FY2009 CDM/JI Feasibility Study (Digest Version)

Project Title

"CDM Feasibility Study on Biomass Cogeneration using Pelletized Agricultural Residues in Jiangsu, China"

Implementer

JAPAN NUS.Co.,Ltd.(hereinafter called JANUS)

Counterparts and their roles

1. Xuzhou Yifeng Sanpu Environmental Heat and Power Co, Ltd (Project Owner)
Provision of project information, collection of necessary information, preparation of "Biomass fuel collection, storage and consumption plan", preparation of monitoring plan, and establishment of monitoring system

2. Beijing CDM Science & Technology Consulting Company
Provision of support to JANUS in China, provision of technical support to the project owner, collection of basic information on CDM project, and preparation of Chinese PDD

3. CDM R&D Center of Tsinghua University
Collection of basic information, provision of technical support and CDM support to the project owner, and provision of support during field survey

1. Project description

The project plans to introduce 50MW Biomass Co-generation Plant to generate both heat and electricity using agricultural residues collected from surrounding farmlands. The project will install three 130t/h boilers, two 25MW steam turbines and two 30MW generators (total output: 50MW). Activities which will lead to reduction of GHG emission include replacement of grid electricity and utilization of agricultural residues currently being left to decay. The crediting period is 10 years (2012-2021) and the expected emission reduction is approximately 270,000tCO_2e/year.

The project will be implemented by the joint venture of Xuzhou Yifeng Sanpu Environmental Heat and Power Co, Ltd and the other investment partner. The consturction of the project is expected to start in 2010.

Applied Methodology

ACM0006 (Version 9) and ACM0002 (Version 10)

2. Content of Feasibility Study

(1) Subjects of study

(a) Determination of baseline scenario and project boundary

ACM0006 “Consolidated methodology for electricity generation from biomass residues”（Ver.09）provides 22 kinds of baseline scenarios. Applicability of scenario No.2 (replacement of grid electricity + replacement of coal-fired boilers + dumping and decay of biomass residues) is investigated. In particular, information on existing boilers needs to be collected in order to prove the baseline scenario of heat generation is heat generation using coal fired boilers.

(b) Estimation of GHG emission reduction

Project data and other published data of IPCC（Intergovernmental Panel on Climate Change）and Chinese Government are collected to estimate GHG emission reduction in accordance to ACM0006.

(c) Monitoring methodology and monitoring plan

Monitoring method, monitoring equipments and monitoring system for each monitoring parameter are discussed with the project owner.

(d) Environmental Impact

Anticipated environmental impacts of the project and their countermeasures are investigated based on the information in environmental impact assessment report.

(e) Stakeholder’s Comment

The project is introduced to the stakeholders and their comments on the project are collected.

(f) Economic Analysis

Based on the feasibility study report provided by the project owner, economic analysis of the project is carried out both as a CDM project and not as CDM project.

(g) Assessment and demonstration of additionality

Based on the feasibility study report and other additional information, investment analysis of the project is carried out to demonstrate the additionality. In addition, barrier analysis and common practice analysis are carried out.

(h) Financial Plan

Since the project will be implemented by a joint venture of Xuzhou Yifeng Sanpu Environmental Heat and Power Co, Ltd and the other investment partner, appropriate partner need to be found.

(i) Co-benefit

Co-benefit of the project is “Reduction of atmospheric pollution” and “Reduction of waste”. Data collection

and analysis is carried out to quantitatively evaluate those Co-benefits.

(2) Contents and results of survey

Contents and results of the survey for each survey subjects listed in previous section are summarized below.

(a) Determination of baseline scenario and project boundary

- In order to check the applicability of Scenario No.2 of ACM0006 (replacement of grid electricity + replacement of coal-fired boilers + dumping and decay of biomass residues) to the project, current situation of heat supply and disposal of biomass resudue were investigated.
- As a result of the investigation, it was concluded that the replacement of coal-fired boilers is not applicable as a baseline scenario. From our investigation, it was found that most of the coal-fired boilers have mandatorily been shut down by local government. Instead, heat supply by coal-fired cogeneration plant which is common practice around the project area was chosen as baseline scenario for heat supply.
- Through field investigation, it was confirmed that the biomas residues are left to decay beside the farmland thus it is applicable as the baseline scenario.

