**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Haikou Rural Methane Digesters Project in Hainan Province
Version number of the PDD	Version 02
Completion date of the PDD	29/12/2014
Project participant(s)	Guizhou Honor Carbon Asset Management Co.,Ltd
Host Party(ies)	People's Republic of China
Sectoral scope(s) and selected methodology(ies)	Scope 1: Energy industries(renewable-/non-renewable sources) Scope 15: Agriculture AMS-I.C. (Version 19.0):"Thermal energy for the user with or without electricity" AMS-III.R.(Version 03.0):" Methane recovery in agricultural activities at household/small farm level"
Estimated amount of annual average GHG emission reductions	53,680 tCO_2e

SECTION A. Description of project activity
A.1. Purpose and general description of project activity
>>

Haikou Rural Methane Digesters Project in Hainan Province (here after referred as 'the project') is respectively located in Haikou City, Hainan Province,P.R. China. and the annual average temperature of the project is 24.2℃. In the project 15,555 biogas digesters have been constructed in 15,555 peasant households. The owners of the digesters are 15,555 farmers who construct the biogas digesters. But because the number is large and the owners are scatter, Guizhou Honor Carbon Asset Management Co., Ltd, which is authorized by the owners will execute the corresponding value of distributing VERs revenue on behalf of all peasant households.

The project aims to help farmers to build methane digesters where organic matter including manure and wastes are decayed anaerobically. According to the investigation report of the project, there are 2.5 pigs in every peasant household averagely and a standard biogas digester with a volume of $8m^3$ is constructed. The anaerobic digester with a capacity of $8m^3$can fully handle the manure of these pigs and to collect biogas generated during the treatment process for heat supply, which meets the thermal demands of the households themselves by using the biogas stove with rated power 2.33kW each unit.

Before the project construction, all the swine manure was stored in the uncovered anaerobic mature management system (i.e.deep pit) for more than three months according to the investigation report issued by the local energy office. A large amount of methane was emitted to the atmosphere during the manure storage with the anaerobic condition in the deep pit. Moreover, according to the investigation the householders using coal for cooking and heating in the absence of the project activity, that means the heat would be generated in coal stove with fossil fuel coal in the absence of the project activity. The scenario in the absence of the project activity is identical to the baseline scenario.

The project results in a reduction of greenhouse gas (GHG) emissions in these two ways: on the one hand, the recovery and utilization of biogas from digested slurry in the biogas digester reduce CH_4 emission that would otherwise have been stored in a deep pit. It can prevent methane (CH_4) emissions by changing the management practice of manure in order to achieve the controlled anaerobic digestion equipped with methane recovery system. On the other hand, the biogas are used as thermal energy to replace the fossil fuel (coal) currently used to meet the households' daily energy needs for cooking and heating. The thermal generated from the burning biogas replace effectively equal amount of the heat which would otherwise be generated by coal stove. The combined annual GHG emission reduction for both components of the project is estimated at 53,680 tCO_2e.

The project will have positive environmental and economic benefits and contribute to the local sustainable development in the following aspects:

1. To recover methane and substitute the consumption of fossil energy,
2. To increase employment for the local people through the construction of methane pools and the follow-up service,
3. To improve the living and cooking conditions and the health of the local people,
4. To popularize practical energy technology and improve population quality.

A.2. Location of project activity
A.2.1. Host Party(ies)
>>

People's Republic of China

A.2.2. Region/State/Province etc.
>>
Hainan Province

A.2.3. City/Town/Community etc.
>>

Haikou City

A.2.4. Physical/ Geographical location
>>

Households located in 20 towns of Haikou City are involved in this project. P.R. China. The location of the Project is shown in Table A1.

TableA1. Locations of project counties

Town	Longtitude	Altitude
Sanjiang	110.5925 °-110.6687 °	19.8071 °-19.8629 °
Dazhi Po	110.5023 °-110.6833 °	19.7958 °-19.8001 °
Chengxi	110.3210 °-110.3892 °	19.8002 °-19.8985 °
Longqiao	110.3602 °-110.3612 °	19.8813 °-19.8922 °
Xinpo	110.3025 °-110.4187 °	19.6898 °-19.7365 °
Zuntan	110.3412 °-110.3985 °	19.6092 °-19.7011 °
Longquan	110.4589 °-110.5298 °	19.7528 °-19.8235 °
Longtang	110.4025 °-110.4825 °	19.8526 °-19.8892 °
Yun Long	110.5298 °-110.5998 °	19.8523 °-19.8890 °
Hongqi	110.5268 °-110.6102 °	19.7892 °-19.8412 °
SanmenPo	110.6120 °-110.6985 °	19.4218 °-19.6238 °
Dapo	110.5333 °-110.6328 °	19.8057 °-19.9256 °
Jia Zi	110.3201 °-110.4988 °	19.5703 °-19.6251 °
Jiuzhou	110.3598 °-110.4201 °	19.7015 °-19.7895 °
Changliu	110.1670 °-110.1675 °	19.9523 °-19.9967 °
Xi Xiu	110.1666 °-110.1702 °	20.0052 °-20.0062 °
Haixiu	110.3197 °-110.3198 °	19.9892 °-19.9736 °
Shishan	110.1808 °-110.1940 °	19.9061 °-19.9461 °
Yongxing	110.2455 °-110.2787 °	19.8672 °-19.9392 °
Dongshan	110.1985 °-110.2158 °	19.6025 °-19.7425 °

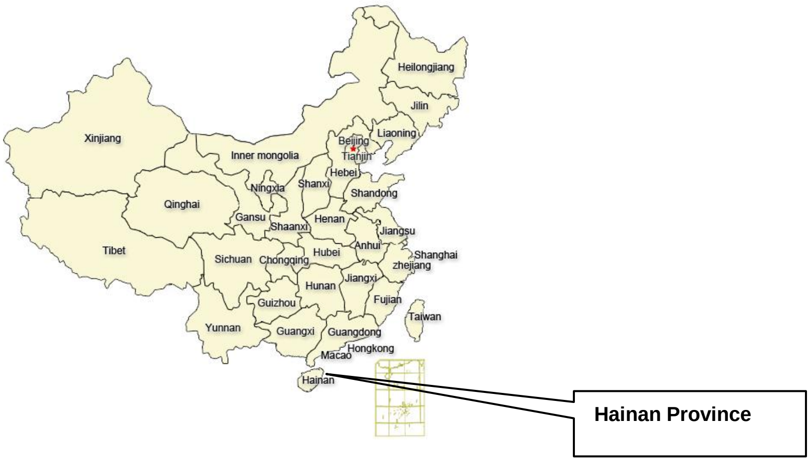

Figure A-1.Geographical Location of Hainan Province in China

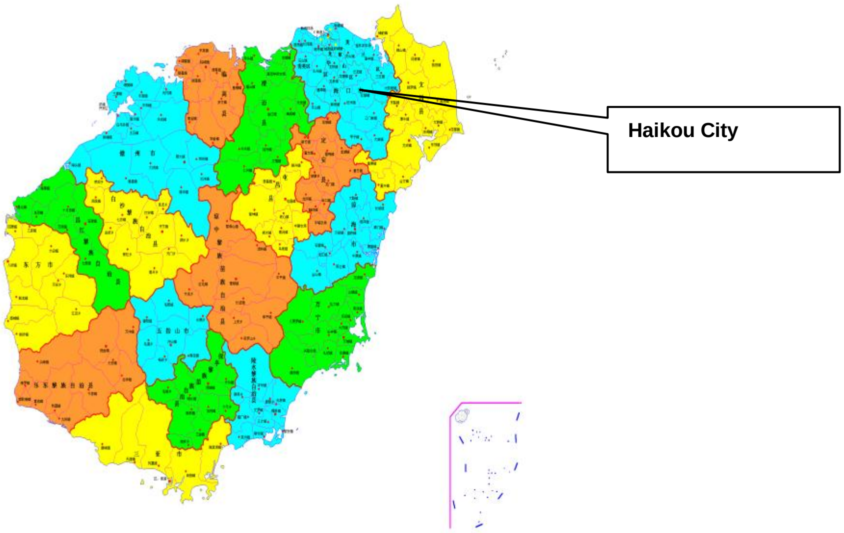

Figure A-2.Geographical Location of Haikou City in Hainan Province

A.3. Technologies and/ormeasures

>>

The core of the project is the processor of decomposition of organic wastes. Under the anaerobic circumstance, the swine manure is decomposed by the cooperation of bacteria of hydrolysis, acidification and methanogen, generating methane. Given the methane digester be constructed, the manure is stored in deep pits and the methane from the slurry fermentation is emitted to the atmosphere. The generated methane is transmitted by pipe to the user and utilized as the energy resource for cooking and heating. The biogas slurry and residue are aerobically used as the organic in the dry vegetable fields. The following figure A-4 shows the process chart.

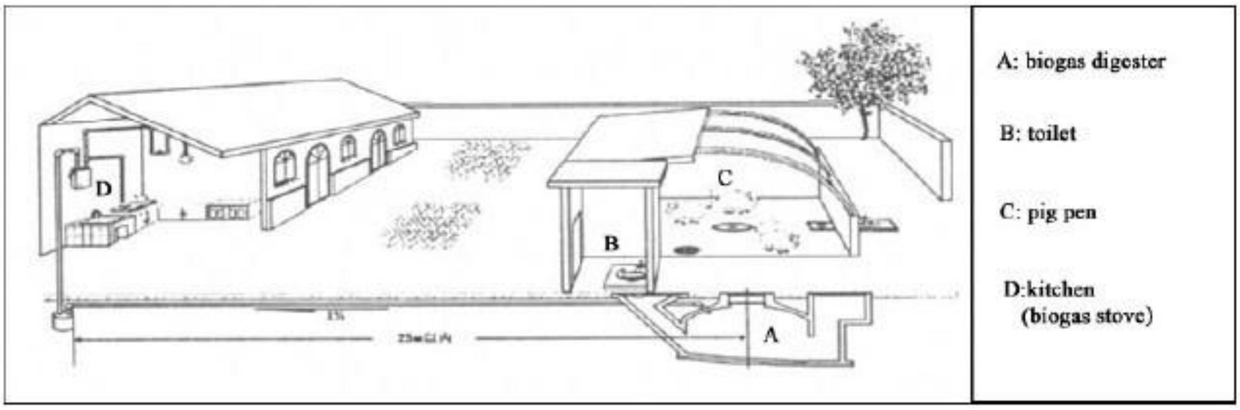

Figure A-4 Schematic diagram of methane production and utilization

According to the technical requirements of building methane digester in Haikou City rural eco-energy construction technical specification, the methane digester of the Project was constructed in accordance with the design standard layout of Hainan multi-function high-performance A, B-type pool. Its standard capacity is 8m^3.

