FY2009 CDM/JI Feasibility Study Report Summary

Title

Eco-Farming Biogas Digestor CDM Project under the PoA in Yunnan Province China

Name of the Responsible Company

E&E Solutions Inc.

Organization Structure for the Study

- E&E Solutions Inc.(EES)：Japanese consultant which conduct this Study.
- Xuanwei agriculture bureau；Project implementator
- Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd; Counter Part Company in this project in China Candidate company for CME（Coordinating/managing entity）
- Tepia Corporation Japan Co., Ltd：Project participant of Japan side.

1. Outline of the Project

In the proposed CDM project, the biogas digesters for swine manure will be installed for the 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 project, shall be recovered and utilized for cooking and other purposes by combusting the recovered methane. The fossil fuel(coal) currently used to meet the household's daily energy needs will be replaced by using methane as an energy source. Consequently, the greenhouse gas (GHG) emission will be reduced drastically.-

In addition, air pollution substances including CO and SOx caused by coal combustion in the room for cooking will also be reduced.

Although the two thirds (2/3) of the installation cost is subsidized by China government to enhance the distribution of the biogas digeste, the installation cost of biogas digester is still expensive for poor households even considering the financial support. Adequate technical support on the maintenance of the biogas digester is also be expected.

The proposed project was planned employing programmatic CDM scheme to resolve these problems. Yunnan Sun Valley Energy Conservation Industry Development Co., will be CME (Coordinator and Management Entity) of the proposed PoA (programme of Activity) . For each programme activities (CPA: CDM programme activity) under the proposed PoA, the Rural Energy and Environmental Office within the jurisdiction of Agricultural Bureau of the municipal government will be the implementer/Project Participants.

The target farmers/households 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. By means of methane collection and the replacement of coal, annual GHG emission reduction is supposed to be 3.57 tons per household, and, total potential reduction through the whole CPA is

evaluated as 360,000t-CO_2e.

Methodology Applied

Small Scale CDM methodology AMS III.R and AMSI.C

2. Contents of the Study

(1) Major issues to be studied

Following study was conducted in this Feasibility Study.

1) Study on the effective Supporting Scheme to disseminate the biogas digester : Originally, the biogas digester was developed as the poverty alleviation measure. However, due to it's expensive cost for installation, only relatively rich households can introduce it but not for poor households which is the original target of the biogas digester. As the main purpose of this CDM project is to enhance the dissemination of the digester to the poverty group using CDM scheme, effective Supporting Scheme to disseminate the biogas digester should be studied/constructed in this project. Present condition of the biogas digester dissemination, specification of the target households, measure to construct the effective supporting scheme should also be discussed in this study.
2) Identification of the Baseline scenario and project boundary ; Baseline methodology AMS III-R, which is the methodology to be employed to the project, requests to determine the amount of waste or raw materials that would decay anaerobically in the absence of the project activity with a confidence level of 95% by survey of a sample group of households/small farms. So that, adequate survey method/sampling plan should be studied in the feasibility study.
3) Development of the Monitoring Plan : As the target farms are dispersed and numerous, it is necessary to develop effective monitoring plan to monitor the emission reduction of each farms. Also, To evaluate the energy consumption for each farm with high reliability, adequate sampling method should be developed based on the requirement of AMS-I.C.
4) Discussion on the project implementation: Project implementation plan ,including schedule, role of each project participants, burden of the expenses etc. organization and project benchmark should be discussed in the study.
5) Environmental Impact Assessment and Stakeholder consultation; Environmental impact assessment and stakeholder consultation should be conducted during the Feasibility Study.

(2) Study Contents and Methods

(a)Pre-Survey

Data/Information on Energy strategy, Present Status of the waste energy utilization, Energy saving, Waste management policy in China and Yunnan province was conducted from internet and existing document. Law and regulation regarding animal waste management and environment management were also be collected.

In addition, questionnaire was prepared and sent to counter part organization in China to collect/clarify of the unclear issues.

(b)On-site Survey

Based on the result of above mentioned study (a), necessary information for following study (i.e., (c)～(j)) was collected during the on-site survey. The basic structure and time schedule of the CDM project also be discussed with counter part organizations during the on-site survey.

1st site survey was conducted from Oct.11 to Oct.17of 2009.

Kick off meeting with Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd; was hold at the 1st site survey. Work plan for this Feasibility Study and the role of each side was discussed and agreed. The basic condition and concept on transaction of CER from China to Japan was also be discussed in this meeting.