(b) Estimation of GHG emission reduction

- GHG emission reduction of the project was estimated using data in the feasibility study report and other data such as default values which are domestically and internationally acknowledged.
- Expected GHG emission reduction by the project is 274,584tCO_2e/year.

(c) Monitoring methodology and monitoring plan

- Availability of necessary monitoring equipment specified in ACM0006 was checked with the project owner. Installation of all necessary monitoring equipment has already been included in the project plan. Monitoring method and QA/QC of monitoring have been explained to the project owner.

(d) Environmental Impact

- Environmental impact assessment report was reviewed to investigate anticipated environmental impacts, laws and standards to be complied with, and countermeasure to reduce the impact.

(e) Stakeholder’s comment

- Hearing was carried out to farmers who will sell biomass residues to the project. Their comments were positive as the project will not only remove wastes from their farmland but also provide new income source.
- Official explanatory meeting of the project and formal comment collection will be conducted once the start of construction becomes clear.

(f) Economic Analysis

- Economic analysis of the project was carried out base on the data in the feasibility study report and additional information. Internal Rate of Return (IRR) of the project was calculated and the economic potential of the project both as CDM and not as CDM were evaluated.
- As a result, IRR of the project without CDM was 4.51% while IRR with CDM was 12.03% assuming that

the CER price was 9€/tCO_2e.

(g) Assessment and demonstration of additionality

- Investment analysis was carried out and it was found that IRR of the project without CDM was lower than 8% which is the benchmark for power generating project in China.
- Common practice analysis was carried out by studying prevalence of biomass power generation in Jiangsu province and in China based on published literature and registered CDM projects.

(h) Financial Plan

- The project was introduced to a few Japanese investors in order to find the investment partner.
- Comments and requests from the investors were delivered to the Xuzhou Yifeng Sanpu Environmental Heat and Power Co, Ltd and the terms of the contract have been under discussion.

(i) Co-benefit

- Quantitative analysis was carried out in accordance with "Co-benefit quantitative evaluation manual, Version. 1" (Japanese Ministry of Environment), using data from published literature and the feasibility study report.
- Evaluation result showed that the project will greatly contribute to reduction of SO_2 emission and agricultural wastes.

3. Feasibility Study Results

(1) Determination of baseline scenario and project boundary

ACM0006 "Consolidated methodology for electricity generation from biomass residues - Version 9"and ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources – Version 10" will be applied to the project. Study results of (a) Applicability, （b）Baseline Scenario, （c）Project Boundary and（d）Baseline Emission are summarized below.

(a) Applicability

ACM0006 is applicable to biomass residue fired electricity generation project activities, including cogeneration plants. The project activity may include the following activities or combination of these activities:

(1) Greenfield power projects；
(2) Power capacity expansion projects；
(3) Energy efficiency improvement projects;
(4) Fuel switch projects

The project is installation of new cogeneration plant, and thus corresponds to (1) Greenfield power projects.

The project must meet four conditions in Table 1 to apply ACM0006.

Table 1 Condition of application of ACM0006 and situation of the project

Condition of application	Situation of the project
No other biomass types than *biomass residues* are used in the project plant and these biomass residues are the predominant fuel used in the project plant (some fossil fuels may be co-fired).	Predominant fuels used by the proposed project are straws, and only fossil fuel used in the project is diesel for ignition.
For projects that use biomass residues from a production process, the implementation of the project shall not result in an increase of the processing capacity of raw input (e.g. sugar, rice, logs, etc.) or in other substantial changes (e.g. product change) in this process.	The straws used by the proposed project are byproducts of agriculture crops, not from a production process.
The biomass residues used by the project facility should not be stored for more than one year.	The storage time of the straws is not meant to surpass one year. According to the project owner's plan, the stored stalks will be controlled through implementation of the *First-in First-out* regulation, which means that the stalks entered the storage firstly would be preferentially used. Once straws are compressed into pellets at pellet production station, pellets will be stored for maximum 3 months at station. At the project site, pellets will be stored in storehouse for maximum 3 months. Thus the total storage duration will be less than one year.
No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion (e.g. esterification of waste oils).	Except for mechanical treatment and transportation of straws, the proposed project has no significant consumption of fossil fuels.

