	Project emissions in 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)
$PE_{flare,y}$	Emissions from flaring or combustion of the landfill gas stream in the year *y* (tCO_2e)
$PE_{process,y}$	Emissions from the landfill gas upgrading process in the year y (tCO_2e), determined by following the relevant procedures described in Annex 1 of AMS-III.H

Determination of $PE_{power,y}$

Project emissions from electricity consumption are determined as per the procedures described in AMS-I.D "Grid connected renewable electricity generation". Since the project generates electricity, internal electricity consumption is deducted from the gross generation, and only the net export is taken into account to calculate the emission reductions. Therefore, there is no need to consider the electricity consumption under this item.
Also, since there is no use of fossil fuels for the operation of the project activity, $PE_{powe,y} = 0$.

Determination of $PE_{flare,y}$ (this part would be deleted if there is no flaring system employed by the CPA)
In case flaring (single or multiple) is used to destroy all or part of the recovered LFG, project emissions from flaring in year y ($PE_{flare,y}$ in tCO2e) shall be determined following the procedure described in the "Tool to determine project emissions from flaring gases containing methane".

According to the "Tool to determine project emissions from flaring gases containing methane", project emissions from flaring of the residual gas stream are calculated based on the flare efficiency and the mass flow rate of methane in the LFG that is flared. The flare efficiency depends on both the actual efficiency of combustion in the flare and the time that the flare is operating. The efficiency of combustion in the flare is calculated from the methane content in the exhaust gas of the flare, corrected for the air used in the combustion process, and the methane content in the residual gas.

For open flares, a default value of 50% is to be used provided that it can be demonstrated that the flare is operational (e.g. through a flame detection system reporting electronically on continuous basis). If the flare is not operational the default value to be adopted for flare efficiency is 0%.

For enclosed flares, the temperature in the exhaust gas of the flare is measured to determine whether the flare is operating or not.
For enclosed flares, either of the following two options can be used to determine the flare efficiency:
(a) To use a 90% default value. Continuous monitoring of compliance with manufacturer's specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour.
(b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).
In both cases, if there is no record of the temperature of the exhaust gas of the flare or if the recorded temperature is less than 500 °C for any particular hour, it shall be assumed that during that hour the flare efficiency is zero.

CME should document in the CPA-DD, which type of flare and which approach to determine the flare efficiency is used. In case of use of the default value for the methane destruction efficiency, the manufacturer's specifications for the operation of the flare and the required data and procedures to monitor these specifications should be documented in the CPA-DD.

For the CPA, the flare type is open flare or enclosed flare, and the flare efficiency is the Default value or Calculated value.

$PE_{flare,y}$ is determined by the following seven steps:

STEP 1: Determination of the mass flow rate of the residual gas that is flared
STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas
STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis
STEP 4: Determination of methane mass flow rate of the exhaust gas on a dry basis
STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis
STEP 6: Determination of the hourly flare efficiency
STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Project participants shall apply these steps to calculate project emissions from flaring ($\boldsymbol{PE_{flare,y}}$) based on the measured hourly flare efficiency or based on the default values for the flare efficiency ($\boldsymbol{\eta_{flare,h}}$). Note that steps 3 and 4 are only applicable in case of enclosed flares and continuous monitoring of the flare efficiency.
The calculation procedure in this tool determines the flow rate of methane before and after the destruction in the flare, taking into account the amount of air supplied to the combustion reaction and the exhaust gas composition (oxygen and methane). The flare efficiency is calculated for each hour of a year based either on measurements or default values plus operational parameters. Project emissions are determined by multiplying the methane flow rate in the residual gas with the flare efficiency for each hour of the year.

STEP 1: Determination of the mass flow rate of the residual gas that is flared

This step is skipped, because the quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density of methane ($\rho_{CH4,n,h}$) in the same reference conditions.

STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

This step is skipped, because the quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density of methane ($\rho_{CH4,n,h}$) in the same reference conditions.

STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis

This step is skipped, because the default value is use to determine the flare efficiency.

STEP 4: Determination of methane mass flow rate of the exhaust gas on a dry basis

This step is skipped, because the default value is use to determine the flare efficiency.

STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis

The quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density of methane ($\rho_{CH4,n,h}$) in the same reference conditions (normal conditions and dry or wet basis).
It is necessary to refer both measurements (flow rate of the residual gas and volumetric fraction of methane in the residual gas) to the same reference condition that may be dry or wet basis. If the residual gas moisture is significant (temperature greater than 60ºC), the measured flow rate of the residual gas that is usually referred to wet basis should be corrected to dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis (i.e. water is removed before sample analysis).

$$TM_{FG,h} = FV_{RG,h} \times fv_{CH4,RG,h} \times \rho_{CH4,n} \quad (16)$$

Where:

$TM_{RG,h}$	kg/h	Mass flow rate of methane in the residual gas in the hour *h*
$FV_{RG,h}$	m^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *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).
$\rho_{CH4,n}$	kg/m^3	Density of methane at normal conditions (0.716)

STEP 6: Determination of the hourly flare efficiency

The flare efficiency of the PoA, is determined by the default value.

For enclosed flares and use of the default value for the flare efficiency, the flare efficiency in the hour *h* ($\eta_{flare,h}$) is:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour *h*.
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h, but the manufacturer's specifications on proper operation of the flare are not met at any point in time during the hour *h*.
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h.

In case of open flares, the flare efficiency in the hour h ($\eta_{flare,h}$) is

- 0% if the flame is not detected for more than 20 minutes during the hour *h*.
- 50%, if the flame is detected for more than 20 minutes during the hour *h*.

STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Project emissions from flaring are calculated as the sum of emissions from each hour h, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour *h* ($\eta_{flare,h}$), as follows:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \left(1 - \eta_{flare,h}\right) \times \frac{GWP_{CH4}}{1000} \quad (17)$$

Where:

$PE_{flare,y}$	tCO_2e	Project emissions from flaring of the residual gas stream in year *y*
$TM_{RG,h}$	kg/h	Mass flow rate of methane in the residual gas in the hour *h*
$\eta_{flare,h}$	-	Flare efficiency in the hour *h*
GWP_{CH4}	tCO_2e/tCH_4	Global Warming Potential of methane valid for the commitment period

Constants used in equations

Parameter	***SI Unit***	***Description***	***Value***
P_n	Pa	Atmospheric pressure at normal conditions	101,325
T_n	K	Temperature at normal conditions	273.15
R_u	$Pa.m^3/kmol.K$	Universal ideal gases constant	8,314
GWP_{CH4}	tCO^2/tCH_4	Global warming potential of methane	21
$\rho_{CH4,n}$	kg/m^3	Density of methane gas at normal conditions	0.716

Determination of $PE_{process,y}$

The CPA recovers LFG for power generation and does not involve upgrading process, therefore, $PE_{process,y}$ is equal to 0.

Leakage emissions

According to AMS-III.G:

If the methane recovery technology is equipment transferred from another activity, leakage effects are to be considered.

Similarly, according to AMS-I.D:

If the energy generating equipment is transferred from another activity, leakage is to be considered.

confirm if there is any equipment transferred from another activity. If not, LEy=0

Emission Reductions (ex-ante)

According to AMS-III.G, the expected emission reductions achieved by the CPA are estimated ex-ante as:

$$ER_{y,estimated} = BE_y - PE_y - LE_y \quad (18)$$

By combining all the above equations, the ex-ante estimate of the emission reduction is:

$$ER_{y,estimated} = p_{captured} \cdot BE_{CH4,SWDS,y} - MD_{reg,y} \cdot GWP_{CH4} + EG_{BL,y} \cdot EF_{CO2,grid,y} - PE_{flare,y} - LE_y \quad (19)$$

Emission Reductions (ex-post)

According to AMS-III.G, the actual emission reduction achieved by the CPA will be calculated using the amount of methane actually recovered and destroyed/gainfully used by the project activity, calculated as:

$$ER_{y,calculated} = \left(MD_y - MD_{reg,y}\right) \cdot GWP_{CH4} - PE_y - LE_y \tag{20}$$

Where:

MD_y is methane captured and destroyed/gainfully used by the project activity in the year y (t_{CH4}).

$$MD_y = w_{CH4,y} \cdot D_{CH4,y} \cdot \sum_i LFG_{i,y} \tag{21}$$

Where:

$LFG_{i,y}$ Landfill gas destroyed via method i (flaring, fuelling, combustion, injection in a grid, etc.) in the year *y* (m^3LFG)

