CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM ACTIVITY DESIGN DOCUMENT FORM (CDM-SSC-CPA-DD)
Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for submission of CPAs that apply a small-scale approved methodology using the provision of the proposed small scale CDM PoA.

(ii) The coordinating/managing entity shall prepare a CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)[1, 2] that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

[1] The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

[2] At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case).

SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

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CPA(1) in Xuanwei-Under the PoA "Yunnan Eco-Farming Biogas Project"

Version: Version 1.01

Date: 25/12/2009

A.2. Description of the small-scale CPA:

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The proposed CPA is the first project under the PoA "Yunnan Eco-Farming Biogas Project". In the CPA, the biogas digesters of $8m^3$ shall be installed for 2,000 households of Xuanwei city in Yunnan province, People's Republic of China. The methane, which is supposed to be emitted to the atmosphere in the absence of the proposed CPA, shall be recovered. In addition, the thermal energy for cooking and other purposes shall be obtained by combusting the recovered methane through the proposed CPA and the fossil fuel(coal) currently used to meet the household's daily energy needs shall be replaced. Consequently, the greenhouse gas (GHG) emission shall be reduced drastically.

Two thousands (2,000) farmers are selected among those formers living in Xuanwei City without installing any digester so far due to the various barriers. The target farmers to be included in the CPA should satisfy the conditions of key criteria on the income level specified on E.5.2 of PoA-DD. Also, the selected farmers are supposed to breed at least 4 pigs per household. The sludge of human and pigs' excreta will be used as fertilizer in the fields after utilized by the biogas digesters.

The amount of initial investment of CPA is about RMB16 million, including the cost of the biogas digesters installation and the kitchens, pens and toilets renovation. China government will cover RMB3.3milion and the farmers should bear the balance of the expenses (RMB12.7milion). The target farmers will obtain loans with low interest rate (2.7%) from the PoA due to the installation of the biogas digesters, and then use CER income as the repayment of funds. The lifetime of the biogas digesters is supposed to be 15 years, and RMB160 will be spent for the maintenance annually.

With the implementation of the CPA, the coal which is used as fuel conventionally will be replaced by the methane gas for daily use. Therefore, the coal consumption will be reduced. By means of methane collection and the replacement of coal, annual GHG emission reduction is supposed to be 2.13 tons per household, and 4,261t CO_2e is supposed to be reduced through the whole CPA.

By the promotion of the biogas digesters spread in rural area, this CPA will contribute to the sustainable development of China in following points:

1. To contribute to the energy saving plan and renew energy plan of the 11th 5-year plan by Chinese government.
2. To contribute to the "West Development" strategy.
3. To reduce GHG and pollutants by collecting methane and reducing the coal consumption.
4. To improve the life condition of the farmers.
5. To lighten financial burden of the farmers by control of the coal consumption
6. To expand the energy saving technology market in China

A.3. Entity/individual responsible for the small-scale CPA:

>> Here the information on the entity/individual responsible of the CPA shall be included, hence forth referred to as CPA implementer(s). CPA implementers can be project participants of the PoA, under which the CPA is submitted, provided their name is included in the registered PoA.

Table 1 CPA Implementers

Name of CPA implementer(s)	Private or Public	Kindly indicate if the CPA implementers involved wishes to be considered as project participant (Yes/No)
Xuanwei agriculture bureau	Public	No

A.4. Technical description of the small-scale CPA:

A.4.1. Identification of the small-scale CPA:

>>

A.4.1.1. Host Party:

>>

People's Republic of China

A.4.1.2. Geographic reference or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

>>Geographic reference or other means of identification[3], Name/contact details of the entity/individual responsible for the CPA, e.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

Boundary	Latitude and longitude
Xuanwei City	Latitude: 25 ° 53 ′ N ～ 26 ° 44 ′ N Longitude: 103 ° 35 ′ E ～ 104 ° 40 ′ E

[3] E.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

Figure 1 Physical location of the CPA

The contract information of the CPA implementer is provided in Annex 1.

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

>>

01/04/2010

A.4.2.2. Expected operational lifetime of the small-scale CPA:

>>

15 years

A.4.3. Choice of the crediting period and related information:

Fixed Crediting period

A.4.3.1. Starting date of the crediting period:

>>

01/01/2011

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP:

>>

NOTE: Please note that the duration of crediting period of any *CPA* shall be limited to the end date of the *PoA* regardless of when the CPA was added.

10 years

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

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Year	Annual estimation of emission reductions (tonnes of CO_2 e)
2011	7,137
2012	7,137
2013	7,137
2014	7,137
2015	7,137
2016	7,137
2017	7,137
2018	7,137
2019	7,137
2020	7,137
Total estimated reductions (tonnes of CO2e)	7,137
Total number of crediting years	10
Annual average of the estimated reductions over crediting period (tonnes of CO2e)	7,137

A.4.5. Public funding of the CPA:

>>

No public fund from Annex I Party is involved in this CPA.