As shown in Table 1, the project meets all conditions and therefore ACM0006 is applicable to the proposed project.

（b）Baseline Scenario

According to the description in ACM0006, realistic and credible alternatives should be separately determined regarding:

(i) How power would be generated in the absence of the CDM project activity;
(ii) In case of cogeneration projects: how the heat would be generated in the absence of the project activity; and
(iii)What would happen to the biomass residues in the absence of the project activity

ACM0006 provides 8-11 different scenarios for (i)～(iii) respectively, and suggests 22 combined scenarios. Since the baseline of the project is: (i) The generation of power in the grid（P4）、(ii) The use of heat from external sources, such as district heat (H7)、(iii) The biomass residues are dumped or left to decay under mainly aerobic conditions (B1), the baseline of the project corresponds to baseline scenario No.2 in ACM0006.

Scenario No.2: P4 + (B1 or B2 or B3) + (H6 or H7 or H8)

Explanation on reason why scenario No.2 was selected for the project is shown below.

(i) Power generation

In the case of "The proposed project activity not undertaken as a CDM project activity" (P1), income of the project is sales of electricity and sales of heat which are not sufficient to make the project profitable. Thus P1 is not realistic. As all electricity generated from the project will be supplied to the East China Power Grid and replace the electricity which would be generated in the grid, the applicable baseline is "The generation of power in the grid" (p4).

(ii) Heat generation

"The proposed project activity not undertaken as a CDM project activity" (H1) is not an appropriate baseline scenario due to the same reason with P1 for power generation.

The project will supply heat to the surrounding factories which have been using heat generated from small coal-fired boilers. In such case, "The generation of heat in boilers using fossil fuels" (H6) is applicable as baseline scenario. However, in October 2008, the local government has announced regulation which stipulates shutdown of coal-fired boiler. Thus the boilers which were going to be replaced by the project have also been shut down. In this case, H6 does not comply with the regulation and thus it is not applicable as baseline scenario. Instead, "The use of heat from external sources, such as district heat" (H7) was selected as the most plausible scenario because the district heat supply from coal-fired cogeneration plant is common practice around the project area.

(iii) Use of Biomass

Biomass residues generated within the project area are currently dumped around the farmland and not being utilized. Therefore the applicable baseline scenario is "The biomass residues are dumped or left to decay under mainly aerobic conditions" (B1). Xuzhou government announced "Notice on prohibition of un-controlled burning of agricultural residues such as straw (November 14, 2008)" which states that those who violated the regulation will be punished. Therefore, "The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes" (B3) does not comply with regulation and thus not applicable as baseline scenario.

<u>（c）Project Boundary</u>

The project boundary is shown in Figure 1, and GHG emission sources within the project boundary are shown in Table 2.