$w_{CH4,y}$ Methane content in LFG in the year y (volume fraction, m^3CH4 /m^3LFG)

$D_{CH4,y}$ Density of methane at the temperature and pressure of the landfill gas in the year *y* (tonnes/m^3)

Given that in each CPA, LFG is destroyed either via flaring or combustion for power generation, the following equation is established:

$$\sum_i LFG_{i,y} = LFG_{total,y} = LFG_{flare,y} + LFG_{electricity,y} \tag{21-1}$$

where:

$LFG_{flare,y}$ Volume of LFG sent to flaring at normal conditions in year y

$LFG_{electricity,y}$ Volume of LFG sent to power generation at normal conditions in year y

In conclusion, actual emission reductions are calculated as:

$$ER_{y,calculated} = \left(w_{CH4,y} \cdot D_{CH4,y} \cdot LFG_{total,y} - MD_{reg,y}\right) \cdot GWP_{CH4} + EG_{BL,y} \cdot EF_{CO2,grid,y} - PE_y - LE_y \tag{22}$$

D.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	$EGP_{y,j}$
Unit	MWh
Description	Power generated by source j in the year y (yyyy-yyyy)
Source of data	China Electric Power Yearbooks (yyyy-yyyy) China Energy Statistical Yearbooks (yyyy-yyyy)
Value(s) applied	Details in Appendix 4
Choice of data or Measurement methods and procedures	Official Statistical Data
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$GEN_{import,y}$
Unit	MWh
Description	Power imported from other grid in year y (yyyy-yyyy)
Source of data	Compilation of Electric Power Industry Statistics (yyyy-yyyy)
Value(s) applied	Details in Appendix 4
Choice of data or Measurement methods and procedures	Official Statistical Data
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	PR_y
Unit	%
Description	Rate of electricity consumption of thermal power plants in year y (yyyy-yyyy)
Source of data	China Electric Power Yearbooks (yyyy-yyyy)
Value(s) applied	Details in Appendix 4
Choice of data or Measurement methods and procedures	Official Statistical Data
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$FC_{i,y}$
Unit	$10^4t/10^8m^3$
Description	Quantity of fuel i (in a mass or volume unit) consumed by power plant j feeding the project electricity system in year y
Source of data	China Energy Statistical Yearbooks (yyyy-yyyy)
Value(s) applied	Details in Appendix 4
Choice of data or Measurement methods and procedures	Official Statistical Data
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$NCV_{i,y}$
Unit	MJ/ fuel in a mass or volume unit
Description	The Net Calorific Values of Fuel i (mass or volume unit) in year y
Source of data	China Energy Statistical Yearbooks (yyyy)
Value(s) applied	Details in Appendix 4
Choice of data or Measurement methods and procedures	National Fixed Value
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$EF_{CO_2,i,y}$
Unit	tC/TJ
Description	The Emission Factor of Fuel *i* in a mass or volume unit in year y
Source of data	yyyy IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	Details in Appendix 4
Choice of data or Measurement methods and procedures	yyyyIPCC Default Value
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$EF_{Coal,Adv,y}$
Unit	%
Description	Commercially available coal-fired power plant corresponding to the best practice in terms of efficiency
Source of data	yyyy Baseline Emission Factors for Regional Power Grids in China
Value(s) applied	XX%
Choice of data or Measurement methods and procedures	National Fixed Value
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$EF_{Gas,Adv,y}$
Unit	%
Description	Commercially available gas-fired power plant corresponding to the best practice in terms of efficiency
Source of data	yyyy Baseline Emission Factors for Regional Power Grids in China
Value(s) applied	XX%
Choice of data or Measurement methods and procedures	National Fixed Value
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$EF_{Oil,Adv,y}$
Unit	%
Description	Commercially available oil-fired power plant corresponding to the best practice in terms of efficiency
Source of data	yyyy Baseline Emission Factors for Regional Power Grids in China
Value(s) applied	XX%
Choice of data or Measurement methods and procedures	National Fixed Value
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	$CAP_{y,j}$
Unit	MW
Description	The Install Capacity of Power Sources j in the year y
Source of data	China Electric Power Yearbooks(yyyy-yyyy)
Value(s) applied	Details in Appendix 4
Choice of data or Measurement methods and procedures	Official Statistical Data
Purpose of data	Calculation of baseline emissions
Additional comment	/