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

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1. For the purposes of registration of a Programme of Activities (PoA)[4] 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[5], which:

   (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 sectoral scope, and;

[4] Only those PoAs need to be considered in determining de-bundling that are: (i) in the same geographical area; and (ii) use the same methodology; as the PoA to which proposed CPA is being added

[5] Which may be a (i) registered small-scale CPA of a PoA, (ii) an application to register another small-scale CPA of a PoA or (iii) another registered CDM project activity

(b) The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

2. If a proposed small-scale CPA of a PoA is deemed to be a debundled component in accordance with paragraph 2 above, but the total size of such a CPA combined with a registered small-scale CPA of a PoA or a registered CDM project activity does not exceed the limits for small-scale CDM and small-scale A/R project activities as set out in Annex II of the decision 4/CMP.1 and 5/CMP.1 respectively, the CPA of a PoA can qualify to use simplified modalities and procedures for small-scale CDM and small-scale A/R CDM project activities.

The PoA, on which this CPA is based, is the only PoA proposed in Yunnan. According to the website of UNFCCC, there are no registered/ applied for registration CPA or SSC-CDM involving the same CPA implementers as this CPA. Therefore, it can be said that this CPA is not a debundled component of a larger project.

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

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According to information provided by UNFCCC and the CPA implementers of this CPA, this CPA is not registered as CPA under other PoA or as an individual CDM.

SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

>>

Yunnan Eco-Farming Biogas Project

B.2. Justification of the why the small-scale CPA is eligible to be included in the Registered PoA :

>>

The proposed CPA is eligible to be included in the proposed PoA since it can satisfy all the following criteria as specified in A.4.2.2 of PoA-DD:

- The CPA is in Yunnan Province.
- The CME of the PoA is SVEC (Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd.).
- The all farmers included in the CPAs meet the key criteria as indicated in the E.7.2 of PoA-DD.

- In the proposed CPA, a new biogas digester shall be installed for each household.
- The PoA coordinating/managing entity is
- The biogas digesters design is based on the technical standards established by the China government.
- The CPA's farmers breed at least 3 pigs.
- The CPA applies the same technology and baseline and monitoring methodology, AMS I.C. and AMS III.R, as other CPA of the proposed PoA.

B.3. Assessment and demonstration of additionality of the small-scale CPA, as per eligibility criteria listed in the Registered PoA:

>>

According to PoA-DD E.5.2, this CPA meet the specification as following, therefore this CPA activity is additional.

key criteria		Data	Yes or NO	Remarks
Project *IRR*	≦	4%	Yes	
Annual income of household, *I*	≦	US$456.25= RMB12,463	Yes	
Chinese government subsidy, *S*	=	RMB1,650	Yes	
Ratio of loan, L*/(I-S)*	≦	50%	Yes	
Ratio of individual payment, *R*	≧	100%	Yes	

The results of financial analysis for typical farmers is as follows:

Criteria	Without CER	With CER
Project IRR	1.8%	4.73%

Several barriers are mentioned herewith even though only one of barrirs is necessary to demonstrate the aditionality according to the guideline of small-scale CDM project.

1. Investment Barrier

Based on statistics from China State Statistical Bureau, in 2008 the average income of farmer in Yunnan province is RMB3,102.6, and the average expenditure is RMB2,991 counting 96.4%. According to the total expenditure, for daily use such as food, clothes and residence counts 49.6%, 3.9% and 20.2%. For living and production, the expenditure of traffic and communication counts 8%. The left 16.5% of total expenditure is for other activities, such as children's education, medical expenses, housing renovation, etc. The statistics indicate the net income is only about RMB112, which is supposed to be saved.

Table 2 Yunnan farmers' balance sheets in 2008

Income/ expenditure		Amount (RMB)	Percent of income
Income		3,102.6	100%
expenditure	Food	1,483.2	47.8%
	Clothes	119.6	3.9%
	Residence	626.1	20.2%
	Family equipment	119.0	3.8%
	Traffic communication	248.3	8.0%
	Education	182.0	5.9%
	Medical expenses	44.0	1.4%
	Other	168.6	5.4%
Balance		111.8	3.6%

Source: China State Statistical Bureau

According to the CPA design, each biogas digester costs RMB8,000, including installation of biogas digester and renovation of toilets, pens and kitchens.(According to the first half rural areas energy report of Yunnan province in 2009, materials and equipments cost RMB5,000, personnel and other expenses cost RMB3,000.) The government will provide RMB1,650 to one household per biogas digester, about RMB6,350 need to be mobilized by the participating household.