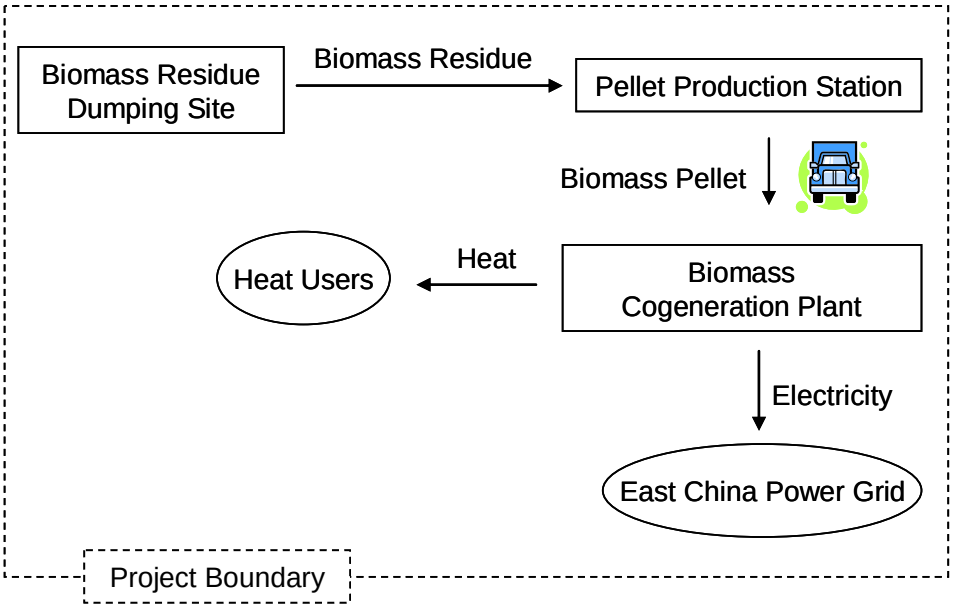

Figure 1 Project boundary

Table 2 GHG emission sources

	Source	Gas	Included?	Justification/Explanation
Baseline	Electricity generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Heat generation	CO_2	Yes	Although heat generation is part of the project activity, the project estimates emission reduction from heat supply as ZERO because the baseline scenario of heat supply is "district heat" which should be conservatively counted as zero according to ACM0006.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of surplus biomass	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Yes	Important emission source
		N_2O	No	Excluded for simplification. This is conservative.
Project	On-site fossil fuel and electricity consumption due to the project activity (stationary or mobile)	CO_2	Yes	Included as emission sources by project activity
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.

	Off-site transportation of biomass residues	CO_2	Yes	Included as emission sources by project activity
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Combustion of biomass residues for electricity and / or heat generation	CO_2	No	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Yes	CH_4 emission will be caused during the course of power / heat generation.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.

（d）Baseline Emissions (Emission Reductions）

Baseline Emission is calculated with the following equation.

$$ER_{electricity,y} + ER_{heat,y} + BE_{biomass,y} \quad (i)$$

- $ER_{electricity,y}$: Emission reductions due to displacement of electricity
- $ER_{heat,y}$: Emission reductions due to displacement of heat
- $BE_{biomass,y}$: Methane emissions due to natural decay or burning of anthropogenic sources of biomass residues

$ER_{electricity,y}$ is calculated as “Annual electricity supply × Emission factor of East China Power Grid (CM)”. According to ACM0006, in case when H7 was selected for the baseline scenario of heat supply, $ER_{heat,y}$ should be zero which is conservative. $BE_{biomass,y}$ is methane emission from biomass residues used in the project and it is calculated with Equation (46) in ACM0006.

(2) Project Emission

(a) Project Emission

Project Emission is calculated using Equation (2) in ACM0006 shown below.

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH4} \cdot (PE_{biomass,CH4,y} + PE_{WW,CH4,y}) \quad (ii)$$

- PET_y : CO_2 emissions from transportation of straw pellets to the project site
- $PEFF_y$: CO_2 emissions from on-site consumption of fossil fuels due to the project activity
- $PE_{EC,y}$: CO_2 emissions from consumption of electricity
- GWP_{CH4} : Global Warming Potential for CH_4
- $PE_{biomass,CH4,y}$: Methane emissions from the controlled combustion of biomass residues
- $PE_{WW,CH4,y}$: Methane emissions from waste water treatment

PET_y is CO_2 emission from transport of straw pellets from pellet production stations to the project site by trucks （Equation（3）or（4）in ACM0006）. $PEFF_y$ is CO_2 emission from consumption of diesel which is used for ignition and the Equation (1) in "Tool to calculate project or leakage CO_2 emission from fossil fuel combustion" is used for calculation. $PE_{EC,y}$ is CO_2 emission from use of electricity at pellet production stations and the calculation method should refer to "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". Methane emission from combustion of biomass residues at the project plant ($PE_{biomass,CH4,y}$) is calculated using Equation (6) in ACM0006. As the proposed project does not generate any wastewater from the treatment of the biomass residues, $PE_{WW,CH4,y}$ is zero.