The only one existing ammonia manufactory in Yunnan province which install the Bio Digester was inspected by study team. Discussion with Xuanwei agriculture bureau (Project implementator) was held during the 1st site-survey and it is confirmed if the necessary requirement for CDM is satisfied. Detail of the plan for Bio Digester introduction was also be confirmed.

2nd site survey was conducted from Dec.13 to Dec.19of 2009.

During the 2nd site survey, stakeholder consultation was held in the project site. Comment of the stakeholder regarding the CDM project was collected and discussed. In addition, detailed information on Bio Digester was collected in the 2nd site survey. Action plan after the Feasibility study was also be discussed.

(c) Study on the Project boundary and Baseline scenario

In accordance with the guideline namely " Guidance on the registration of project activities under a programme of activities as a single CDM project activity ", baseline scenario of the CDM project was studied. Project boundary was also be established based on the guideline .

Beside, additionality of the project was proved in accordance with Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

(d) Study on the Monitoring method

In accordance with the Methodology AMS-III.R and AMS-I.C, monitoring plan which can be adopted to the project was developed.

According to the methodology AMS-III.R, sampling method can be employed only when the emission reduction is less than 5t-CO2e/year per system. As the ex-ante estimation of the emission reduction was less than 5t-CO2e/year per system. Sampling method can be employed in this project. Effective sampling method was studied and established in the study and discussed the implementation method with the counter part organizations.

(e)Study on Project period and Crediting Period

Study team discussed the project period and crediting period of the CDM project with Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd which will become CME

(Coordinating Managing Entity) of the project.

As this project will be programmatic CDM, the duration of PoA (Programme of Activities) will be 28 years at maximum. Crediting period of each CDM Program Activity (CPA) which will conducted unther the PoA will be10years in this project.

(f)Evaluation of the Emission Reduction of the Project

Emission reduction of the first CPA was evaluated based on the small scale methodology of AMSII.D. Total potential emission reduction in whole Yunnan province was also be evaluated in this study.

(g)Study on Environmental Impact of the Project

Laws and regulations which can be applied to the project were listed and studied. It is found that the environmental assessment law is applied to the project. Both negative and positive environmental impact of the project was studied and listed.

(h)Other Indirect Impact

Indirect impacts other than environmental issue, including social and economical issues were discussed and studied.

(i)Stakeholder's comment

Stakeholder meeting was held in this study and comment on the project was collected. In addition, interview and questionnaire survey also be conducted.

(j)Study on Cash planning

Financial issue and Cash planning of the project was discussed with Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd which will become CME (Coordinating Managing Entity) of the project.

(k)Praparation of PDD

Based on the study above mentioned (i.e.,(a)～(j), PDD (including PoA-DD and CPA-DD) was prepared.

Approved small scale methodology AMSII.D was employed for the PDD.

(n)Study on Co-benefit effect

Co-benefit effect of the project is evaluated in the study. Emission reduction of SO2 was selected as an index of the co-benefit effect.

3. Study Results

(1) Baseline scenario and Project boundary.

Geographic reference or other means of identification , 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.

Also the CPA included in the project boundary should satisfy following requirements

- The CPA is implemented in Yunnan Province, China.

- The CME of the proposed PoA is SVEC and the each REEO, the implementer of the CPA has an exclusive agreement with SVEC on PoA development.
- The CPA will install a new biogas digester for each household.
- All the farmers included in the CPAs must meet the key criteria for demonstrating additionality of CPA as indicated in E.5 of this PoA-DD.
- The farmers enrolled in CPA must breed at least 4 pigs.
- The design of the biogas digesters is to be based on the technical standards established by Chinese government.
- The CPA should apply the same technology as well as the baseline and monitoring methodology, AMS I.C. and AMS III.R as all the other CPAs in the PoA do. Versions of the baseline and monitoring methodology may be changed according to most recent guidance provided by the CDM Executive Board.

(2) Evaluation of the Emission Reduction

Emission Reduction of the project was evaluated based on the following method.

Baseline Emission

(a) CH4 emission from manure management

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.

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

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 4.
MS	Fraction of swine manure handled using manure management system. In this project, 100 percent of manure is stored in deep pit.

Calculation of baseline CH4 emission from manure management for each household

Baseline CH4 emission can be calculated based on equation:

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

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

(b) Baseline CO_2 emission from the coal consumption

According to the methodology AMS-I.C. (version.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%.