Data / Parameter	GWP_{CH4}
Unit	tCO_2e/tCH_4
Description	CH_4 global warming potential of CH_4
Source of data	yyyy IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions
Choice of data or Measurement methods and procedures	-
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$p_{captured}$
Unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	XX
Value(s) applied	XX%
Choice of data or Measurement methods and procedures	Technical specifications of the LFG capture system to be installed (if available) or a default value of 50%
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable to Step A.1.1

Data / Parameter	$W_{j,x}$
Unit	t
Description	Amount of solid waste type j disposed or prevented from disposal in the SWDS in the year x
Source of data	Estimated based on total amount of waste prevented from disposal and average weight fraction of the waste type collected
Value(s) applied	(see tables below)
Choice of data or Measurement methods and procedures	For application A, the parameter is estimated once based on the total amount of waste disposed of and average weight fraction of the waste type.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Value(s) applied:

year	Total amount of waste prevented from disposal (tones)

Data source:

Component	Average weight fraction of the waste type	Rate of degradation
Wood and wood products		
Pulp, paper and cardboard		
Food, food waste, beverages and tobacco		
Textiles		
Garden, yard and park waste		
Glass, plastic, metal other inert		

Data source:

Data / Parameter	f_y
Unit	-
Description	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
Source of data	Select the maximum value from the following: (a) contract or regulation requirements specifying the amount of methane that must be destroyed/used (if available) and (b) historic data on the amount captured
Value(s) applied	0
Choice of data or Measurement methods and procedures	For application A: Estimated once for the crediting period (f_y) According to the methodology of ACM0001, f_y in the tool shall be assigned a value 0 because the amount for LFG that would have been captured and destroyed is already accounted for $BE_{CH4,y}$.
Purpose of data	Calculation of baseline emissions
Additional comment	-

D.6.3. Ex-ante calculation of emission reductions

>>

Provide a transparent ex ante calculation of project emissions, baseline emissions, project emissions (or, where applicable, direct calculation of emission reductions) and leakage emissions expected during the crediting period, applying all relevant equat

D.6.4. Summary of the ex-ante estimates of emission reduction

Year	Baseline emissions ($t\ CO_2e$)	Project emissions ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions ($t\ CO_2e$)
Year A				
Year B				
Year C				
Year …				
Total				
Total number of crediting years				
Annual average over the crediting period				

D.7. Application of the monitoring methodology and description of the monitoring plan

D.7.1. Data and parameters to be monitored

Data / Parameter	$LFG_{total,y}$
Unit	Nm^3 (dry basis)
Description	Total amount of LFG captured at Normal Temperature and Pressure in year y
Source of data	Measurements by project participants using a flow meter
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Measured continuously by flow meter F1, and recorded at least once per hour. Data to be aggregated monthly and yearly.
Monitoring frequency	continuously
QA/QC procedures	The flow meter (accuracy: XX) should be calibrated once per year, in accordance with the national standard
Purpose of data	Calculation of baseline emissions
Additional comments	The flow meter automatically measures temperature and pressure, expressing LFG volumes in Normalized cubic meters (Nm^3). Data will be archived during the crediting period and kept until two years after. In case the flow meter can neither measure temperature nor pressure simultaneously, the thermometer and manometer should be installed.

Data / Parameter	$LFG_{electricity,y}$ ($LFG_{,i,y}$, where i index combustion for electricity)
Unit	Nm^3 (dry basis)
Description	Amount of LFG combusted to generate power at Normal Temperature and Pressure in year y
Source of data	Measurements by project participants using a flow meter
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Measured continuously by flow meters F2~Fn, and recorded at least once per hour. Data to be aggregated monthly and yearly.
Monitoring frequency	continuously
QA/QC procedures	Flow meter(s) (accuracy: XX) should be calibrated once per year, in accordance with the national standard.
Purpose of data	Calculation of baseline emissions
Additional comments	Flow meter(s) will automatically measure temperature and pressure, expressing LFG volumes in Normalized cubic meters (Nm^3). Data will be archived during the crediting period and kept until two years after. In case the flow meter(s) can neither measure temperature nor pressure simultaneously, the thermometer(s) and manometer(s) should be installed.