Based on statistics of the farmer's income in Yunnan province, a family of four can save RMB448 during a year, which counts only 7% of self-paid per biogas digester. Even if a family of four cuts down expenses, the saving is supposed to be RMB920, counting one seventh of the total self-paid. Besides, the maintenance and repair also costs money. It is difficult for the farmers to install the biogas digesters according to the statistics of the farmer's average income in Yunnan province.

The average annual income of the target farmers of CPA is about RMB1,400, counting only about 45% of the average annual income of the whole Yunnan province. According to Table 2, it is known that they spend almost all income on food. According to the standard of the United Nation (poverty line of US$1.25 a day per person), the target farmers are below the poverty line. Take a family of four as an example, their annual income is RMB5,600, which is less than RMB6,350 needed for the installation of the biogas digester. The lifetime of the biogas digesters is supposed to be 15 years, and RMB160 will be spent for the maintenance annually.

Therefore, the target farmers of the CPA will not invest unless they get finance. A fund will be set up to run the PoA. It will be set up by 2.7% interest rate to loan to the farmers whose self-paid counts 30% of annual income for the RMB6,350 initial investment cost. Each CPA household getting finance from PoA fund is supposed to meet the IRR benchmark (4%). The loan will be repaid by the CER income of CDM.

2. Technical Barrier

The farmers in the project areas are lack of education, so whether the biogas digesters can function and maintain properly is a problem. The most problem is the farmers haven't known the time of pouring pig manure as fermentation raw materials, and neither have they known the quantity and density of the raw materials.

To solve the problem, guidance and support from the expert, who has the qualification from the Ministry of Agriculture, is required. Farmer training will be carried out concerning the time of pouring pig manure, the quantity and density, and methods of operating biogas digester properly. Each village (town) will set up service station, in which experts with the qualification are deployed.

However, in reality the income of migrant workers is relatively large, so the outflow of experts with the qualification is serious. In addition, due to the spread of the biogas digesters, more experts are required. It is necessary to set a training course for educating experts by cooperating with local government. According to the first half rural areas energy report of Yunnan province in 2009, there is a lack of about 3,000 experts at present.

The CPA has also faced similar challenge. It is necessary to construct a new service station to support 2,000 households, and it is necessary to employ about 10 experts. Furthermore, it is necessary to strengthen the education for training more experts through cooperating with the local government. If CER income will be obtained, it is expected that experts' working condition will be improved and the problem of the talent outflow will also be improved.

3. Barrier from Prevailing Practice

The urbanization construction of rural areas in Yunnan province is later than the other provinces. One reason is there are 26 races in Yunnan province, each of which has its life style and custom. The other reason is the rural areas in Yunnan province are mostly in the mountains, so it is difficult for infrastructure construction of town gas and water service.

According to the traditional way, in Chinese rural areas farmers store manure from animals and persons in deep pit. When the pit almost overflows, they carry manure to the fields by buckets and use it as fertilizer. For daily use the farmers use energy they can get in easy way. In the past they got energy by deforestation, due to the protection of forest by Chinese government, felling was prevented. Furthermore, the farmers are afraid of landslide, so along with the increase of income coal consumption has increased nowadays.

According to China energy statistic yearbook, the amount of the coal consumption for daily use in Yunnan province (in which there are lots of poor areas) is 3.16 million tons, 2.58 million tons of which is used by rural areas, making up 82% of the total. This ratio exceeds 15% more than a Chinese average level. 6 There are two reasons of the high consumption of coal. One reason is the rural areas in Yunnan province are mostly in the mountains so that town gas and electricity is almost not. The other reason is Yunnan is the place of origin coal, so it is easy for the farmers to get coal. It is believed that coal is the most energy for the farmers' daily use. The CPA is located in Xuanwei city, which is the place of origin coal in Yunnan province. There is hardly any town gas, so the farmers always use coal to cook.

In conclusion, the CER revenue for the activity is indispensable to achieve this project and thus is additional.

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA is located within the geographical boundary of the registered PoA.

>>

This CPA will adopt the biogas digesters to treat pig manure an aerobically, in order to replace the slurry that would have been stored in a deep pit. The biogas will be recovered and used for cooking and heating water for household members to replace coal. Only CO_2 emission from the coal burning is included in calculating the project GHG emission reduction.

In the table below, all sources of the baseline and the project activity are listed.