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

$$BE_{y,household} = BE_{CH4,household} + BE_{CO2,household}$$

Where,

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

(d) Total baseline GHG emission of CPA

Total baseline GHG emission of CPA can be calculated based on following equation

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

Where,

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

Project Emission

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

(a) CH4 emission from biogas digester

The CH4 emission from biogas digester is calculated using following equation:

$$PE_{CH4,household} = LF_{AD}\left[GWP_{CH4} \times D_{CH4} \times B_o \times VS_{m,y}\right] + 1000$$

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)

(b) 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.

(c) Project GHG emission calculation for each household

GHG emission for each household under the project activity can be calculated based on following equation;

$$PE_{y,household} = PE_{CH4,household} + PE_{CO2,household}$$

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

(d) Total project GHG emission of CPA

Total project GHG emission of CPA can be calculated based on following equation

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

Where,

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

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.

Total CPA GHG emission

Calculation of total CPA GHG emission reductions can be use following equation

$$ER_y = BE_y - PE_y - LE_y$$

Based on the methodology mentioned above, the emission reduction per household is evaluated as 3.57t-CO_2/year. For 2,000 households, total emission reduction will be 7,137 t-CO_2/year.

(3) Monitoring Plan

The monitoring plan is provided as follows.

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.

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

Where:

n	Numbers of households to make questionnaire surveys with random sampling method;
μ (α)	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.

Following paremeters will be monitored.

- Number of house hold which bio-digester install BDN
- Annual Coal consumption in the farm after the installation of the bio-digester
  PG_{coal} : Sampling method
- Net Caloric Value of the Coal $CV_{Rawcoal}$: NDRC standard value(check & Reviewed every year)
- Annual Working hours of the bio-digester H: Sampling methods
- Air temperature of the project site T : Public data
- Average Pig number in the farm SP : Based on the report of the farm
- Total volume of the volatile solid VS : to be calculated based on SP
- Sludge removal and treatment : Confirm to be treated under aerobic condition

(4) Calculated emission Reduction

Calculated emission reduction are shown in following table.

Year	Project Emission ($t\text{-}CO_{2e}$)	Baseline Emission ($t\text{-}CO_{2e}$)	Leakage ($t\text{-}CO_{2e}$)	Emission Reduction ($t\text{-}CO_{2e}$)
2010	8,322	15,459	0	7,137
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
Total (tonnes of CO_2e)	83,220	154,590	0	71,370

(5) Project Period

Default period of the PoA will 28years. CPA crediting period will be 10years .

Project period will be set as 15years considering the expected lifetime of the facilities.

The contract of the construction will be entered by end of March 2010 at earliest and the contract date will be the start date of the project.

(6) Environmental Impact

No negative environmental impact will be caused by the project.

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

(7) Stakeholder Comment

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.

(8) Project Organization

PoA Coordinating or Managing Entity (CME): CME of the proposed PoA is Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd (hereafter refereed as SVEC). SVEC, a leading private company providing in various energy saving services in cooperation with the local authorities on industrial and agricultural energy management, as the PoA coordinator, will organize and supervise the whole PoA and is also responsible for the management of each CPA's application, data monitor, calculation of GHG emission reduction, and it will also take charge of necessary communication with the UNFCCC and DOE.

Implementer of CPAs under the proposed PoA (Implementer): The Rural Energy and Environmental Office (hereafter referred as REEO) within the jurisdiction of Agricultural Bureau of the municipal government in the targeted County or City of the Province is to be the implementer of the CPAs under the proposed PoA. REEO, as a CPA implementer will be responsible for monitoring the necessary data to calculate the amount of GHG emission reduction and submit to CME.

(9) Project cost and fainancial plan

According to the estimation of the Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd; Total Initial cost for the Peoject will be, 7,620,000Yen, of them 1/3 will be subsidized by province and country.

(10) Additionality

(a) 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. 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. 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.

(b) 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.

(c) 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. 1 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.

(12) Possibility of the realize of the project

During the Study period, Xuanwei agriculture bureau, which will be a Project implementator, and Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd;, which will be a CME of the proposed project, subscribed "Agreement on the CDM implementation" of this project. This agreement clearly specifies about the exclusive implementation between two parties. Many farm in Yunnan province also show the interesting in the project. So that the possibility to materialize this project seems high.

Beside, Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd has acquired the license for the finance business for the farms and is inducing the farms to attend the project scheme.

The most critical issue of the proposed project is the financial sustainability of the project.
Small interest charge and CER from the farms is only income of the project so that the profitability of this project is low .
Although Yunnan Sun Valley Energy Conservation Industry Development Co., Ltd does not expect to get financial benefit but to expect future customer retention, low profitability of the project can affect the sustainability of the project.
Strengthening method on the financial side should be discussed before starting the CDM project.