Data / Parameter	$LFG_{flare,h}$ ($FV_{RG,h}$, $LFG_{,i,y}$, where i index flaring)
Unit	Nm^3/h (dry gas)
Description	Volumetric flow rate of the LFG to be flared in dry basis at normal conditions in the hour *h*
Source of data	Measurements by project participants using a flow meter
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	If the CPA will not employ volumetric flow meters Fn+1, which can convert volumetric flow to normal conditions, volumetric flow measurement will refer to the actual pressure and temperature.
Monitoring frequency	Continuously. Values to be averaged hourly or at a shorter time interval.
QA/QC procedures	Flow meter(s) (accuracy: XX) should be calibrated once per year, in accordance with the national standard.
Purpose of data	Calculation of project emissions
Additional comments	Monitored only in case of flaring. Flow meter(s) will automatically measure temperature and pressure, expressing LFG volumes in Normalized cubic meters (Nm^3). Data will be archived during the crediting period and kept until two years after. In case the flow meter(s) can neither measure temperature nor pressure simultaneously, the thermometer(s) and manometer(s) should be installed.

Data / Parameter	$w_{CH4,y}$ (equivalent also to $fv_{CH4,RG,h}$)
Unit	$m^3\ CH_4/m^3$ dry gas
Description	Volumetric fraction of CH_4 in the LFG in the hour *h* on a dry basis
Source of data	Measurements by project participants using a continuous gas analyser
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Continuous gas analyser operating in dry-basis, if not specified in the underlying methodology. Volumetric flow measurement should always refer to the actual pressure and temperature. Some CPAs will be possible to employ volumetric flow meters, which can convert volumetric flow to normal conditions.
Monitoring frequency	Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures	Calibration should include zero verification with an inert gas (e.g. N_2) and at least every one year with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period. accuracy: XX
Purpose of data	Calculation of baseline emissions and project emissions
Additional comments	As a simplified approach, project participants may only measure the volumetric fraction of methane and consider the remaining part as nitrogen (N_2).

Data / Parameter	T_t
Unit	K
Description	Temperature of the LFG in time interval t
Source of data	On-site measures
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Continuous unless differently specified in the underlying methodology. Instruments with recordable electronic signal (analogical or digital) are required.
Monitoring frequency	hourly
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration is according to manufacturer's specifications and the frequency of calibration is every year. accuracy: at least 1°C
Purpose of data	Calculation of baseline emissions
Additional comments	This parameter is monitored only in case LFG flow measures are not already automatically adjusted for temperature and pressure. Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency). Besides, this parameter must be monitored continuously to assure the applicability condition, i.e. the gaseous stream flow temperature being below 60°C, is met.

Data / Parameter	P_t
Unit	Pa
Description	Pressure of the LFG in time interval t
Source of data	On-site measures
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Continuous unless differently specified in the underlying methodology. Instruments with recordable electronic signal (analogical or digital) are required.
Monitoring frequency	hourly
QA/QC procedures	Periodic calibration against a primary device must be performed periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) must be calibrated yearly. accuracy: at least 2%
Purpose of data	Calculation of baseline emissions
Additional comments	This parameter is monitored only in case of flaring and/or if LFG flow measures are not already automatically adjusted for temperature and pressure. Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency).

Data / Parameter	T_{flare}
Unit	°C
Description	Temperature in the exhaust gas of the flare
Source of data	Measurements by project participants
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500 ºC indicates that a significant amount of gases are still being burnt and that the flare is operating.
Monitoring frequency	Continuously.
QA/QC procedures	Thermocouples should be replaced or calibrated every year. accuracy: at least 1°C
Purpose of data	Calculation of project emissions
Additional comments	An excessively high temperature at the sampling point (above 700 ºC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow.

Data / Parameter	***Other flare operation parameters*** (only for open flare)
Unit	-
Description	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer’s specifications including a flame detector in case of open flares.
Source of data	Measurements by project participants
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	-
Monitoring frequency	Continuously
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Only applicable in case of use of a default value

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Net amount of electricity supplied to the grid or the consumer would have bought electricity from the grid as a result of the implementation of the CPA in year y
Source of data	Electricity meter
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Measured continuously by electricity meter(s). This parameter represents the difference between the amount of electricity exported to the grid and imported from the grid. The data is measured and recorded hourly, and aggregated monthly.
Monitoring frequency	continuously
QA/QC procedures	Cross check measurement results with invoices for electricity sale. Electricity meter (Accuracy: XX) will be subject to calibration yearly, in accordance with Stipulated Procedures for Technical Administration of Electricity Metering Equipment (DL/T448-2000).
Purpose of data	Calculation of baseline emissions
Additional comments	Data will be archived during the crediting period and kept until two years after.