Table 3 Emission sources included or excluded from the project boundary

	Sources	Gas	Included?	Explanations
Baseline	Emissions from manure	CH_4	YES	Major emission source
		N_2O	NO	Not significant. Excluded for simplification and conservativeness
		CO_2	NO	Not significant. Excluded for simplification and conservativeness
	Emissions from burning of coal	CO_2	YES	Major emission source
		N_2O	NO	Not significant. Excluded for simplification and conservativeness
		CH_4	NO	Not significant. Excluded for simplification and conservativeness

[6] China Energy Statistical Yearbook 2008

	Emissions from burning of biomass (firewood and crop straw)	CO_2	NO	Not significant. Excluded for simplification and conservativeness
		N_2O	NO	Not significant. Excluded for simplification and conservativeness
		CH_4	NO	Not significant. Excluded for simplification and conservativeness
Project Activity	Emissions from biogas digester	CH_4	YES	Major emission source
		N_2O	NO	Not significant. Excluded for simplification
		CO_2	NO	Not significant. Excluded for simplification
	Emissions from burning of coal	CO_2	NO	Not significant. Excluded for simplification
		N_2O	NO	Not significant. Excluded for simplification
		CH_4	NO	Not significant. Excluded for simplification
	Emissions from burning of biomass (firewood and crop straw)	CO_2	NO	Not significant. Excluded for simplification
		N_2O	NO	Not significant. Excluded for simplification
		CH_4	NO	Not significant. Excluded for simplification

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:

>>

(Copy this table for each data and parameter)

Parameter:	MS percent
Data unit:	Fraction
Description:	Fraction of manure handled in system j in the baseline
Source of data used:	Project proponents
Value applied:	100 percent
Justification of the choice of data or description of measurement methods and procedures actually applied :	Manure produced by pig was applied to deep pit
Any comment:	

Data / Parameter:	LF_{AD}
Data unit:	%
Description:	Methane leakage from anaerobic the biogas digester
Source of data used:	2006 IPCC Guidelines
Value applied:	10%
Justification of the choice of data or description of measurement methods and procedures actually applied :	

Any comment:	

Data / Parameter:	VS
Data unit:	kg dry matter/animal/day
Description:	Volatile solid excretion
Source of data used:	2006 IPCC Guidelines
Value applied:	0.3 kg dry matter/animal/day
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Bo
Data unit:	m^3CH4/kg-dm VS
Description:	Maximum methane production
Source of data used:	IPCC 2006 Guidelines
Value applied:	0.29
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	MCF
Data unit:	Fraction
Description:	Methane conversion factor
Source of data used:	IPCC 2006 Guidelines
Value applied:	25% for Xuanwei
Justification of the choice of data or description of measurement methods and procedures actually applied :	Decided according to annual average temperature of Xuanwei (2003-2008)
Any comment:	

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2 e/tCH4
Description:	Global warming potential for CH4
Source of data used:	IPCC 2006 Guidelines
Value applied:	21
Justification of the	

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	D_{CH4}
Data unit:	kg/m^3
Description:	Conversion factor of 1 m^3 CH4 to kilograms CH4
Source of data used:	2006 IPCC Guidelines
Value applied:	0. 67
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF_{Coal}
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor per unit of energy of the fuel
Source of data used:	2006 IPCC Guidelines
Value applied:	94.6 tCO_2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	The data corresponds the emission factor for raw coal 25.8 tC/TJ ($25.8 \times 44 \div 12 = 94.6$ tCO_2/TJ) provided by National Development and Reform Committee (NDRC: www.ccchina.gov.cn)

Data / Parameter:	η_{coal}
Data unit:	%
Description:	Efficiency of the plant using coal
Source of data used:	
Value applied:	20%
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	η_{gas}
Data unit:	%
Description:	Efficiency of the gas stove
Source of data used:	National Standards of China
Value applied:	50%
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the minimum requirements of National Standards of China
Any comment:	

Data / Parameter:	NCV
Data unit:	kJ/kg
Description:	Default net calorific values of cooking coal
Source of data used:	Published data by China NDRC (www.ccchina.gov.cn)
Value applied:	20908
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EFcoal
Data unit:	tC/TJ
Description:	Carbon emission factor per unit of energy of coal that would have been used in the baseline in (tC/ TJ)
Source of data used:	Published data by China NDRC (www.ccchina.gov.cn)
Value applied:	25.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Fraction oxidized
Data unit:	
Description:	Fraction oxidized
Source of data used:	Published data by China NDRC (www.ccchina.gov.cn)
Value applied:	1.00
Justification of the	

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	H
Data unit:	Hour
Description:	annual operational hours of biogas digesters
Source of data to be used:	Baseline survey
Value of data	8640
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	To cross-check the operation hour with the biogas volumes.
Any comment:	Data will be archived electronically during project plus 3 years

B.5.2. Ex-ante calculation of emission reductions:

>>

1. Baseline emission

(1) CH4 emission from manure management

Four steps have been applied to determine CH4 emissions from manure management:
Step 1: Identification of baseline emission sources;
Step 2: Identification of emission factor for methane emission from manure management;
Step 3: Survey of swine population;
Step 4: Calculation of baseline CH4 emission from manure management for each household.

Step 1: Identification of baseline emission sources

Baseline emission sources for manure management have been identified previously in Table 1.