4. Study on the Co-benefit effect

(1) Envaironmental effect in the Host countary

(a) Target Items

・SO_x Emission

(b) Baseline scenario

General Coal is used as a fuel for cooking and heating in the farms in Yunnan province.
Project scenario：

[1] China Energy Statistical Yearbook 2008

In the project scenario Biogas (Methane) will be used as a fuel for cooking and heating in the farms and coal consumption in the farm will be reduced.

(c) Beseline emission

①SOx emission

Baesline emission of SOx is calculated based on the following equation.：

$BE_{SOx,y} = CC_{BL,y} * CR_{S,fuel}/100*64/32$

Where

$BE_{SOx,y}$：Baseline Sox generation in year y (t/y)

$CC_{BL,y}$：Coal consumption in the Baseline scenario in year y (t/y)

$CR_{S,fuel}$：Sulfa concentration in the coal (%)　（In Yunnan：3.09%）

Following equation is employed for Ex-ante estimation.

$CC_{BL,y}= (MP_{digester}*Q_{CH4}*\eta_{gas})/(Q_{coal}*\eta_{BL,coal})$

Where

$MP_{digester}$：Annual Methane generation from Biogas-Digester for one system($kgCH_4/y$)

Q_{CH4}：Calorific value of Methane（=50MJ/kg、IPCC Deafault Value）

η_{gas}：Energy efficiency of the Biogas stove

Q_{coal}: Calorific value of coal（=20.90MJ/kg、IPCC Deafault Value）

$\eta_{BL,coal}$：Energy efficiency of the Cole stove

Also

$MP_{digester}= V_S*365*Bo*D_{CH4}*SP*90\%$

Where

V_S：Manure generation from pig（=0.3kg dry matter/animal/day、IPCC）

B_o: Methane generation potential from manure（=0.29m3CH4/dmVS、IPCC）

D_{CH4}：Methane density（=0.67kg/m3、IPCC）

SP：Pig number before the installation of the digester

(d) Project Emission

①SOx emission

SOx emission in the project is set as zero (0).

(e)Ex-anteCaclulation of the Emission Reduction

①SOx emission Reduction

SOx emission Reduction for one digester system is calculated as 52.5kgSO2/year and the total reduction in the project site is evaluated 105tSO2 assuming 2,000 households.

(f) Monitoring Method

①SOx emission

Following parameters will be monitored by survey method.

- Annual coal consumption in the households before the project.
- Annual coal consumption in the households after the project.
- Annual working hours of the biogas Digester
- Annual working hours of the biogas stove

5. Study on the Sustainable Development

N/A

○ 経済性分析に関する添付資料

投資分析 (CERなし) Biodigestor

Table 1. P/L (PJ without CDM)

No.	Item	Unit	Sum	Construction	Project-1	Project-2	Project-3	Project-4	Project-5	Project-6	Project-7	Project-8	Project-9	Project-10	Project-11	Project-12	Project-13	Project-14	Project-15
				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Total revenue	RMB	10,185		679	679	679	679	679	679	679	679	679	679	679	679	679	679	679
1.1	Coal savings	RMB	10,185		679	679	679	679	679	679	679	679	679	679	679	679	679	679	679
1.2	CER revenue	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.1	VAT	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	Urban construction tax and education surtax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Total O&M cost	RMB	2,400		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
3.1	Labor cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2	Administration cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3	Biogas treatment cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4	Operational cost	RMB	2,400		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
3.5	Electricity cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.6	Water cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Depreciation cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Capital cost and interest	RMB	495		99	99	99	99	99	0	0	0	0	0	0	0	0	0	0
6	Profit before tax	RMB	7,290		420	420	420	420	420	519	519	519	519	519	519	519	519	519	519
7	Corporate tax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Profit after tax	RMB	7,290		420	420	420	420	420	519	519	519	519	519	519	519	519	519	519

Table 2. C/F (PJ without CDM)