Data / Parameter	$MD_{reg,y}$
Unit	tCO_2e
Description	Methane emissions that would be captured and destroyed to comply with national or local safety requirement or legal regulations in the year y (tCO_2e)
Source of data	Relevant laws and regulations
Value(s) applied	XX [ex ante estimated]
Measurement methods and procedures	Regular follow-up of laws and regulations by project participants (e.g. governmental publications, official communications, official journal, conference).
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions
Additional comments	-

D.7.2. Description of the monitoring plan

>>

Based on the monitoring activities, reports on the real and measurable emission reductions achieved by the CPA will be prepared and submitted for verification.

Part 1.Objective

The objective of the monitoring plan is to ensure the complete, consistent, clear, and accurate monitoring and calculation of emission reductions during the whole crediting period of the CPA. CPA implementers will be responsible for the implementation of the monitoring plan under the supervision of the CME.

This monitoring plan sets out a number of monitoring tasks in order to ensure that all aspects of emission reductions calculation for all CPAs are controlled and reported. This requires an on-going monitoring of the project to ensure performance according to its design and that claimed Emission Reductions (ERs) are actually achieved.

The monitoring plan is a guidance document that provides the set of procedures for preparing key project indicators, tracking and monitoring the impacts of CPAs. The monitoring plan will be used throughout the defined crediting period for each CPA to determine and provide documentation of GHG emission impacts from the CPA.

Part 2. Responsibilities of operational and management structure

The CPA implementer will implement the respective monitoring plan. The plan could be revised according to suggestions from DOE and the practical circumstances, in order to keep it consistent, transparent and conservative during the monitoring process.

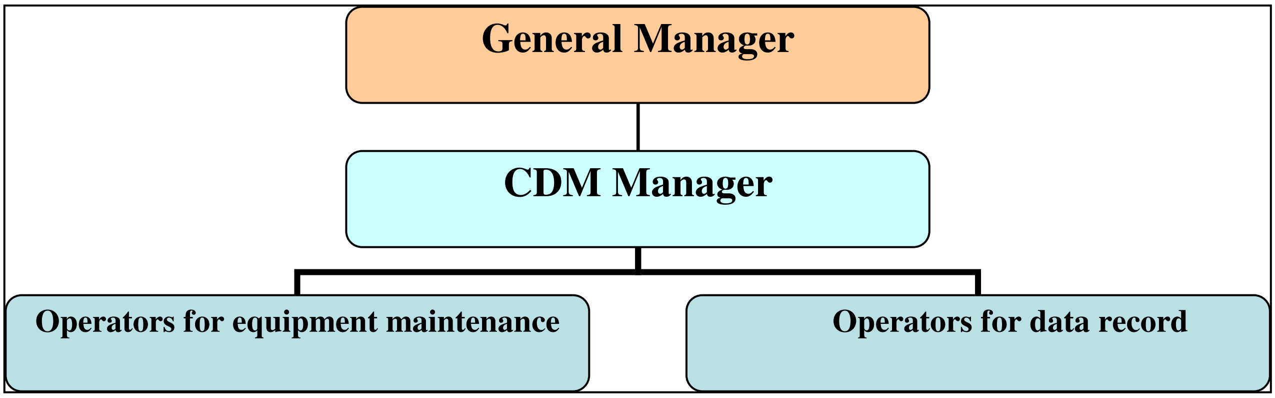

Figure 5 Operational and management structure

1. Principal of the monitoring procedure

The general manager of the CPA implementer is the leader of the monitoring tasks: he/she sets out the responsibility of everyone in the monitoring system, and establishes the related documents. The general manager ensures that staff in the monitoring system has the ability to deal with the assigned tasks.