Step 2: Identification of emission factor for methane emission from manure management

Swine manure is stored in deep pits around 6 months before land application. Annual average temperature ranges 14℃ in the Xuanwei. According to IPCC Tier 2 approach, formula (1) is applied to calculate methane emission factor for deep pit manure management system. Default IPCC values for Bo and Vs will be applied because no national specific values.

$$EF_{CH4} = (VS \times 365) \times (Bo \times 0.67 kg/m^3 \times MCF \times MS) \quad (1)$$

Where,

EF_{CH4} Annual CH4 emission factor for swine in Xuanwei, kgCH4/swine/year

VS	Daily volatile solid excreted for swine, kg dry matter swine/day, as per 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10
Bo	Maximum methane producing capacity for manure produced by swine, m^3 CH4 kg of VS excreted, as per 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10
0.67	Conversion factor of m^3 CH4 to kilograms CH4, kg/m^3
MCF	Methane conversion factor for deep pit manure management system upon the climate of Yunnan Province, %, from IPCC 2006 Guidelines Table 10A-7, chapter 10, volume
MS	Fraction of swine manure handled using manure management system. In this project, 100 percent of manure is stored in deep pit.

Step 3: Survey of swine population

In order to obtain information on the swine population raised by households, an extensive household survey for 70 households within and without biogas digester was conducted. Table 3 presents the swine population of the households.

Table 4 the swine population of the households (head/household)

Swine population Average	Swine population within biogas digesters household	Swine population without biogas digesters household
7.86	8.97	6.74

Step 4：Calculation of baseline CH4 emission from manure management for each household

Baseline CH4 emission can be calculated based on equation (2):

$$BE_{CH4,household} = GWP_{CH4} \times \frac{1}{1000} \times SP \times EF_{CH4} \quad (2)$$

Where,

$BE_{CH4,household}$	Baseline CH4 emission from deep pit manure management system for the biogas digester, tCO_2e/year
GWP_{CH4}	Global Warming Potential (GWP) of CH4.
SP	Average swine population for household
EF_{CH4}	CH4 emission factor for deep pit swine manure management, kg CH4/swine/year

(2) Baseline CO_2 emission from the coal consumption

Four steps will be applied to determine CO_2 emission in baseline:
Step 1: Identification of baseline emission sources;
Step 2: Identification of emission factors;
Step 3: Survey and calculation of the coal consumption before biogas digester construction;
Step 4: Calculation of baseline CO_2 emission from the coal consumption.

Step 1: Identification of baseline emission sources

Baseline CO_2 emission sources have been identified as listed in Table 1.

Step 2: Identification of emission factor of the coal combustion

According to the IPCC 2006 Guidelines, Volume 2, Chapter 2, Table 2.5, the CO2 emission factor per unit of energy of the fuel that would have been used in the baseline plant, 94.6 tCO2 / TJ, default value for coking and other bituminous coal.

Step 3: Survey and calculation of the coal consumption before biogas digester construction

Since the methane leakage from biogas digesters is estimated to be 10%, the amount of methane generated by each biogas digester using only swine manure can be estimated to be, on equation (3):

$$MG_y = (VS \times 365) \times Bo \times D_{CH4} \times SP \times (1 - LF_{AD}) \quad (3)$$

Where,

MG_y	Methane generated by one biogas digester from swine manure only, kgCH4
VS	Daily volatile solid excreted for swine, kg dry matter swine/day, as per 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10
Bo	Maximum methane producing capacity for manure produced by swine, m^3 CH4 kg of VS excreted, as per 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10
LF_{AD}	Methane leakages from anaerobic the biogas digesters; a default value of 0.10 can be taken according to table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10.
D_{CH4}	Conversion factor of m^3 CH4 to kilogram CH4 (as per 2006 IPCC guidelines, see Volume 4, Chapter 10, Page 10.42).
SP	Average swine population for household

The net quantity of heat supplied by the project corresponds to the methane from the biogas digester, taking into account the efficiency of the gas stove on equation (4):

$$EG_y = MG_y \times Q_{CH4} \times \eta_{gas} \div 1000000 \quad (4)$$

Where,

EG_y	The net quantity of heat supplied by the project activity during the year y in TJ
MG_y	Methane generated by one biogas digester from swine manure only, kgCH4
Q_{CH4}	Lower heating value of methane, 50MJ/kg
η_{gas}	The efficiency of the gas stove, 55%

Step 4：Calculation of baseline CO_2 emission from the coal consumption

According to the methodology AMS-I.C. (v.15), the simplified baseline is the fuel consumption of the fossil fuel technology that would have been used in the absence of the project activity times the CO2 emission factor for the fossil fuel displaced on equation (5):

$$BE_{CO2,household} = EG_y \times EF_{coal} \div \eta_{coal} \quad (5)$$

Where,

$BE_{CO2,household}$	Baseline CO_2 emission from the coal combustion for household before the installation of the biogas digester, tCO_2e/year for each household
EG_y	The net quantity of heat supplied by the project activity during the year y in TJ
EF_{coal}	The CO2 emission factor per unit of energy of the fuel that would have been used in the baseline plant, 94.6 tCO2 / TJ, IPCC 2006 Guidelines, Volume 2, Chapter 2, Table 2.5, default value for coking and other bituminous coal.
η_{coal}	The efficiency of the plant using fossil fuel that would have been used in the absence of the project activity, 20%.