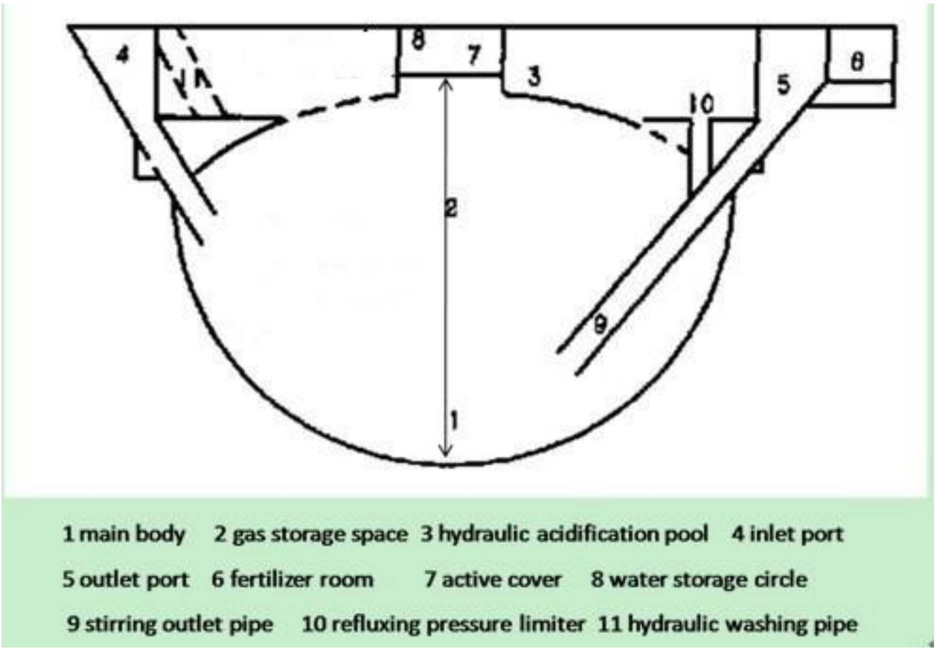

Figure A-5 Schematic diagram of A, B-type methane digester

The project aims to install 15,555 domestic biogas stoves for rural households in Haikou City to replace the traditional coal utilization for cooking and heating. This leads to the reduction of coal consumption and consequently the reduction of CO_2 emission. The rated power of each biogas stove is 2.33kW. Therefore, the total size of the project is 36.24MW (2.33*15,555*10^{-3}), below the 45 MW limit of the small scale CDM project.

The parameters of the biogas stove engaged in the project are listed below:

Parameters	Value	Justifications
Rated Power	2.33kW	The report by the third party.
Thermal Efficiency	≥55%	The minimum value stipulated by National Standard of P.R .China (GB/T3606-83) domestic biogas stove.
Technical life of equipment	15 year	Required by the project owner and confirmed by stove manufacturer.

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
P. R. China (host)	Guizhou Honor Carbon Asset Management Co., Ltd(owner)	No

A.5. Public funding of project activity

>>

There is no public funding involved in this project.

A.6. Debundling for project activity

>>

The project is not a debundled component of any other large scale project according to the "Guidelines on assessment of debundling for SSC project activities" (Version 03). A small-scale project activity shall be consider as a debundled component of a large project activity if there was a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

(a) With the same project participants;

(b) In the same project category and technology/measure; and

(c) Registered within the previous 2 years; and

(d) Whose project boundary is within 1 km of the project boundary of the small-scale activity at the closest point?

The project participant has not registered small-scale CDM project within the previous 2 years. And there is no other project boundary within 1km of the project boundary of the small-scale activity at the closest point.

The following table has indicated that the project is not a debundled component of a larger project activity.

Exempling Critieria	Justification
Each of the independent subsystems/ measures(e.g., Biogas digesters, residential solar energy systems, kerosene or in cane scent lighting replacements) included in one or more CDM project activies is no greater than 1% of the small scale thresholds defined by the applied methodology.	1) The threshold of AMS-III.R is aggregated annual emission reductions of all systems included shall be less than or equal to 60kt CO_2 equivalent. Consequently the 1% threshold of AMS-III.R is 600t CO_2/system/year. As discussed above, the expected emission reduction per biogas digester from AMS-III.R

	is 0.5182[1]t CO_2/year, which is no greater than 600t CO_2e, and the methane digesters are each implemented in multiple homes.
	2) The threshold of AMS-I.C is the total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45MW_{th} .As discussed above , the rated unit thermal energy generation capacity is 2.33kW_{th} ,which is far below 450$kW_{th,}$ and the methane digesters are each implemented in multiple homes as well
The subsystems/measures are indicated in the PDDs to be each implemented at or in multiple locations(e.g., installed at or in multiple homes)	3) The project is installation of biogas digesters in 15,555 individual households.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

>>

AMS-III.R: Methane recovery in agricultural activities at household/small farm level (Version 03.0)

Type I: Renewable Energy Projects

AMS-I.C.: Thermal energy production with or without electricity (Version 19.0)

http://cdm.unfccc.int/methodologies/DB/JQHRMGL23TWZ081T6G7G1RZ63GM1BZ

http://cdm.unfccc.int/methodologies/DB/6EL4AG49US2S1DNH55Y4S7GDQFA2JF

B.2. Project activity eligibility

>>

The methodology AMS-III.R(version 03.0) comprises recovery and destruction of methane from manure and wastes from household agricultural activities that would be decayed anaerobically emitting methane to the atmosphere in the absence of the project activity. The methodology AMS-I.C(version 19.0 comprises renewable energy technologies that supply individual households with thermal energy that displaces fossil fuels.

The project activity will change the existing swine manure treatment at the household level from deep pits to household biogas digesters. The biogas digesters provide biogas for cooking and other heating needs for households, replacing the fossil fuel coal. The project will reduce CH_4 emission from the slurry stored in a deep pit, and reduce CO_2 emission from burn of coal.

Therefore, this project can satisfy the applicable conditions of the methodologies AMS-III.R (version 03.0) and AMS-I.C (version 19.0) as follows in Table B1 and Table B2.

[1] According to the criteria 2 of AMS III.R/ver03.0, the baseline CH_4 emission from pig manure management system is 0.6299tCO_2e/year/household, and the CH_4 emission from physical leakage of anaerobic digester for each household is 0.1117t CO_2/year/household. The project leakage needs not to be considered since all the biogas digester are newly built and no equipment transfer is involved in the project activity, hence ,the each household annual emission reduction from methane recovery systems is 0.5182(0.6299-0.1117=0.5182) tCO_2e/year/household.

Table B1: Category III.R-Version 03.0Methane recovery in agricultural activities at household/small farm level is defined as follows:

Applicability of AMS-III.R-Version 03.0	Project activity
1. This project category comprises recovery and destruction of methane from manure and wastes from agricultural activities that would be decaying anaerobically emitting methane to the atmosphere in the absence of the project activity. Methane emissions are prevented by: ● (a) Installing methane recovery and combustion system to an existing source of methane emissions, or： ● (b) Changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system.	This project is a Greenfield one which comprises recovery and combustion of methane from manure that would be decayed anaerobically, emitting methane to the atmosphere in the absence of the project activity. Methane emissions are prevented by: (b) Changing the management practice of a biogenic waste or raw material in order to achieve the controlled anaerobic digestion equipped with methane recovery and combustion system. Before the project construction, all the swine manure was stored in the uncovered anaerobic mature management system (i.e.deep pit) for more than three months. A large amount of methane was emitted to the atmosphere during the manure storage with the anaerobic condition in the deep pit, and the householders using coal for cooking and heating in the absence of the project activity. However, the project is to build methane digesters at farmer households, in order to recycle manure and wastes from agricultural activities which are involved in anaerobic reaction.The produced methane is used for cooking and heating instead of fuel, lest GHG emits to the atmosphere.
2. The category is limited to measures at individual households or small farms (e.g. installation of a domestic biogas digester). Methane recovery systems that achieve an annual emission reduction of less than or equal to 5 tones of CO_2e per system are included in this category. Systems with annual emission reduction higher than 5 tones of CO_2e are eligible under AMS III.D.	The project is planned to install 15,555biogas digesters with reactor size of 8 m^3 under the pig pen of each rural household, so it is measured at each individual household. For each biogas digester, the methane recovery systems will achieve an annual emission reduction of 0.5182tCO_2e, which are less than 5 tCO_2e per system.
3.This project category is only applicable in combination with AMS-I.C, AMS-I.I and /or AMS-I.E.	This project category will be applied in combination with AMS I.C(version 19.0).
4.The project activity shall satisfy the following conditions: (a) The sludge must be handled aerobically. In case of soil application of the final sludge the proper conditions and procedures that ensure that there are no methane emissions must be ensured. (b) Measures shall be used (e.g. combusted or burnt in a biogas burner for cooking needs) to ensure that	(a)The sludge would be handled aerobically. The final sludge will be used for soil application, which is under aerobic condition, could be ensured that there are no methane emissions. (b)This project is to change swine manure management from deep pit storage to anaerobically digest in biogas digesters, recover methane produced by digester and use biogas for cooking and heating water for individual household. The

all the methane collected by the recovery system is destroyed.	local technicians provide technical service to ensure all the biogas stoves are always well-maintained and in the normal operation. The basic structure of biogas digester mainly has: main body, gas storage space, hydraulic acidification pool, inlet port, outlet room, etc. The methane is basically stored in the gas storage space in the digester for a period of time then used as a kind of fuel, so as that there is no way to leak to other places. Therefore, all the methane collected in the recovery system is destroyed under the combustion process. If the biogas stove is damaged, the methane will be stored in gas storage space of biogas digester for some times, in addition, the household will contact the technicians for any repairs and maintenance activities in the first time to avoid any unexpected leakage from biogas digesters.
5.Aggregated annual emission reductions of all systems included shall be less than or equal to 60kt CO_2 equivalent	The annual emission reduction from methane recovery systems is 8,060tCO_2e (0.5182*15,555=8,060) according to the AMS III.R (Version 03.0), which is less than the 60kt CO_2e.In addition, the annual emission reduction from coal consumption is 45,620tCO_2e (2.9328[2]*15,555=45,620) from the methodology AMS I.C(version19.0), hence, the combined annual emission reductions for both components of all systems included is 53,680 tCO_2e ,which is also less than 60kt CO_2e.