2. Executive person of the monitoring procedure

CDM Managers: CDM Managers are appointed for the CPAs, specifically responsible for training, checking the daily operation, reporting forms and archiving emergency situation reports. The CDM Managers report monthly to the General Manager (GM) about the project performance and monitored data. In the event that non-conformance in the performance to the mentioned procedures and/or functioning problems of the monitoring equipment are identified, the CDM managers will inform the GM about the situation and work out relevant measures to be taken. The CDM managers will also be responsible for aggregating the monitored data monthly and yearly, archiving and keeping data during the crediting period and two years after.

3. Operators of the monitoring procedure

Operators will take turns to work in the control centre 24 hours a day. They will be in charge of data supervision, filling operation report forms and, checking and inspecting the system. If necessary, they will have the responsibility for executing the emergency plan and drafting emergency situation reports.

4. Training plan

The monitoring staff is trained together. The project owner sent training notification and training content and schedule to all trainees. All attendances have to sign-in and give feedback to courses. The training records are archived for verification.

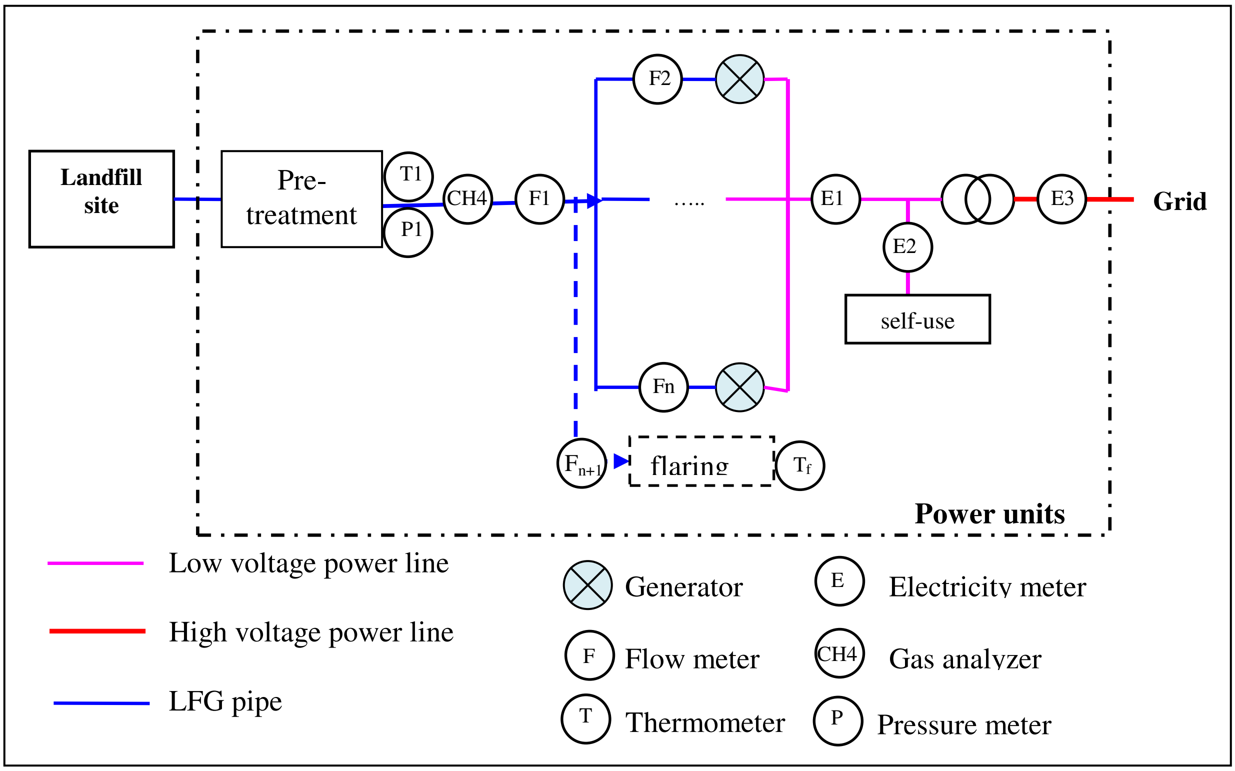

Figure 5 Monitoring System

Main monitoring equipment:

CH_4 – Gas analyzer to continuously measure methane fraction in LFG ($v_{CH4,t,db}$ / $fv_{CH4,RG,h}$).