(3) Total baseline GHG emission calculation per household GHG emission for each household under the baseline scenario can be calculated based on equation (6)

$$BE_{y,household} = BE_{CH4,household} + BE_{CO2,household} \quad (6)$$

Where,

$BE_{y,household}$	Baseline GHG emission for household before the installation of the biogas digester, tCO_2e/year for each household

(4) Total baseline GHG emission of CPA

Total baseline GHG emission of CPA can be calculated based on equation (7)

$$BE_y = \left(BE_{CH4,household} + BE_{CO2,household}\right) \times BDN \quad (7)$$

Where,

BEy	Total baseline GHG emission of CPA, tCO_2e/year
BDN	Biogas digester numbers in CPA

Table 5 Data of Baseline Emission

	Value	Data unit
Average baseline CO_2 emission from the coal burning	1.68	tCO_2/household/year
Methane emission from each household	0.75	tCO_2/household/year
Baseline emissions per household	3.57	tCO_2/household/year
Total Baseline emission	7,137	tCO_2/year

2. Project Emission

Project emissions consist of CO_2 emissions from the coal combustion and CH4 emissions from biogas digester.

(1) CH4 emission from biogas digester

The CH4 emission from biogas digester is calculated using equation (8):

$$PE_{CH4,household} = LF_{AD}\left[GWP_{CH4} \times D_{CH4} \times B_o \times VS_{m,y}\right] \div 1000 \quad (8)$$

Where:

$PE_{CH4,household}$	Project emissions from physical leakages in the each biogas digesters in year y, (t CO_2e).
LF_{AD}	Methane leakages from anaerobic the biogas digesters; a default value of 0.10 can be taken according to table 10A-8 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10.
GWP_{CH4}	Global Warming Potential of CH4.
D_{CH4}	Conversion factor of m^3 CH4 to kilogram CH4 (as per 2006 IPCC guidelines, see Volume 4, Chapter 10, Page 10.42).
Bo	Maximum methane producing potential of the manure type treated in the biogas digesters as per 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10 (m^3 CH4 per kg of dm by animal type)
VS	Annual amount of volatile solids treated in the biogas digesters on dry matter weight basis as per 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, and Chapter 10 (kg of dm per year)

(2) Project CO_2 emission from the coal combustion

Based on the methodology AMS-I.C. only the amount of coal replaced by the renewable energy is considered, which is not part of the baseline. Because the biogas is 100 % renewable, the project emission from the coal consumption is zero.

(3) Project GHG emission calculation for each household

GHG emission for each household under the project activity can be calculated based on equation (9)

$$PE_{y,household} = PE_{CH4,household} + PE_{CO2,household} \quad (9)$$

Where,

$PE_{y,household}$	Annual project GHG emission of the household after the installation of the biogas digester, tCO_2e/year for each household
$PE_{CH4,household}$	Project emissions from physical leakages in the each biogas digesters in year y, (t CO_2e).
$PE_{CO2,household}$	0

(4) Total project GHG emission of CPA

Total project GHG emission of CPA can be calculated based on equation (10)

$$PE_y = \left(PE_{CH4,household} + PE_{CO2,household}\right) \times BDN \quad (10)$$

Where,

PEy	Total project GHG emission of CPA, tCO_2e/year
BDN	Biogas digester numbers in CPA

Table 6 Data of Project Emission

	Value	Data unit
Average project CO_2 emission from the coal burning	0	tCO_2/household/year

Methane emission from each biogas digester	0.30	tCO_2/household/year
Project emissions per household	0.30	tCO_2/household/year
Total Project emission	8,322	tCO_2/year

3. Leakage

For methodology AMS I.C (Version 15) titled "Thermal energy production with or without electricity" if the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered. For methodology AMS III.R (version 1) titled "Methane recovery in agricultural activities at household/small farm level", if the energy methane recover and combustion equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered for ^{CPA}, it is not the case.

Therefore, leakage will not be considered.