Table B2: Category I.C－Version19.0. Thermal energy for the user with or without electricity is defined as follows:

Applicability of AMS-I.C-Version 19.0	Project activity
1.This methodology comprises renewable energy technologies that supply users with thermal energy that displaces fossil fuel use. These units include technologies such as solar thermal water heater sand dryers, solar cookers, energy derived from renewable biomass and other technologies that provide thermal energy that displaces fossil fuel.	This category comprises renewable energy technologies that supply individual households or users with thermal energy that displaces fossil fuels.
2.Biomass-based co-generating systems that produce heat and electricity are included in this category.For the purpose of this methodology. Cogeneration shall mean the simultaneous generation of thermal energy and electrical and/or mechanical energy inone process. Project activities	Biomass-based co-generating systems are not included in the project.

[2]For AMS I.C/ver.19.0,the baseline CO_2 emission from coal consumption is 2.9328tCO_2e/year/household, the only involved equipment involved in AMS I.C part is the biogas stove. No fossil fuel is involved, hence, no project emissions are considered under the AMS-I.C, the project leakage needs not to be considered since all the biogas digester are newly built and no equipment transfer is involved in the project activity, hence ,the each household annual emission reduction from coal consumption is 2.9328(2.9328-0-0=2.9328) tCO_2e/year/household.

that produce heat and power in separate element processes (for example, heat from a boiler and electricity from biogas engine) do not fit under the definition of cogeneration project.	
3.Emission reductions from a biomass cogeneration system can accrue from one of the following activities: (a) Electricity supply to a grid; (b) Electricity and/or thermal energy (steam or heat) production for on-site consumption or for consumption by other facilities; (c) Combination of (a) and (b).	The project is not a biomass-based cogeneration system.
4. The total installed/rated thermal energy generation capacity of the project equipment is equal to or less than 45 MW thermal.	The thermal energy generated will be used by the household themselves. The biogas stove is 2.33kW. The total installed thermal generation capacity of this project is 36.24MW which below 45MW.
5.For co-fired systems, the total installed thermal energy generation capacity of the project equipment, when using both fossil and renewable fuel shall not exceed 45MW thermal (see paragraph 6 for the applicable limits for cogeneration project activities)	The project is not a co-fired system.
6.The following capacity limits apply for biomass cogeneration units: (a) If the project activity includes emission reductions from both the thermal and electrical energy components, the total installed energy generation capacity (thermal and electrical) of the project equipment shall not exceed 45 MW thermal. For the purpose of calculating this capacity limit the conversion factor of 1:3 shall be used for converting electrical energy to therma l energy (i.e., for renewable project activities, the maximal limit of 15 MW(e) is equivalent to 45MW thermal output of the equipment or the plant); (b) If the emission reductions of the cogeneration project activity are solely on account of thermal energy production (i.e., no emission reductions accrue from electricity component), the total installed thermal energy production capacity of the project equipment of the cogeneration unit shall not exceed 45 MW thermal; (c) If the emission reductions of the cogeneration project activity are solely on account of electrical energy production (i.e., no emission reductions	The project is not a biomass-based cogeneration system.

accrue from thermal energy component), the total installed electrical energy generation capacity of the project equipment of the cogeneration unit shall not exceed 15 MW.	
7.The capacity limits specified in the above paragraphs apply to both new facilities and retrofit projects. In the case of project activities that involve the addition of renewable energy units at an existing renewable energy facility, the total capacity of the units added by the project should comply with capacity limits in paragraphs 4 to 6 and should be physically distinct from the existing units.	There is no existing renewable energy facility. The total installed thermal generation capacity of this project is 36.24MW, less than 45 MW.
8.Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category.	This project is a greenfield project.
9.New Facilities (Greenfield projects) and project activities involving capacity additions compared to the baseline scenario are only eligible if they comply with the related and relevant requirements in the "General Guidelines to SSC CDM methodologies"	This project is a greenfield project. The project methodology AMS-III.R 'Methane recovery in agricultural activities at household/small farm level' is only applicable in combination with AMS-I.C 'Thermal energy production with or without electricity'. It is complied with the related and relevant requirements in the "General Guidelines to SSC CDM methodologies"
10.If solid biomass fuel (e.g., briquette) is used, itshall be demonstrated that it has been produced using solely renewable biomass and all project or leakage emissions associated with its production shall be taken into account in emissions reduction calculation.	No solid biomass fuel is involved in the project.
11. Where the project participant is not the producer of the processed solid biomass fuel, the project participant and the producer are bound by a contract that shall enable the project participant to monitor the source of the renewable biomass to account for any emissions associated with solid biomass fuel production. Such a contract shall also ensure that there is no double-counting of emission reductions.	The project activity is implemented by a project coordinator Guizhou Honor Carbon Asset Management Co.,Ltd who is authorized by all the rural households and acts as project participant to execute the power on behalf of the rural households. There is a contract between the Guizhou Honor Carbon Asset Management Co., Ltd and Local energy office authorised by rural households to execute their rights, which could ensure that no double counting of emission reductions would occur, and enable the project participant could monitor the source of the renewable biomass to account for any emissions associated with the project.
12.If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered into that ensure there is no double-counting of emission reduction.	The heat produced by the project activity will be used by the household who installed the biogas digesters themselves. Each household has a unique serial number which will be used for monitoring and avoid double counting of emission reduction.
13. If the project activity recovers and utilizes biogas for power/heat production and applies this	The project activity recovers and utilizes biogas for heat production and applies both this methodology

methodology on a standalone basis i.e. without using a Type III component of a SSC methodology, any incremental emissions occurring due to the implementation of the project activity (e.g. physical leakage of the anaerobic digester, emissions due to inefficiency of the flaring), shall be taken into account either as project or leakage emissions.	and III.R. So leakage will not be considered.
14.Charcoal based biomass energy generation project activities are eligible to apply the methodology only if the charcoal is produced from renewable biomass sources provided: (a) Charcoal is produced in kilns equipped with methane recovery and destruction facility; or (b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered. These emissions shall be calculated as per the procedures defined in the approved methodology AMS-III.K. Alternatively, conservative emission factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable e.g. source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln, operating conditions such as ambient temperature.	The project is not a charcoal based biomass energy generation project.

B.3. Project boundary

>>

In accordance with the methodology AMS-I.C(vesion19.0), the spatial extent of the project boundary encompasses (c) Industrial, commercial or residential facility, or facilities, consuming energy generated by the system and the processes or equipment affected by the project activity. The emission reductions from replacing coal for cooking and heating are also need to be considered. Based on the methodology AMS-III.R(version 03.0), the project boundary encompasses the physical, geographical site of the methane recovery and combustion systems. The spatial scope of the project boundary is showed in Figure B1.

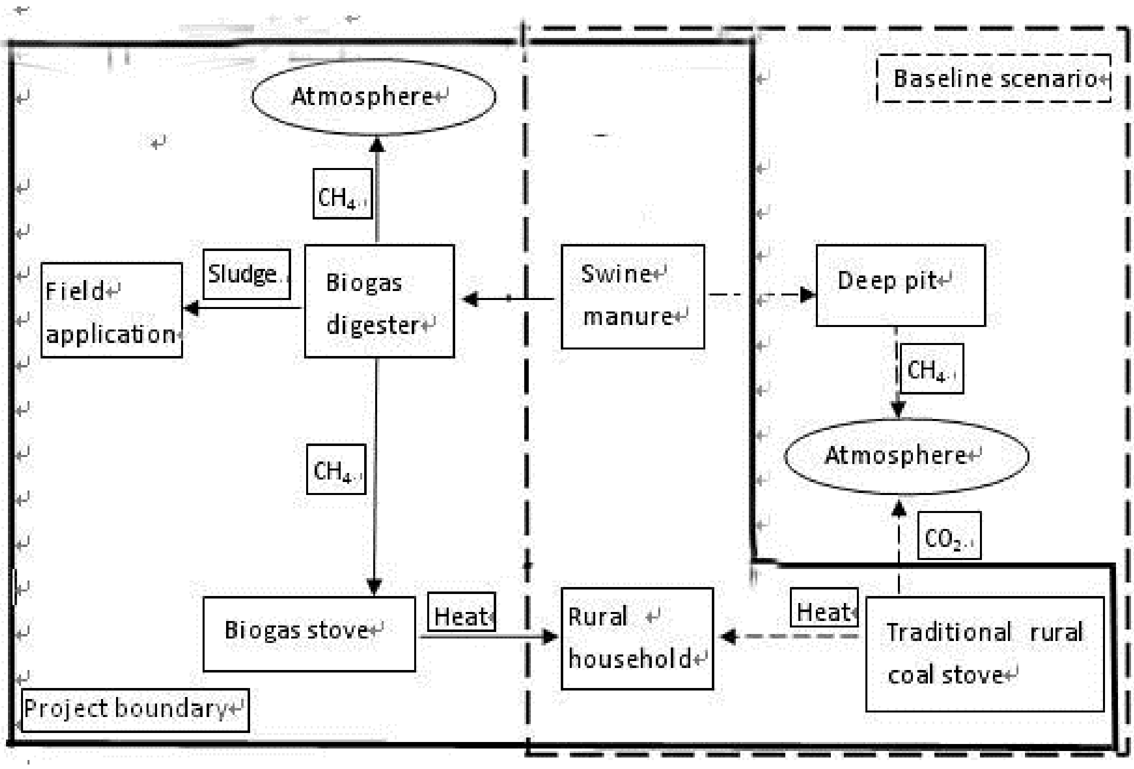

Figure B1 Project boundary of the project activity

Within the project boundary, the project adopts biogas digester to treat pig manure anaerobically. The produced biogas is recycled and used for cooking meals and heating water for household member sand livestock - replacing coal. In case of land application of the final sludge the proper condition and procedures will ensure that there are no methane emissions. Moreover, according to the design, the digesters are built under the pigsties and toilets, and as per conservative consideration, the mankind manure from toilets is not considered to calculate the emission. Emission sources and gases included in the project boundary are listed in Table B1.