F1 - Flow meter to continuously measure flow rate of total captured LFG ($LFG_{total,y}$, unit: Nm^3/h), with automatic measure adjustment for temperature and pressure. If automatic adjustment is not available, additional instruments T1 (thermometer) and P1 (pressure meter) are used to monitor parameters Tt and Pt.

F2~Fn - Flow meters to continuously measure flow rates of combusted LFG for power generation of each generator set, with automatic measure adjustment for temperature and pressure. The sum of all readings of F2~**Fn** is the total LFG flow rate used for electricity generation ($LFG_{electricity,y}$, unit: Nm^3/h)

Fn+1 If the CPA has no flaring, delete this flow meter. – Flow meter to continuously measure the flow rate of flared LFG, with automatic measure adjustment for temperature and pressure ($LFG_{flare,y}$, unit: Nm^3/h).

E1 - Electricity meter to continuously measure the total electricity generated by all the generators.

E2 - Electricity meter to continuously measure electricity consumed by the CPA.

E3 - Electricity meter (main meter, bi-directional) to continuously measure the amount of electricity supplied to the grid ($EG_{BL,y}$).

T1 - Thermometer to continuously measure the temperature of gas after the pre-treatment. (only in case LFG flow measures are not already automatically adjusted for temperature and pressure)

P1 - pressure meter to continuously measure the pressure of gas after the pre-treatment. (only in case LFG flow measures are not already automatically adjusted for temperature and pressure)

T_f If the CPA has no enclosed flaring, delete this meter. – Thermometer to continuously measure the temperature of the flare exhaust gas (only for enclosed flares).

Total amount of LFG captured

Flow meter (F1) and flow meters (F2~**Fn**) **and flow meter (Fn+1) [If the CPA has flaring]** monitor the total amount of LFG captured, fed to the gas engines **and fed to flaring [If the CPA has flaring]**, respectively.

The monitoring frequency is continuous. The data will be recorded and electronic archived once per hour by computer automatically. The operators will check the data daily, and totalize the data monthly.

Methane fraction in the LFG

A cellular gas analyzer will continuously monitor the methane concentration in the LFG. Data will be electronically recorded and archived once per hour. The operators will check the data daily, and totalize the data monthly.

Net electricity exported to the grid

Electricity meter E3 is the main meter for monitoring the net amount of electricity generated using LFG and onsite consumption of electricity provided by the grid.

Electricity meter E3 is usually installed by the grid company at the project site. The electricity data are recorded and archived by the DCS automatically and shown in the grid company control system. The data will be recorded monthly. The electricity receipts will be used as cross check during verification. E3 will be calibrated by a qualified party once a year according to the industry standards and applicable regulations.

As a back up monitoring system, the other two meters E1 and E2 will be installed at the project site and will monitor the total electricity generation (EG_{total}) and self-consumption (EG_{self}), respectively. When E3 does not work normally, the net electricity EG_{BL} can be calculated as EG_{total} - EG_{self}.

Part 4. QA/QC

All the monitoring devices listed above (flow meters, gas analyzer and electricity meters) will be calibrated once a year by a qualified third party. The calibration report will be kept in the archives by the project owner, and checked by CDM manager. The operator who is responsible for equipment maintenance will invite a qualified third party to make the calibration. When the data is not available from the main monitoring devices, the data measured by the back-up devices, if available, will be used.

SECTION E. Approval and authorization

>>

Indicate whether the letter(s) of approval from each Party that wishes to be involved in the CPA, is available at the time of submitting the CPA-DD to the validating DOE. If so, provide along with the CPA-DD the letter(s) of approval of the Party(ies).

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

Organization	
Street/P.O. Box	
Building	
City	
State/Region	
Postcode	
Country	
Telephone	
Fax	
E-mail	
Website	
Contact person	
Title	
Salutation	
Last name	
Middle name	
First name	
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2: Affirmation regarding public funding

There is no public funding from Annex I parties utilized in this CPA or that in case such public funding is involved, it dose not result in diversion of Official Development Assistance (ODA).

Appendix 3: Applicability of the selected methodology(ies)

No further information

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

The grid emission factor ($EF_{grid,CM,y}$) calculated as per the "Tool to calculate the emission factor for an electricity system" is shown in Annex 3 of each CPA DD.

Appendix 5: Further background information on monitoring plan

No further information

History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the component project design document form for small-scale component project activities" (EB 66, Annex 17).
01	EB33, Annex44 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		