Therefore, Equation (ⅱ) of Project Emission is summarized as follows:

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH4} \cdot PE_{biomass,CH4,y} \quad (ⅲ)$$

(b) Leakage

ACM0006 defines leakage as CO_2 emission that occurs when the project uses biomass residues which had been used by other people prior to the implementation of the project. ACM0006 states that those people might have to use fossil fuel instead of biomass residues and thus it would result in emission of CO_2. In other word, if it is possible to prove that the use of biomass residues in project activity would not result in increase use of fossil fuels in other places, it is possible to say that leakage is zero.

ACM0006 provides three options (L1-L3) to be used to demonstrate that the biomass residues used in the project did not result in increase of fossil fuel consumption elsewhere. The proposed project will select L2. L2 demonstrates that the quantity of available biomass residue in the region is at least 25% larger than the quantity of biomass residues that are utilized (e.g. for energy generation or as feedstock), including the project plant. A survey carried out by Sanpu town government showed that available biomass within 20km in radius of the project site was 2,000,000t/year and biomass residues in this region are not utilized. Since the consumption of biomass residues by the project is 420,000t/year, it is possible to say that there are sufficient amount of biomass residues.

From above, it is possible to prove that the project would not result in increase of fossil fuel consumption and thus leakage is zero.

(3) Monitoring Plan

Monitoring will be carried out in accordance with ACM0006, ACM0002 and relevant tools. Monitoring parameters specified in ACM006 and their monitoring plan is summarized in Table 3.

Table 3 Monitoring parameters and their monitoring plan

Parameter	Description	Frequency	Measurement method	QA/QC
$BF_{k,y}$	Quantity of biomass residues combusted in the project plant	Continuous	Measured on belt conveyer before the biomass residues are fed into boilers	Monitoring equipment shall undergo maintenance subject to national standard. Measurement shall be crosschecked with an annual energy balance which is based on quantities of biomass residues consumed and stock changes.
$BF_{T,k,y}$	Quantity of biomass residue transported to the project site	Continuous	Measured with truck scale installed at the entrance and exit of the site	Crosscheck the measurements with an annual energy balance that is based on purchased quantities and stock changes
NCV_k	Net Calorific Value of biomass residues	Once for half year	Measured at the on-site laboratory regularly and also measured at reputed laboratory once for half year	Check the consistency of the measurements by comparing the measurement results with measurements from previous years, relevant data sources (e.g. values in the literature) and default values by the IPCC. If the measurement results differ significantly from previous measurements, conduct additional measurements.
AVD_y	Average return trip distance between pellet production stations and the project site	Continuous	Distance between each pellet production station and the project site are measured	Check consistency of distance records provided by the truckers by comparing recorded distances with information from other sources (e.g. maps).
TL_y	Average load of the trucks used for transportation of biomass	Continuous	Measured with truck scale	-
$FC_{i,j,y}$	Quantity of diesel combusted at the project site	Continuous	Purchase amount, consumption and stock of diesel for ignition are measured	The consistency of metered fuel consumption quantities should be crosschecked by an annual energy balance that is based on purchased quantities and stock changes. Metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.

EG_y ($EG_{project\ plant,y}$)	Electricity delivered to grid	Continuous	Amount of electricity generation and sales are measured with electricity meter	Meters will be calibrated periodically. Data measured by meters will be cross checked by the electricity sales documents.
EC_{PJ}	On-site electricity consumption attributable to the project activity	Continuous	Electricity meters are installed at each pellet production stations and electricity consumption is measured	Meters will be calibrated periodically. Data measured by meters will be cross checked by the electricity invoices.
Leakage	Quantity of biomass residues utilized in the region	Every year	Statistical data is obtained from agricultural department of local government	-
Leakage	Quantity of available biomass residues in the region	Every year	Statistical data is obtained from agricultural department of local government	-

(4) GHG Emission Reductions

Estimation of GHG Emission Reductions and breakdown of Project Emissions are shown in Table 4 and Table 5 respectively.