4. Calculation of total CPA GHG emission reductions can be use equation (11)

$$ER_y = BE_y - PE_y - LE_y \quad (11)$$

Table 7 Data of Emission Reduction

	Value	Data unit
Emissions reduction per household	3.57	tCO_2/household/year
Total Emission Reduction	**7,137**	tCO_2/year

B.5.3. Summary of the ex-ante estimation of emission reductions:

>>

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
2011	**8,322**	**15,459**	0	**7,137**
2012	**8,322**	**15,459**	0	**7,137**
2013	**8,322**	**15,459**	0	**7,137**
2014	**8,322**	**15,459**	0	**7,137**
2015	**8,322**	**15,459**	0	**7,137**
2016	**8,322**	**15,459**	0	**7,137**
2017	**8,322**	**15,459**	0	**7,137**
2018	**8,322**	**15,459**	0	**7,137**
2019	**8,322**	**15,459**	0	**7,137**
2020	**8,322**	**15,459**	0	**7,137**
Total (tones of CO_2e)	**83,220**	**154,590**	0	**71,370**

B.6. Application of the monitoring methodology and description of the monitoring plan:

B.6.1. Description of the monitoring plan:

>>

The monitoring plan is provided as follows.

1. Monitoring summary

CPA implementer will operate and manage the CPA, and measure necessary data for the monitoring of the CPA and report to periodically PoA based on the operation and monitoring manual prepared by PoA. The monitoring method will be carried out by implement of questionnaire survey. The result of questionnaire survey of this CPA will be monitored. Monitoring data includes the amounts of the running biogas digesters and pigs. The total amounts of the biogas digesters of this CPA will become the monitoring sample through the equation as below.

$$n = N \div \left\{ \left(\varepsilon \div \mu(\alpha) \right)^2 \times \left[(N-1) \div \rho(1-\rho) \right] + 1 \right\}$$

Where:

n	Numbers of households to make questionnaire surveys with random sampling method;
$\mu(\alpha)$	Value of standard normal distribution when reliability 95%, taking 1.96;
N	Total numbers of households in the CPA to be monitored;
ε	Precision taking 5%;
ρ	Population rate, taking 0.5.

2. Monitoring system

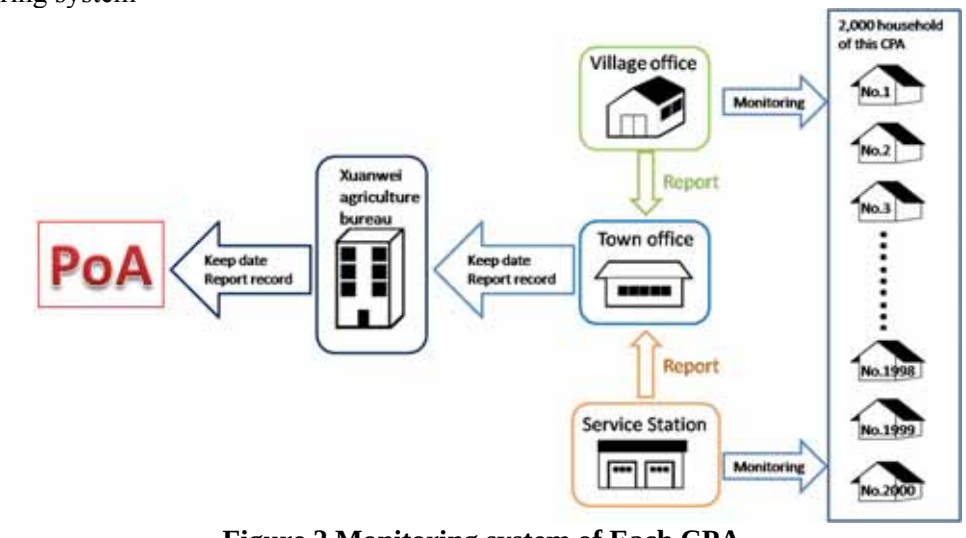

Figure 2 Monitoring system of Each CPA

3. The role of the CPA implementers

	Rural Energy and Environment Office (CPA implementers)
Operation and management of monitoring	Operate and manage monitoring of CPAs
Data collection and reporting	1. Each city agriculture bureau's service station will monitor the amount and operate time of the biogas digesters. Each service station must keep data and report record to each town office.

	2. Each village office will monitor swine population and the coal consumption of households after the installation of the biogas digesters. Each village office must keep data and report record to each town office.
Data keep and management	1. Data will be archived originally and electronically during project plus 3 years in each town office, and then report record to each city agriculture bureau. 2. Data will be archived originally and electronically during project plus 3 years in each city agriculture bureau, and then report record to PoA.
Quality assurance	Undertake regular maintenance of the monitoring systems

4. Avoid double accounting

CPAs will make mark as Figure 3 for each biogas digesters with serial number to avoid double accounting of the biogas digesters

Figure 3 Mark of biogas digesters

5. Monitoring data

Data / Parameter:	BDN
Data unit:	Number
Description:	Total number of household biogas digester users included in the biogas digesters project activity.
Source of data to be used:	Sample survey

Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Monitoring data
QA/QC procedures to be applied:	Verify the household number of biogas digesters according to the sales record of biogas stove.
Any comment:	Data will be archived electronically during project plus 3 years