No.	Item	Unit	Sum	Construction	Project-1	Project-2	Project-3	Project-4	Project-5	Project-6	Project-7	Project-8	Project-9	Project-10	Project-11	Project-12	Project-13	Project-14	Project-15
				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Inflow	RMB	11,835	1,650	679	679	679	679	679	679	679	679	679	679	679	679	679	679	679
1.1	Total revenue	RMB	10,185	0	679	679	679	679	679	679	679	679	679	679	679	679	679	679	679
1.2	Return of working capital	RMB	0																0
1.3	Return of salvage value	RMB	0																0
2	Outflow	RMB	10,895	8,000	259	259	259	259	259	160	160	160	160	160	160	160	160	160	160
2.1	Capital investment	RMB	8,000	8,000															
2.2	Working capital	RMB	0	0															
2.3	VAT	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	Total O&M cost	RMB	2,895		259	259	259	259	259	160	160	160	160	160	160	160	160	160	160
2.5	Urban construction tax and education surtax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.6	Corporate tax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.7	Others	RMB	0																
3	Cash inflow after tax	RMB	940	-6,350	420	420	420	420	420	519	519	519	519	519	519	519	519	519	519
4	Cumulative cash flow after tax	RMB	-45,265	-6,350	-5,930	-5,510	-5,090	-4,670	-4,250	-3,731	-3,212	-2,693	-2,174	-1,655	-1,136	-617	-98	421	940
5	Cash inflow before tax	RMB	940	-6,350	420	420	420	420	420	519	519	519	519	519	519	519	519	519	519
6	Cumulative cash flow before tax	RMB	-45,755	-6,350	-5,930	-5,510	-5,090	-4,670	-4,250	-3,731	-3,212	-2,693	-2,174	-1,655	-1,136	-617	-98	421	940
	Index							**After tax**			**Before tax**								
				IRR				**1.70%**			**1.70%**								

投資分析（CERあり） Biodigestor

Table 1. P/L (PJ with CDM)

No.	Item	Unit	Sum	Construction	Project-1	Project-2	Project-3	Project-4	Project-5	Project-6	Project-7	Project-8	Project-9	Project-10	Project-11	Project-12	Project-13	Project-14	Project-15
				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Total revenue	RMB	11,785		839	839	839	839	839	839	839	839	839	839	679	679	679	679	679
1.1	Coal savings	RMB	10,185		679	679	679	679	679	679	679	679	679	679	679	679	679	679	679
1.2	CER revenue	RMB	1,600		160	160	160	160	160	160	160	160	160	160	0	0	0	0	0
2.1	VAT	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.2	Urban construction tax and education surtax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Total O&M cost	RMB	2,400		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
3.1	Labor cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.2	Administration cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.3	Biogas treatment cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.4	Operational cost	RMB	2,400		160	160	160	160	160	160	160	160	160	160	160	160	160	160	160
3.5	Electricity cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.6	Water cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Depreciation cost	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Capital cost and interest	RMB	495		99	99	99	99	99	0	0	0	0	0	0	0	0	0	0
6	Profit before tax	RMB	8,890		580	580	580	580	580	679	679	679	679	679	519	519	519	519	519
7	Corporate tax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Profit after tax	RMB	8,890		580	580	580	580	580	679	679	679	679	679	519	519	519	519	519

Table 2. C/F (PJ with CDM)

No.	Item	Unit	Sum	Construction	Project-1	Project-2	Project-3	Project-4	Project-5	Project-6	Project-7	Project-8	Project-9	Project-10	Project-11	Project-12	Project-13	Project-14	Project-15
				2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	Inflow	RMB	13,435	1,650	839	839	839	839	839	839	839	839	839	839	679	679	679	679	679
1.1	Total revenue	RMB	11,785	0	839	839	839	839	839	839	839	839	839	839	679	679	679	679	679
1.2	Return of working capital	RMB	0																0
1.3	Return of salvage value	RMB	0																0
2	Outflow	RMB	10,895	8,000	259	259	259	259	259	160	160	160	160	160	160	160	160	160	160
2.1	Capital investment	RMB	8,000	8,000															
2.2	Working capital	RMB	0	0															
2.3	VAT	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.4	Total O&M cost	RMB	2,895		259	259	259	259	259	160	160	160	160	160	160	160	160	160	160
2.5	Urban construction tax and education surtax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.6	Corporate tax	RMB	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.7	Others	RMB	0																
3	Cash inflow after tax	RMB	2,540	-6,350	580	580	580	580	580	679	679	679	679	679	519	519	519	519	519
4	Cumulative cash flow after tax	RMB	-36,465	-6,350	-5,770	-5,190	-4,610	-4,030	-3,450	-2,771	-2,092	-1,413	-734	-55	464	983	1,502	2,021	2,540
5	Cash inflow before tax	RMB	2,540	-6,350	580	580	580	580	580	679	679	679	679	679	519	519	519	519	519
6	Cumulative cash flow before tax	RMB	-28,955	-6,350	-5,770	-5,190	-4,610	-4,030	-3,450	-2,771	-2,092	-1,413	-734	-55	464	983	1,502	2,021	2,540
	Index							**After tax**			**Before tax**								
				IRR				**4.63%**			**4.63%**								