Table 4 GHG Emission Reduction（tCO_2e/yr）

Year	Emission reductions due to displacement of electricity	Baseline emissions due to natural decay biomass residues	Project Emission	GHG Emission Reduction
2012	280,153	17,575	23,144	274,584
2013	280,153	17,575	23,144	274,584
2014	280,153	17,575	23,144	274,584
2015	280,153	17,575	23,144	274,584
2016	280,153	17,575	23,144	274,584
2017	280,153	17,575	23,144	274,584
2018	280,153	17,575	23,144	274,584
2019	280,153	17,575	23,144	274,584
2020	280,153	17,575	23,144	274,584
2021	280,153	17,575	23,144	274,584
Total	2,801,530	175,750	231,440	2,745,840

Table 5 Breakdown of Project Emissions（tCO_2e/yr）

On-site consumption of fossil fuels	255
Consumption of electricity	11,251
Transportation of straw pellets	5,151
Methane emissions from the controlled combustion of biomass residues	6,487
Total	23,144

(5) Project Period and Crediting Period

The project period is 15 years and the selected crediting period is 10 years. Construction period is 18 months, and the project plans to start operation from 2012. In order to prove that CDM support has been seriously considered prior to the implementation of the project, notification will be sent to UNFCCC and NDRC prior to order of construction materials.

(6) Environmental Impacts and other indirect effects

Environmental impact assessment of the project was carried out in 2006. In the assessment, environmental impact was evaluated for air, water, solid wastes and noise in accordance with relevant national standards. As a

result of the environmental impact assessment, it was revealed that the project has little impact to surrounding environment and effective countermeasures will be implemented to reduce wastewater and solid wastes. As for atmospheric pollution, the project plans to install fluidized-bed boiler which has high desulfurization efficiency as well as dust collecting equipment with 99% efficiency to meet the emission standards stipulated by law. No other indirect impacts are expected.

(7) Stakeholder's Comment

Stakeholder's comments on the project needs to be collected to prepare PDD. Stakeholders of the proposed project include local government, local residents, farmers who sell biomass residues to the project, heat users and grid company. Official explanatory meeting of the project and formal comment collection will be conducted once the start of construction is fixed.

In December 2009, hearing was carried out to the farmers who will sell biomass residues to the project. Their opinions were positive such as "we are happy because wastes will be removed and we can obtain additional income". The project is also beneficial to the farmers and thus early start of the project is awaited.

Moreover, the result of questionnaire survey to local residents carried out as part of environmental impact assessment showed that 96.4%（109 people）of the residents answered that they would like to support the project from the view point of environmental protection.

(8) Implementation Structure

Implementation structure of the project is shown in Figure 2.