Data / Parameter:	PGcoal
Data unit:	Kg/household/year
Description:	Average annual coal consumption for household after installation of biogas digesters
Source of data to be used:	Sample survey
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Monitoring data
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	H
Data unit:	Hour
Description:	Annual operational hours of biogas digesters
Source of data to be used:	Sample survey
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8640
Description of measurement methods and procedures to be applied:	Monitoring data
QA/QC procedures to	To crosscheck the operation hour with the biogas volumes.

be applied:	
Any comment:	Data will be archived electronically during project plus 3 years

Data / Parameter:	T
Data unit:	℃
Description:	Annual Average ambient temperature at county weather station nearby project site
Source of data to be used:	Xuanwei weather station
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Purchase from County meteorology stations. Archive electronically during project plus 5 years.
QA/QC procedures to be applied:	
Any comment:	Used to select the annual MCF from IPCC 2006 Guidelines

Data / Parameter:	SP
Data unit:	Number
Description:	Swine population in individual household in project case
Source of data to be used:	Sample survey
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Monitoring data
QA/QC procedures to be applied:	
Any comment:	Archive electronically during project plus 3 years

Data / Parameter:	The amount of manure VS generated by pigs in individual household
Data unit:	Kg dry matter/day
Description:	Volatile solid contained in the manure generated by pigs in individual household in project case
Source of data to be used:	Sample survey
Value of data applied	Product of pig number in Table 4 and IPCC default VS values of 0.3 kg dry

for the purpose of calculating expected emission reductions in section B.5	matter/animal/day
Description of measurement methods and procedures to be applied:	The amount of pig manure VS generated in individual household will be calculated as product of swine population (SP) in individual household in project case and IPCC default VS values
QA/QC procedures to be applied:	
Any comment:	Archive electronically during project plus 3 years

Data / Parameter:	Sludge
Data unit:	
Description:	Destination of biogas sludge application
Source of data to be used:	Household
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	Data will be archived electronically during project plus 3 years

SECTION C. Environmental Analysis

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

☑ Please tick if this information is provided at the PoA level. In this case sections C.2 and C.3 need not be completed in this form.
This information is provided at the PoA level.

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

>>
Not applicable.

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

>>

Not applicable.

SECTION D. Stakeholders' comments

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

☐ Please tick if this information is provided at the PoA level. In this case sections D.2 to D.4 need not be completed in this form.

This information is provided at the CPA level.

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

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The questionnaire survey activity was carried out by PoA (Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd) and CPA (Xuanwei agriculture bureau) starter during 16/11/2009 to 30/11/2009, covering the area of 30km around the project site, including municipal government, public institute, farmers, state-owned and private enterprises. Total numbers of delivered questionnaire are 70 and among them 70 were collected. That is, percentage of reply is 100%.

Questionnaire was made easy to answer, such as the comments on the economy and environment impact, project information, CDM project knowledge, etc.

D.3. Summary of the comments received:

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Item	Responses	Amount	Percentage (%)
Knowledge of this CDM project	Know very well	3	4.29%
	Know	2	2.86%
	Don't know	65	92.86%
Source of information for knowledge of the project	Mass media	5	7.14%
	Internet	0	
	Introduction on site	0	
	Others	0	
Knowledge of "Three in one" technology	Know very well	68	97.14%
	Know	1	1.43%
	Don't know	1	1.43%
Produce negative effect of environmental from "Three in one"	Yes	0	
	Don't know	12	17.14%
	No	58	82.86%
"Three in one" bring economic interests of personal	Yes	69	98.57%
	Don't know	1	1.43%
	No	0	
Advantage of "Three in one"	Improving the living environment	70	100.00%

	Save expenses	66	94.29%
	Easy to use	67	95.71%
	Other	0	
Should popularize of "Three in one"	Yes	70	100.00%
	Don't know	0	
	No	0	
Accept of this CDM project	Yes	70	100.00%
	Don't know	0	
	No	0	

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

>>

No any modifications is necessary for the project planning due to the comments received since most of responses support the construction and implementation of the project without any amendment of the mentioning in full or partial.

Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	Xuanwei agriculture bureau
Street/P.O.Box:	No547 Zhenxing Middle Road Xuanwei-City, Yunnan, China
Building:	Xuanwei agriculture bureau 5F
City:	Xuanwei
State/Region:	Yunnan Province
Postfix/ZIP:	655400
Country:	China
Telephone:	+86-874-7134983
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	Staionmaster
Last Name:	Xia
Middle Name:	
First Name:	Yune
Department:	Agricultural environmental protection monitoring station
Mobile:	+86-139-8740-7734
Direct FAX:	
Direct tel:	+86-874-7134983
Personal E-Mail:	ynxwxye_1966@126.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public fund from Annex I Party is involved in this CPA.

Annex 3

BASELINE INFORMATION

Refer to this CPA-PDD main text.

Annex 4

MONITORING INFORMATION

Refer to this CPA-PDD main text.

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