The local energy office takes the charge of the construction and operation as well as database establishment of the biogas digesters, which included unique serial number complied with household's information. Each digester is given a serial unique number which is specially designed for the project once it has been installed. That can avoid any coincidence with other projects. The specially designed number is closely associated with householder's information including name, ID card and family address. All data are collected, modified and managed by Local energy office. In the project, each household has a biogas digester number as their ID. It will be in charge of the monitoring and avoid double counting when calculating the emission reduction.

Table B1. Emission sources and gases included within the project boundary

	Sources	Gas	Included/ Excluded	Justification /Explanation
Baseline	Emissions from manure	CH_4	Included	Major source
		N_2O	Excluded	Excluded for simplification. This is conservative.
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not included.

	Emissions from burning of coal	CO_2	Included	Major source
		N_2O	Excluded	Base on the investigation, the coal consumption under baseline condition is higher than that in project condition. Therefore, N_2O emissions from burning of coal are not included. This is conservative.
		CH_4	Excluded	Base on the investigation, the coal consumption under baseline condition is higher than that in project condition. Therefore, CH_4 emission from burning of coal in the baseline scenario is higher than that in project condition. This is conservative. Excluded for simplification. This is conservative.
Project Activity	Emissions from biogas digester	CH_4	Included	Leakage from biogas digester is major emission source under project activity according to AMS III.R(version 03.0)
		N_2O	Excluded	No N_2O formed in biogas digester
		CO_2	Excluded	CO_2 emissions from the decomposition of organic waste are not included.

B.4. Establishment and description of baseline scenario
>>

As described in section B.3, the GHG emission under the baseline condition comprises two sources: (a) CH_4 emission from manure management; and (b) CO_2 emission from combustion of coal.

According to version 19 of AMS I.C. for biogas digesters with biogas recovered and gas burners that displace traditional stove using fossil fuels (coal), the simplified baseline is the coal consumption of the technologies that would have been used in the absence of the project activity. Baseline emission (BE_y) is the coal consumption that would have been used in the absence of the project activity times an emission coefficient for replaced coal.

Under the baseline condition, through the survey it was found that all of swine manure was thrown directly into deep pit without being treated until the deep pit was all full, and the deep pit only had swine manure. Because 100% of swine manure was left and stored in the deep pit for about more than three months, large amount of methane was emitted to the atmosphere during the manure storage with the anaerobic condition in the deep pit. According to version 03.0 of AMS III.R, the baseline scenario is the situation where, in the absence of the project activity, swine manure is left to decay anaerobically within the project boundary and methaneis emitted to the atmosphere. Baseline emissions (BE_y) are calculated ex ante using the amount of swine manure that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach (please refer to the chapter ‘Emissions from Livestock and Manure Management’ under the volume ‘Agriculture, Forestry and other Land use’ of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). According to the methodology AMS-III.R version 03.0, the option in paragraph 9 (a) and relevant formula shown in paragraph 10 of AMS-III.D[3] "Methane recovery in animal manure management systems" (version 19.0) are used to calculate baseline emissions.

[3]In the latest version of the methodology AMS.III.D (version 19.0), the two paragraphs have been updated to paragraph 15(a) and paragraph 16.

B.5. Demonstration of additionality
>>

The activity had been one of the key factors and consideration of the project owner in forecasting impacting to the continuation of operation of the project with VERs revenue helping a lot to battle against barriers from organizational capacity and financial resources.

Clear additionality made the project owner believe that the project falls under GS concept and relevant board decision was made at the beginning of project decision.

The GS consideration and decision making process is presented as follows:

Table B2 Project Schedule

A chronicle of Events		Date
Project implementation	GS efforts	
Investigation report on households-basic information in Haikou City		24/10/2008
	The meeting summary of each town committee about biogas project as a GS project	10/11/2008
Notice of Haikou City biogas digester construction programme		23/02/2009
Start construction (Project starting time)		04/03/2009
	Consulting contract was signed about developing GS project	20/04/2009
	Draft PDD	12/2013

According to *Guidelines on the Demonstration of Additionality of Small-Scale Project Activities* (Version 09.0), the project activity can be regarded as automatically additional.

Base on *Guidelines on the Demonstration of Additionality of Small-Scale Project Activities* (Version 09.0), type (c) in paragraph 2 is not required documentation of barriers which can be defined as automatically additional if each isolate unit is no larger than 5% of the small-scale CDM thresholds. There are two thresholds for the project activity.

The size of each unit is no larger than 5% of the small-scale CDM thresholds as follow table B3:

Table B3 Demonstration of additionality of the project activity

Methodology	Criteria i	Criteria ii: Thresholds	Value	Application criteria justified? Yes/No
AMS-III.R. (Version 03)	Implemented at unit level	For AMS-III.R. Version 03/13/, its threshold is *aggregated annual emission reductions of all systems included shall be less than or equal to 60kt CO2 equivalent*. 5% of threshold is 3000 tCO2e.	0.5182tCO_2/yr (The emission reductions of each household biogas digester)	Yes

AMS-I.C. (Version 19)	Implemented at unit level	For AMS-I.C. Version 19/14/, its threshold is *the total installed rated thermal energy generation capacity of the project equipment is equal to or less than 45MW thermal*. 5%threshold is 2.25MW perunit.	2.33kW(The rated power of each biogas stove)	Yes

1) The threshold of the project activity under methodology I.C, the rated power of each installed biogas stove is 2.33kW which is far less than 2.25 MW thermal, say 5% of 45MWth as one of the small-scale CDM thresholds.
2) The threshold of the project activity under methodology III.R, the emission reduction per system is 0.5182 tCO_2/yr that is far lower than 3000t CO_2 equivalent, say 5% of 60 $ktCO_2$ equivalent as another one of the small-scale CDM thresholds.

B.6. Emission reductions
B.6.1. Explanation of methodological choices
>>

The applicable methodologies are:

- Version 19.0of AMS-I.C titled “Thermal energy for the user with or without electricity”;
- Version 03.0of AMS-III.R titled “Methane recovery in agricultural activities at household/small farm level”.

The tool ‘IPCC Guidelines for National Greenhouse Gas Inventories (Version 2006)’ to calculate the emission factor for a methane recovery system is also quoted in this methodology.

Emission Reduction (ER_y)

The emission reduction achieved by the project activity will be calculated based on each biogas digester user in Year y:

$$ER_{y,i}=BE_{y,i}-PE_{y,i}-LE_{y,i} \quad (1)$$

$ER_{y,i}$: the emission reduction per household in Year y associated with the project.

$BE_{y,i}$: the baseline emission per household in Year y.

$PE_{y,i}$: the project emission per household in Year y associated with the project.

$LE_{y,i}$: the leakage in Year y associated with the project.

The above-mentioned parameters will be confirmed in the following steps.

1. Baseline Emission Reduction (BE_y)

(1) CH_4 emission from manure management

In order to obtain information on the swine population raised by households, an extensive household survey was conducted. According to the Local Coal Consumption and Biogas Survey Report, the average swine population of the households which have built biogas digesters is 2.50.

According to the methodology AMS-III.R version 03.0, the option in paragraph 9(a) and relevant formulae shown in paragraph 10 of AMS-III.D[4] "Methane recovery in animal manure management system" shall be also used to calculate baseline emission, formula (2) is applied to calculate methane emission as follows:

$$BE_{CH4,y} = GWP_{CH4} * D_{CH4} * UF_b * \quad MCF_j * B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{Bl,j} \qquad (2)$$

Where,

$BE_{CH4,y}$: Baseline emissions from manure management for each household in year y (tCO_2e)

GWP_{CH4} : Global Warming Potential (GWP) of CH_4 (21)

$D_{CH4:}$ Density of methane

LT :Index for all types of livestock

j : Index for animal manure management system

MCF_j: Annual methane conversion factor (MCF) for the baseline animal manure management system j

$B_{0,\ LT}$: Maximum methane producing potential of the volatile solid generated for animal

type LT (m^3 CH_4/kg dm)

$N_{LT,y}$: Annual average number of animals of type LT in year y (numbers)

$VS_{LT,y}$: Volatile solids for livestock LT entering the animal manure management system in

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

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

UF_b Model correction factor to account for model uncertainties (0.94)[5]

(2) Baseline CO_2 emission from coal consumption

Three steps will be applied to determine CO_2 emission in baseline:

- Step 1: Identification of baseline emission sources;

[4] In the latest version of the methodology AMS.III.D (version 19.0), the two paragraphs have been updated to paragraph 15(a) and paragraph 16.
[5] Reference: FCCC/SBSTA/2003/10/Add.2,page 25.

- Step 2: Identification of emission factors;
- Step 3: Calculation of baseline CO_2 emission from coal consumption.

Step 1: Identification of baseline emission sources

Baseline CO_2 emission sources have been identified as listed in Table B1, the baseline CO_2 emission sources is the coal burning used to meet the daily energy needs of a household for cooking and heating and the emissions from manure.

Step 2: Identification of emission factor of coal combustion

According to the baseline methodology for small-scale CDM project activity categories I.C titled "Thermal energy for the user with or without electricity" for renewable energy technologies that displace technologies using fossil fuels, the simplified baseline is the fuel consumption of the technologies that would have been used in the absence of the project activity times an emission coefficient for the displaced fossil fuel. In this project, national specific emission factor provided by National Development and Reform Committee (NDRC) will be adopted (www.ccchina.gov.cn). According to the latest Chinese government publication, EF_{FF,CO_2} =87,300kg CO_2/TJ.

Step 3: Calculation of baseline CO_2 emission from coal consumption

According to the methodology AMS-I.C(version 19.0), for steam/heat produced using fossil fuels the baseline emissions are calculated as follows:

$$BE_{thermal,CO2,y} = (EG_{thermal,y}/\eta_{BL,\ thermal})^{*} EF_{FF,CO2} \quad (3)$$

Where, Carbon emission factor per unit of energy of coal that would have been used in the baseline

$BE_{thermal\ CO\ 2y}$: Baseline CO_2 emission from coal combustion for household before the installation of digester in the city i, tCO_{2e} yr-1 for each household;

$EG_{thermal,y}$: The net quantity of heat supplied for household by the project activity, TJ

$EF_{FF,CO2}$:Carbon emission factor per unit of energy of coal that would have been used in the baseline

$\eta_{BL,\ thermal}$:Thermal efficiency for the traditional coal furnace of the baseline situation;

According to basic physics principle,

$EG_{thermal}=kW_{thermal} \times H_{stove} \times DI$

Where;

$kW_{thermal:}$ The thermal capacity of the biogas stove for household

$H_{stove:}$ Average Operating hours of the stoves for each household

DI: Thermal efficiency of the biogas stove

(3) Total baseline GHG emission calculation per household:

GHG emission for each household under the baseline scenario can be calculated based on equation

$$BE_{y,i=}BE_{CH4\ ,y\ +}\ BE_{thermal,CO2,y} \quad (4)$$

Where,

$BE_{y,\,i,}$: Baseline GHG emission for each household before the installation of digester, t CO_2 e yr-1

2. Project Emission(PE_y)

As per AMS-I.C(version 19.0), project emissions include:

- CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";
- CO_2 emissions from electricity consumption by the project activity using the latest version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption";
- Any other significant emissions associated with project activity within the project boundary;
- For geothermal project activities, project participants shall account for the following emission sources, where applicable: fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam; and carbon dioxide emissions resulting from combustion of fossil fuels related to the operation of the geothermal power plant.

The project activity does not involve on-site consumption of fossil fuels and electricity and does not involve geothermal process. Thus the calculation of project emissions according to AMS-I.C(version 19.0) is not applicable for the project activity and it is taken as zero.

Project emissions consist of CO_2 emissions from coal combustion and the physical leakages of methane from anaerobic digester as per AMS-III.R (version 03.0).

(1) CH_4 emission from physical leakages of anaerobic digester

According to AMS III.R (version 03.0), project emissions due to physical leakage of biogas digester is estimated using option a(a:10% of the maximum methane producing potential of the manure fed into the management systems implemented by the project activity[8] indicated in paragraph 19(a) of AMS-III.D (version 19.0): Methane recovery in animal manure management systems". According to AMS-III.D(version 19.0), the leakage from anaerobic digester is calculated as follows:

$$PE_{PL,y} = 0.10 * GWP_{CH4} * D_{CH4} * \sum_{i,LT} B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{i,y} \quad (5)$$

Where:

$PE_{PL,y}$: Project emissions from physical leakages in the biogas digesters for each household in Year y, (t CO_{2e}).

GWP_{CH4}: Global Warming Potential of CH_4.

D_{CH4} : Density of methane

$B_{o,LT}$: Maximum methane producing potential of the manure type treated in the biogas

$N_{LT, y}$: Annual average number of animals of type LT in year y (numbers)

$VS_{LT, y}$: Volatile solids for livestock LT entering the animal manure management system in year y (on a dry matter weight basis, kg dm/animal/year)

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

2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 10 guidelines specify a default value of 10% of the maximum methane producing potential (Bo) for the physical leakages from anaerobic digesters

(2) Project GHG emission calculation for each household

GHG emission for each household under the project activity can be calculated based on equation (6)

$$PE_{y,i} = PE_{PL,y} \qquad (6)$$

Where,

$PE_{y,i}$: Annual project GHG emission of each household after the installation of digester , t CO2 e yr-1

3. Leakage

For methodology AMS I.C (Version 19.0) titled “Thermal energy for the user 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 03.0) 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.

The project is a Greenfield one and the methane recovery and combustion equipment of the project is not transferred from another activity. So leakage is not to be considered.

4. GHG emission reduction per household

The emission reduction per household within the project activity during a given year *y* is the amount of the household GHG baseline emissions minus the household GHG emissions with biogas digester installed under the project, as follows:

（1） CHG emission reduction per household($ER_{y,i}$)

The emission reduction per household within the project activity during a given year y can be calculated based on equation:

$$ER_{y,i} = BE_{y,i} - PE_{y,i} - LE_y \qquad (1)$$

(1) Calculation of total project GHG emission reductions (ER_y)

$$ER_y = \sum_i N_d \times ER_{y,i} \quad (7)$$

ER_y:Total GHG emission reductions of this project activity ,tCO_2e/yr

N_d: The annual number of biogas systems including the digesters and biogas stoves engaged in the project.

B.6.2. Data and parameters fixed ex ante

(Copy this table for each piece of data and parameter.)

Data/Parameter	GWP_{CH4}
Unit	dimensionless
Description	Global warming potential of CH_4
Source of data	Kyoto protocol Annex
Value(s) applied	21
Choice of data or Measurement methods and procedures	NA
Purpose of data	Baseline emission calculations
Additional comment	NA

Data / Parameter	$B_{o,LT}$
Unit	$m^3CH_4kg^{-1}$of VS excreted
Description	Maximum methane producing potential of the manure type treated in the biogas
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10A-7
Value(s) applied	0.29
Choice of data or Measurement methods and procedures	NA
Purpose of data	Baseline emission calculations
Additional comment	NA

Data / Parameter	$VS_{LT, y}$
Unit	kg dry matter $animal^{-1}day^{-1}$
Description	Volatile solids for livestock LT entering the animal manure management system in year y
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10A-7
Value(s) applied	0.3
Choice of data or Measurement methods and procedures	There is no site-specific value in the project site. The average weight of swine is more than IPCC default. Therefore, in this case, the IPCC default value could be used. It’s conservative.
Purpose of data	Baseline emission calculations
Additional comment	NA

Data / Parameter	D_{CH4}
Unit	t/m^3
Description	Density of methane
Source of data	Methodology AMS-III.D
Value(s) applied	0.00067
Choice of data or Measurement methods and procedures	0.00067 t/m^3at room temperature 20℃ and 1 atm pressure
Purpose of data	Baseline emission calculations
Additional comment	NA

Data / Parameter	UF_b
Unit	
Description	Model correction factor to account for model uncertainties
Source of data	Methodology AMS-III.D
Value(s) applied	0.94
Choice of data or Measurement methods and procedures	According to methodology AMS-III.D(version 19.0)
Purpose of data	Baseline emission calculations
Additional comment	NA

Data / Parameter	$MS\%_{Bl,j}$
Unit	%
Description	Fraction of manure handled in baseline animal manure management system j
Source of data	
Value(s) applied	100
Choice of data or Measurement methods and procedures	In this propose project, the biogas digesters were constructed under the piggery, as the pigs are kept in a confined area and do not leave the area in baseline or project scenario, therefore, it just take swine to calculate the methane emission It's conservative.
Purpose of data	Baseline emission calculations
Additional comment	NA

Data / Parameter	$\eta_{BL,\ thermal}$
Unit	％
Description	Thermal efficiency for the traditional coal furnace of the baseline situation
Source of data	1)Referenced literature value "Clean Energy for Development and Economic Growth: Biomass and Other Renewable Energy Options to Meet Energy and Development Needs in Poor Nations",UNDP,2002 Httpp://www.undp.org/energy/publications/2002/2002b.htm 2) The on-site measurement data of thermal efficiency of traditional coal stoves in project case by the Local energy office.
Value(s) applied	19.5
Choice of data or Measurement methods and procedures	1) According to the related referenced literature, it is cited in the page 8 of the publication reference issued by UNDP that "the most common method of cooking throughout rural areas of the developing country is the open hearth or three-stone fire, which typically transfers only 5-15 per cent of the fuel's energy into the cooking pot. Besides the reference of UNDP, it is also reported in page17 of "Improved Household Stoves in China: An Assessment of the National Improved Stove Program of the reference source that the measured efficiency for traditional coal stoves is 10-15% in China. 2)In this project, the highest efficiency of household coal cooking stove from test report of Local energy office is determined to be19.5%, according to the option (a) and (c) of paragraph 30 of methodology AMS-I.C.(Version19.0),following conservative principle, 19.5% shall be chosen as the baseline thermal efficiency for the traditional coal stoves.
Purpose of data	Baseline emission calculations
Additional comment	NA

Data/ Parameter	$KW_{thermal}$
Unit	kW
Description	The thermal capacity of the biogas stove for household
Source of data	Test report by the third party on Feb. 2012
Value(s) applied	2.33
Measurement methods and procedures	-
Monitoring frequency	Every replacement
QA/QC procedures	Biogas stove failing to work should be repaired timely or if the stove is replaced, the rated power will be record according to the product technical specification provided by biogas stove manufacturers or the third party.
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	DI
Unit	%
Description	Thermal efficiency of the biogas stove
Source of data	Test report by the third party on Feb. 2012
Value(s) applied	55
Measurement methods and procedures	-
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	Emission reduction calculations
Additional comment	NA

B.6.3. Ex-ante calculation of emission reductions
>>

Baseline Emission Reduction

1.CH_4 emission from manure management

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

$BE_{CH4,y}$=21*0.00067*0.94*0.60*0.29*2.50*0.3*365*1=0.6299tCO_2e/year/household

2. Baseline CO_2 emission from coal consumption

Because metering of thermal energy output is not plausible in the case of cooking stoves and the baselineCO_2 emission from coal consumption is therefore difficult to determine, the parameter “net quantity of heat ($EG_{thermal}$) supplied by the project activity” has been used in the baseline emission calculation.

According to the parameter ‘efficiency of the baseline unit’, the parameter “net quantity of heat ($EG_{thermal}$)

supplied by the project activity" has been used in the baseline emission calculation. The baseline emissions are determined by multiplying the net quantity of heat supplied by the project activity and a carbon emission factor per unit of energy of coal that would have been used in the baseline.

According to the methodology AMS-I.C(version 19.0), baseline CO_2 emission per household can be calculated based on equation (3):

$$BE_{thermal,CO_2,y} = (EG_{thermal,y} / \eta_{BL,thermal}) * EF_{FF,CO_2}$$

$EG_{thermal}$= $kW_{thermal}$ ×H_{stove}×DI=2.33kW×4.0h×355d×55%=6,551,028KJ

$BE_{thermal,co2}$=(6,551,028/19.5%)×87,300=2.9328tCO_2e/year/ household

3. Total Baseline Emission=0.6299+2.9328=3.5627tCO_2e/year/household

Project Emission(PE_y):

1. CH_4 emission from physical leakages of anaerobic digester

$$PE_{PL,y} = 0.10 * GWP_{CH4} * D_{CH4} * \sum_{i,LT} B_{0,LT} * N_{LT,y} * VS_{LT,y} * MS\%_{i,y}$$

$PE_{PL,y}$=0.1×21×0.00067×0.29×2.50×0.3×365×1= 0.1117tCO_2e/year/household

2. Total Project Emission=0.1117tCO_2e/year/household

Leakage:

LE_y=0

Therefore, the each household annual total emission reduction is calculated as follow:

ER_y=BE_y-PE_y-LE_y=3.5627-0.1117-0= 3.4510tCO_2e/year/household

According to the AMS III.R(version 03.0),which use a Type III component of a SSC methodology, the each household annual emission reduction from methane recovery systems is 0.5182tCO_2e/year/household(0.6299- 0.1117=0.5182);according to the AMS I.C(version 19) ,which use a Type I component of a SSC methodology, the each household annual emission reduction from coal consumption is 2.9328tCO_2e/year/ household.

Finally, the project activity which contains 15,555 households annual emission reduction is;

ER=N_d*ER_y=15,555×3.4510=53,680tCO_2e/year.

Local energy office

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2 e)	Project emissions (tCO_2 e)	Leakage (tCO_2 e)	Emission reductions (tCO_2 e)
01/01/2012~31/12/2012	55,418	1,738	0	53,680
01/01/2013~31/12/2013	55,418	1,738	0	53,680
01/01/2014~31/12/2014	55,418	1,738	0	53,680
01/01/2015~31/12/2015	55,418	1,738	0	53,680
01/01/2016~31/12/2016	55,418	1,738	0	53,680
01/01/2017~31/12/2017	55,418	1,738	0	53,680
01/01/2018~31/12/2018	55,418	1,738	0	53,680
01/01/2019~31/12/2019	55,418	1,738	0	53,680
01/01/2020~31/12/2020	55,418	1,738	0	53,680
01/01/2021~31/12/2021	55,418	1,738	0	53,680
Total	554,180	17,380	0	536,800
Total number of crediting years	10			
Annual average over the crediting period	55,418	1,738	0	53,680

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

(Copy this table for each data and parameter.)

Data/ Parameter	N_d
Unit	unit
Description	The annual number of biogas systems including the digesters and biogas stoves engaged in the project
Source of data	Notice of Government
Value(s)applied	15,555
Measurement methods and procedures	The initial value was determined by the notice of government. And after construction completed, the technician in every village will monitored and record each system including biogas digester and biogas stove whether is work well. The detail of monitoring of this parameter is in section B7.2.
Monitoring frequency	Annually
QA/QC procedures	According to the operation management regulations of biogas digester, the unique serial number was given to every biogas digester of peasant household, and the relevant information of biogas digester, such as name, location, serial number, as well the date of building was put on record in Local energy office. The technician would take casual inspection to the rural households, in the event of either biogas digester or biogas stove in the biogas system was disused, the reason will be written down clearly and reported to the local energy office immediately. The biogas systems including the biogas digester and the biogas stoves will be checked and running number recorded for the review. Local energy office recorded it in the file of rural household and verified it.
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	$H_{digester}$
Unit	h
Description	Annual operation hours of biogas digester
Source of data	To be determined by the result of the sampling survey
Value(s) applied	8,520
Measurement methods and procedures	The monitoring will be conducted yearly on the selected sample uses determined at the beginning of each year. The data will be summarized calculate and archived yearly by the GS Department.
Monitoring frequency	Annually
QA/QC procedures	Refer to B.7.2
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	$N_{LT, y}$
Unit	head
Description	Annual average number of pigs
Source of data	To be determined by the result of the sampling survey
Value(s) applied	2.5
Measurement methods and procedures	The monitoring will be conducted monthly on the selected sample uses determined at the beginning of each year. The data will be summarized calculate and archived monthly by the GS Department.
Monitoring frequency	Monthly
QA/QC procedures	Refer to B.7.2
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	Application of sludge
Unit	NA
Description	The proper application of biogas sludge
Source of data	To be determined by the result of the sampling survey of household
Value(s) applied	NA
Measurement methods and procedures	All the households have get the training regard to how to deal with the sludge, and let them know the sludge is a good fertilizer, the technician which lived in each village are in charge of the treatment of sludge and each time they will check the treatment method. See to it that immediate rectification problem. The final sludge will be used for soil application. The proper soil application of the final sludge shall be recorded on a sampling basis and reported to the Local energy office.
Monitoring frequency	Every application
QA/QC procedures	Refer to B.7.2
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	H_{stove}
Unit	hour
Description	Average Operating hours of the stoves for each household
Source of data	Project proponents
Value(s) applied	1,420(4*355d)
Measurement methods and procedures	The operating hours of the stoves will be conducted and daily recorded on the stove operation record table by each household user, which can be determined on sample in selected households. The data will be monthly analyzed of average, summarized annually by the Local energy office.
Monitoring frequency	Daily records by household user and archived annually by the Local energy office.
QA/QC procedures	The sample size will reach above 327 households and account will be taken of possible stratification of the sampled population to ensure the precision and confidence.
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	T
Unit	℃
Description	Annual Average ambient temperature at local weather station nearby project site
Source of data	local meteorological bureau
Value(s) applied	24.2
Measurement methods and procedures	Office source meteorological data. Used to select the annual MCF from IPCC. MCF was selected based onthe annual average temperature from Local Meteorological Station.
Monitoring frequency	Monthly monitoring and average annually
QA/QC procedures	The data is official source and no addition QA/QC procedures may need to be planned.
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	MCF_j
Unit	%
Description	Annual methane conversion factors for each manure management system j
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories Vol.4, Ch.10. Table 10.17
Value(s) applied	60
Measurement methods and procedures	Hainan Province locates in the south of China. When the biogas digester was not constructed in the country, the livestock's manure was typically stored in an enclosed animal confinement facility (i.e. pit storage). According to the definition of manure management system in IPCC 2006 Guidelines for National Greenhouse Gas Inventories (volume 4 Chapter. 10: Livestock Emissions), pit storage below animal confinement is used for baseline calculation purposes. The annual weighted temperature in project areas is 24.2℃ provided by the third party, so the methane conversion factor (MCF_j) is 60%. Published data by IPCC Guidelines for National Greenhouse Gas Inventories.
Monitoring frequency	Review appropriateness of the values annually
QA/QC procedures	NA
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	$EF_{FF,}co_2$
Unit	$kgCO_2/TJ$
Description	Carbon emission factor per unit of energy of coal that would have been used in the baseline
Source of data	Published data by China NDRC (http://www.ccchina.gov.cn/archiver/cdmcn/UpFiles/Files/Default/20130917081426863466.pdf)
Value(s) applied	87,300
Measurement methods and procedures	Published data by China statistic bureau
Monitoring frequency	Review appropriateness of the values annually
QA/QC procedures	NA
Purpose of data	Emission reduction calculations
Additional comment	NA

Data/ Parameter	The amount of manure generated by the swine and fed into the digester **(MS % $_{i,y}$)**
Unit	
Description	The amount of pig manure fed into the biogas digester
Source of data	To be determined by the result of the sampling survey
Value(s) applied	100
Measurement methods and procedures	As the biogas digesters are usually installed below the pig pen and the inlet will be directly connected to livestock room so that the manure can be drained into the digester directly, there is no incremental transportation as per the site of manure in baseline and project scenario. 100% swine manure generated in individual household will be fed into the biogas digesters, because the biogas digester was built under the pig pen, the pigs are kept in a confined area and do not leave the area in project scenario, all animal manure generated would fed in to the biogas digester, and the technicians will do random checks to ensure the manure is consistent with the capacity of the digester.
Monitoring frequency	Monthly
QA/QC procedures	NA
Purpose of data	Emission reduction calculations
Additional comment	NA

B.7.2. Sampling plan
>>

1. **The organizational structure of monitoring and sampling**

In order to guarantee the Project's real, measurable and long-term GHG emission reductions, a reliable, transparent and all-around monitoring plan is established, as well as a system for data estimating, measuring, racking, collecting and archiving. The following six sections are included in the monitoring plan and sampling plan:

1.1 Structure

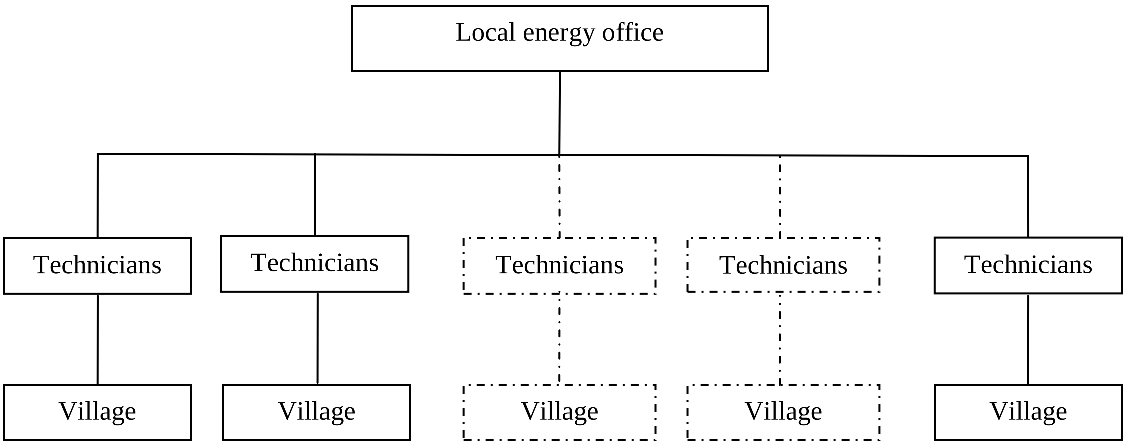

Figure 3The organizational structure of monitoring

1.2. Responsibility
1.2.Local energy office
In charge of organizing technicians to repair and maintain the digesters, preparing the monitoring and sampling during the periods then collecting, gathering and storing the data. There will also be one person responsible for calculating the emission reductions for DOE's verification according to the monitoring data. Local energy office has the list of all the methane digesters systems, and the unique ID (serial number)is given to every biogas digester of peasant household and used in the project management procedure with the relevant information of biogas digester, such as location and serial number put on record in the Local energy office. They will review the monitoring data collected by technicians to ensure no double counting of emission reductions would occur.
1.2.2 Each town's technical principals
Appoint persons to sample, collect, gather and report the data. Hold the responsibility for maintenance arrangement.
1.2.3 Technicians in each village
In charge of investigation, collection and reporting the sampling results, as well as taking charge of maintenance and repairing the digesters all over the village.
1.2.4 Farmers
Cooperate with technicians in filling up the monitoring sheets.

2.The data that need to be monitored

Parameter	Monitoring data	Frequency
N_d	The annual number of biogas systems including the digesters and biogas stoves engaged in the project	Once per year
$H_{digester}$	Annual operation hours of biogas digester	Once per year
$N_{LT, y}$	Annual average number of pigs in year y	Once per month

H_{stove}	Average Operating hours of the stoves for each household	Daily records ,monthly analysis of average and archived annually summary of the final results
$EF_{FF,CO2}$	Carbon emission factor per unit of energy of coal that would have been used in the baseline	Review appropriateness of the values annually.
T	Annual Average ambient temperature at local weather station nearby project site	Monthly monitoring and average annually
MCF_j	Annual methane conversion factors for each manure management system j	Review appropriateness of the values annually
$KW_{thermal}$	The thermal capacity of the biogas stove for household	Every replacement
DI	Thermal efficiency of the biogas stove	Every replacement
-	Application of biogas sludge	Every application
-	The amount of manure generated by the swine and fed into the digester**($MS\ \%_{i,y}$)**	Once per month

3.Quality assurance and quality control procedures

Before the formal operation of the project, the leaders in charge of GS will organize the relevant investigators and super visors to accept formal training on GS and sampling investigation method. Each town principals should spot-check each sample farmers periodically. To ensure the reality of data, the monitoring data of that month should be collected, checked and signed to be archived at the end of each month.

At last, all the data recorded should be analysed separately by grouped statistical treatment. And then the number of operating digesters, the average number of poultry, the average annual running hours and the treatment of biogas residue are estimated with a confidence level of 90%.

The sampling plan will be established at the beginning of the year by Local energy office, according to which 327 households will be monitored. Each technician who gains the qualification would record and report the monitoring data every month to principals who gather and report the data to Local energy office. After these, Local energy office would store the data. The general principle is that zero value will be used for the missing or damaged data. This is most conservative approach.

Parameter	QA/QC
N_d	The unique serial number was given to every biogas system of rural household, and the relevant information of biogas systems such as name, location, serial number, as well the date of building digester was put on record in the local energy office. The technician of every village would take casual inspection to the rural households which belong to the project activity, in the event of either the biogas digester or biogas stove in the biogas system was disused, the reason will be written down clearly and reported to the local energy office immediately. The biogas systems including the biogas digester and the biogas stoves will be checked and running number recorded for the review. Local energy office

	recorded it in the file of rural household and verified it.
$H_{digester}$	It is monitored by farmers in which the stoppage periods for maintenance and extraction residue will be deducted. The technician will check the data and sign for confirmation.
$N_{LT, y}$	The technician would monitor the data by investigating and counting the number of poultry in stock. The technician will check the data and sign for confirmation.
H_{stove}	Monitor the operating hours of the stoves in the selected households (H_{stove}); The operating hours of the stoves will be conducted and daily recorded on the stove operation record table by each household user that the stove is switched on or off. And the data can be determined on the selected sample household user and summarized, analyzed and archived annually by the local energy office. The sample size will reach above 327 households and account will be taken of possible stratification of the sampled population ensure the precision and confidence. In addition, a default conservative value may be assigned for the households where the survey results are deemed unreliable.
T	Achieved from local Meteorological Bureau
MCF_j	Published data by IPCC Guidelines for National Greenhouse Gas Inventories.
$EF_{FF,CO2}$	The data is source from National Development and Reform Commission.
Application of sludge	The technicians are in charge of treatment of methane manure, each time they will record the exact methods of treatment and will do random checks to ensure the treatment is reasonable and correct. The final sludge will be used for soil application. The proper soil application of the final sludge shall be recorded on a sampling basis and reported to Local energy office.
The amount of manure fed into the digester**($MS\%_{i,y}$)**	Because the biogas digester was built under the pigpen, the pigs are kept in a confined area and do not leave the area in project scenario, all animal manure generated would fed in to the biogas digester, the percentage manure would be 100% .And the technicians will do random checks to ensure the manure is consistent with the capacity of the digester.

3.1 All the investigators and technicians must acquire the relevant training (data collection, data analysis. Before starting work, they had taken the training of professional knowledge and GS knowledge, acquired the work permit. In addition, the staffs of local statistical bureau were invited to make professional training of investigation to the staffs and technicians of energy office every year.

3.2 After confirming the sample box peasant households, the principals of Local energy office and village committee organized all the sampled peasant households to hold a meeting, make sure of their cooperation.

3.3 All the survey forms were sent to every sampled peasant household at the beginning of every year, the technicians collected the forms at the ending of every year and kept them in the energy office. The sampled peasant households were renewed every year.

3.4 All the monitoring data of the project activity was kept as electronic form and paper version in the Local energy office and all the date must be kept in the whole crediting period and the next 2 years, as well regular verification.

4. Training

4.1 Training purpose and object.

All the investigators and technicians must acquire the relevant training (data collection, data analysis). Before starting work, they had taken the training of professional knowledge and GS knowledge, acquired the work permit. In addition, the staffs of local statistical bureau were invited to make professional

training of investigation to the staffs and technicians of energy office every year.
After the trainings the technicians will obtain the necessary knowledge about digester maintenance; familiarize themselves with the digester operation principles; master the cause of malfunction and how to handle, moreover they can obtain some basic knowledge about GS, sampling method and how to monitor the data. All the technicians will be trained and the training records would be kept.
According to the monitoring plan, some parameters are suggested to be monitored by the farmers. The farmers will be trained for the competence of carrying out the monitoring plan, such as how to deal with the sludge, the usage method of digester and biogas stove and record/monitor method, etc.

4.2 Training plan and method
The technicians in each village will be trained with the knowledge of digester usage under the organization of the Energy Office. There are trainings at any time from Guizhou Honor Carbon Asset Management Co., Ltd in order to improve the professional knowledge of monitoring for the technicians, and the training plan will be made before the verification of the project. The technicians in each village will teach the farmers how to maintain and operate the digesters effectively, as well as how to record the monitoring data.

5. Sampling plan:

5.1 Sampling Design：

- **Objectives and Reliability Requirements**

This sampling plan is for 15,555 Rural Methane Digesters Project. The project had installed household biogas digesters with the same type, same category and same technology. After construction, biogas digesters generate methane which displaces coal consumption for cooking. There are several parameters to be sampled as shown in Section B.7.1.The parameters are sampled and determined according to the "*Guidelines for sampling and survey for CDM project activities and programmed of activities" Version 02.0*during the crediting period, and with a 90/10 confidence/precision.

- **Target Population**

From the description, the target population is the related 15,555 households with operating biogas digesters. Because this is a verification sampling, the sampling frame is the same as the population.

Table1． The number of biogas system in each town

Town	Number
Sanjiang	479
Dazhi Po	819
Chengxi	513
Longqiao	450
Xinpo	973
Zuntan	1,147
Longquan	1,288
Longtang	1,042
Yun Long	923
Hongqi	1,351
SanmenPo	933

Dapo	857
Jiazi	1,592
Jiuzhou	468
Changliu	129
Xi Xiu	120
Haixiu	110
Shishan	147
Yongxing	105
Dongshan	2,109

- **Sample Method.**

Because the biogas digester of peasant households is numerous and scattered, the type and utilized technology of methane tanks are identical, stratified random sampling is adopted in order that each one can be selected with equal probability. The strata should be mutually exclusive: every element in the population must be assigned to only one stratum. The stratification requires that information on the stratification variable, e.g. survey sample household will be change once per year. Simple random sampling method will be taken in each stratum by using Microsoft Excel.

- **Sample Size.**

Step1: $n_1 = \frac{Z^2\sigma^2}{d^2}$

Where:

Z: the symbol used in general formula for confidence intervals. The Validation Team confirms it is to be 1.645 when confidence interval is 90%;

σ: the population standard deviation, which is not available to PP.

d: the maxim error of estimate.

Step2: Deformation of basic formula

$$n_1 = \frac{Z^2\sigma^2}{d^2} = \frac{Z^2\left(\sigma^2 / X^2\right)}{d^2 / X^2} = Z^2V^2/e^2$$

Where:

V, the coefficient of variation, and V= σ /X. As population standard deviation σ shall be smaller than the sample mean value X, hence from conservative consideration point of view, making V=1 can get the biggest sample size. It is conservative.

e: the relative sampling error, and e=d/X, which is the precision. In this case, e=10% as discussed above.

Consequently, $n1=Z^2V^2/e^2 = 1.645^2/0.1^2 = 270.6$, and round up to be 271.

Step3: Correction based on population size

$$n_2 = \frac{n_1 N}{n_1 + N}$$

Where:

N, the population size, it is 1 under project context.

Consequently

n2=n1*N/(n1+N)=271*15,555/(271+15,555)=266.3 and round up to be 267 , it take n_2=267 is preferable.

Step4: Correction based on sampling approach

$$n_3 = Bn_2$$

Where:
B,thesurvey design effect. As discussed in **Procedures for Administering Data Collection and Minimizing Non-Sampling Errors.** The project adopts multi-stage sampling approach.
In this case,B≤1 as per Sampling Design and Methodology. It's conservative consideration.
Consequently, n_3=B*n_2=1*n_2=267
Step5: Correction based on responding rate

$$n_4 = \frac{n_3}{r}$$

Where:
The responding rate is adopted to be less 90% according to investigation report.
Consequently, n_4=n_3/r=267/90%=296.66, and round up to be 297.

Step6: Correction based on contingency consideration

$$n = 110\% n_4$$

Where:
Consequently, the sample size n=110%*n_4=110%*297=326.7, round up to be 327.

- **Sampling Frame.**

In the investigation, sampling frame is worked out independently by taking town as sampling unit. Sampled group will be changed in each monitoring period. Firstly, calculate the ratio of every administrative town peasant household in the whole project. According to the ratio of every town, calculate the sampling size of every town, and then set the amount of sampling 327households, the actual sampling size is the ratio of every town multiply by 327.

Table2:The number of biogas system in each town

Town	Number	Portion	Number
Sanjiang	479	3.08%	10
Dazhi Po	819	5.27%	17
Chengxi	513	3.30%	11
Longqiao	450	2.89%	9
Xinpo	973	6.26%	20
Zuntan	1,147	7.37%	24
Longquan	1,288	8.28%	27
Longtang	1,042	6.70%	22
Yun Long	923	5.93%	19
Hongqi	1,351	8.69%	28
SanmenPo	933	6.00%	20
Dapo	857	5.51%	18
Jia Zi	1,592	10.23%	33
Jiuzhou	468	3.01%	10
Changliu	129	0.83%	3
Xi Xiu	120	0.77%	3
Haixiu	110	0.71%	2
Shishan	147	0.95%	3
Yongxing	105	0.68%	2

Dongshan	2,109	13.56%	44
Toal	15,555	100%	327

5.2 Data to be collected

- **Field Measurement**

The variables to be monitoring: the annual operating hours of the biogas systems, the pigs of each household bred, the daily hours of operation of biogas stoves, the proper application of biogas residue and the amount manure generated by swine and fed into the digester. Each sampling household will receive a unique monitoring sheet. The local technician will arrive at the households monthly to record the number of pigs and usage information of methane digester. Besides, once anything irregular occur at the methane digester, the households would immediately call for the technician to come deal with it and record the reason and the time paused. All these data will be listed to Excel version by this local energy Office. These data will be filled in the monitoring sheet (See Annex 4) by the drawn sample farmers according to their actual situation. The averages will be calculated including average quantity of the pigs, average the daily operating time of the stove, and average annual running hours of each biogas digester.

Before the formal operation of the project, the leaders in charge of GS will organize the relevant investigators and supervisors to accept formal training on GS and sampling investigation method. Each town principals should spot-check each sample farmers periodically. To ensure the reality of data, the sampling data of that month should be collected, checked and signed to be archived at the end of each month.

- **Quality Assurance/Quality Control**

According to "*Guidelines for sampling and survey for CDM project activities and programmed of activities" Version 03.0,* it adopts 90/10 confidence /precision as the criteria for reliability of sampling efforts and mean value as parameter of interest for the project activities and have considered expected variance for that measure in the sample based on results from similar studies.
On the basis of actual sampling size in the Table 2, taking sampling households randomly from every town .Renew the sampling box every monitoring period by method mentioned.
The survey forms will be uniform formulated by Local energy office, and they will be sent to every sampled peasant household, train all the certified technicians.
Every technician surveys the sampled peasant households fill in the date and signature seasonally, the survey forms will be collected by energy office, and energy office will summarize and keep the survey forms.

- **Data Analysis**

The primary data of surveys were collected and used to calculate GHG emission reductions.

6、Implementation:

In order to ensure that the sampling investigation was fair and avoid beneficial conflict, the GS monitoring team and local coordinators will implement the sampling investigation strictly follow the guidance , the sampling work will be conducted by the person with no interest in the project, i.e the sampling person should exclude the biogas digester users. The monitoring team and local coordinators such as technicians who participate in the sampling investigation will strictly enforce the guidance and the sampling work and will not involve distribution of interests in the project.

This sampling process will be carried out by Local energy office. They have received the professional sampling training. After finish sampling, they have to sign the name on the sampling paper. Once the sampling household is determined, the technicians would hand out the monitoring sheets to the households listed in the sample. Then the result of questionnaires/monitoring sheets will be recorded and checked monthly by the technicians. After the technicians will report the results to the Local energy office every year, the Local energy office will type and summarize the data. Finally the averages will be got out to verify the Emission Reductions of the project activity. The sampling box will be updated each year.

B.7.3. Other elements of monitoring plan
>>
NA

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity
>>

04/03/2009(The date of the project construction start)

C.1.2. Expected operational lifetime of project activity
>>
15 years

C.2. Crediting period of project activity
C.2.1. Type of crediting period
>>
Fixed crediting period.

C.2.2. Start date of crediting period
>>
01/01/2012

C.2.3. Length of crediting period
>>
10 years

SECTION D. Environmental impacts
D.1. Analysis of environmental impacts
>>

In accordance with national environmental protection laws, such a Project needs not to do an environmental impact assessment.

Considering that the project has a positive impact to the local ecology and social environment, and the wide distribution and small engineering quantity of the methane digester, after coordination with the DRC of Hainan Province, the project construction has been approved.

The propose project checked by the examining committee of Hainan environmental protection, which was approved to construction.

SECTION E. Local stakeholder consultation
E.1. Solicitation of comments from local stakeholders
>>

On 15/09/2008, a meeting was held at Local energy office, where local stakeholders such as officers from Haikou Government, energy office and each village committee representative attended. In the meeting the GS knowledge has been introduced. On 10/10/2008, a meeting was held at village committee office, where local stakeholders of farmer representative attended. Moreover, to push the project ahead, and in order to know the public's opinions and suggestions about the proposed project, the format of the public participation is to hand out the questionnaires of the public opinions on the project 10/2008 by the households. The participant who was invited for the survey is people living in the area where the project locates. The survey was carried out by distributing and collecting questionnaires.15,555 biogas households located in 20 towns of Haikou City were chosen, then, several towns were invited to take part in the survey. The questionnaires for stakeholders' opinion were distributed to 8-10 random households in several villages. During the meeting and the survey, it has showed that all involved households and related stakeholders are positive to the project activity and would like to contribute to its construction.

E.2. Summary of comments received
>>

In order to know the public's opinions and suggestions about the project, 5 townships in the propose project were selected in random to take part in the consultations. 50 questionnaires were distributed to the local people, and 50 questionnaires had been returned. The response rate is 100%. Comments from these questionnaires for local people are summarized in this table.

No.	Item	Choice	Numbers(persons)	share（%）
1	Do you know the project	Yes	43	86
		Be aware of	7	14
		No	0	0
2	Would you like to participate in the construction and operation works of the project?	Yes	44	88
		Unconcern	5	10
		No	0	0
3	What benefits will be brought by the project?	To change energy structure, replace firewood	24	48
		GHG emission reductions	0	0
		To improve living conditions	26	52
4	Will the project bring positive impacts to economy development?	Yes	49	98
		Unknown	1	2
		No	0	0
5	Will the project be beneficial to local job opportunities?	Yes	48	96
		Unknown	2	4
		No	0	0
6	What's your attitude about the project's impacts to local environment and ecology?	Positive	50	100
		No impact	0	0
		Negative	0	0

7	What's your attitude about the project's impacts to local resident's daily life?	Positive	48	96
		No impact	2	4
		Negative	0	0
8	Do you support the construction of the project?	Yes	47	94
		Unconcern	3	6
		No	0	0
9	Do you support the project to be a GS project?	Yes	42	84
		Unconcern	8	16
		No	0	0

The result of this investigation shows that 90% of the public people thought that the advantage was bigger than the disadvantage of the project. Therefore, the local people supported the construction and operation of the project, which had positive meaning for local economy development. They also had a positive and optimistic attitude for the environmental impacts caused by the construction of the project. The public generally hope that the project will start as soon as possible in order to spur local economic development, increase incomes and social benefits.

E.3. Report on consideration of comments received
>>

The project owner will pay much attention to the comments and suggestions of the public. During the construction period and operation period of the project, the households will try his best to make sure that all the measures and funds should be put into effect, and strengthen the environmental management, environmental monitoring and on-site supervision and law enforcement to make sure the environmental quality can reach the quality standard and the related requirement.

- - - - -

Appendix 1: Contact information of project participants

Organization	Guizhou Honor Carbon Asset Management Co.,Ltd
Street/P.O.Box	F8 550081, ,China
Building	Keji Building A, Jingyang Knowledge Economic Industrial Zone
City	Guiyang City
State/Region	Guizhou Province
Postcode	550081
Country	P.R.China
Telephone	+86-851-7990160
Fax	+86-851-5518715
E-mail	hycdm@vip.163.com
Website	
Contact person	Wang Can
Title	Manager
Salutation	Ms.
Last name	Wang
Middle name	-
First name	Can
Department	-
Mobile	+86-851-7990160
Direct fax	+86-851-5518715
Direct tel.	+86-851-7990160
Personal e-mail	hycdm@vip.163.com

Appendix 2: Affirmation regarding public funding

There is no public funding from Annex I Parties for the Project.

Appendix 3: Applicability of selected methodology

The applicability of the selected methodology is described in B.2.

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

NA

Appendix 5: Further background information on monitoring plan

No further background information on monitoring plan.

Appendix 6: Summary of post registration changes

NA

- - - - -

History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
03	EB 28, Annex 34 15 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02	EB 20, Annex 14 08 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01	EB 07, Annex 05 21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		