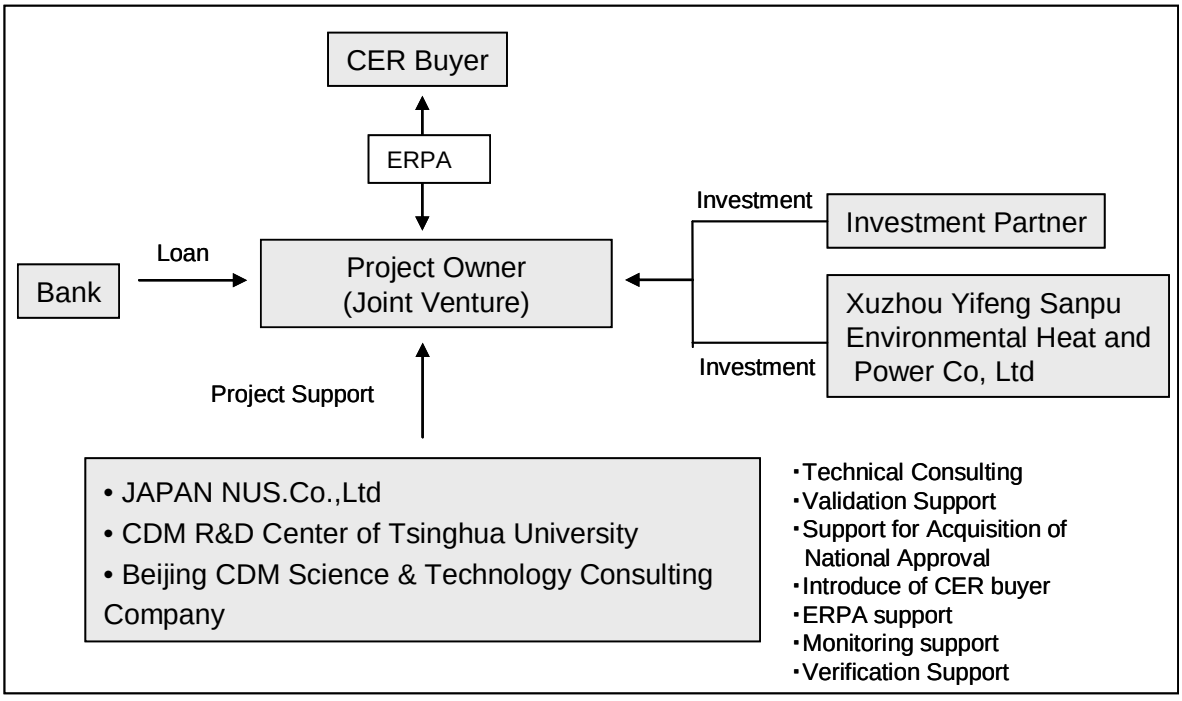

Figure 2　Implementation Structure of the Project

(9) Financial Plan

As for the financial plan, 70% of the initial investment will be financed by bank loan and 30% will be equity. Provision of loan has already been agreed by Bank of China under the condition that the project owner prepares 30% of initial investment as a capital. Since Xuzhou Yifeng Sanpu Environmental Heat and Power Co, Ltd is not able to prepare 30% of initial investment by themselves, they are currenlty looking for investment partner.

During this feasibility study, the project has been introduced to Japanese investors. The project was valued by investors in the point of utilization of agricultural wastes and provision of additional income to the farmers. Investors also valued the project in the point of large GHG emission reduction. Currently disscution regarding termes of contract is underway.

Financial plan is shown in Table 1 in the Attachment.

(10) Economic Analysis

The result of economic analysis is shown in Table 6 (Detail of economic analysis is shown in Table 2 in Attachment).

Table 6　Result of economic analysis

	Project IRR
Without CER revenue	4.51%
With CER revenue	12.03%

In China, projects can acquire permission when IRR of the project is higher than departmental benchmark. Benchmark IRR of power generation project is 8% which is stated in “Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects” (State power company generation and transmission operating department, 2003).

While the project without CER revenue is lower than benchmark IRR of 8%, sales of CER will greatly improve profitability of the project and IRR can become higher than 8%. Above calculation was carried out assuming that CER price is 9€/t-CO_2 which is the lowest price of CER regulated by Chinese government.

(11) Demonstration of Additionality

The project uses “Combined tool to identify the baseline scenario and demonstrate additionality” for demonstration of additionality.

Step 1：Identification of alternative scenarios

Sub-step 1a：Define alternative scenarios to the proposed CDM project activity.

Realistic and credible alternatives for (a) “power generation”, (b) “heat generation”, (c) “use of biomass” are shown below.

(a) Power generation

- The proposed project activity not undertaken as a CDM project activity（P1）

- The generation of power in the grid（P4）

(b) Heat generation

- The proposed project activity not undertaken as a CDM project activity（H1）
- The use of heat from external sources, such as district heat（H7）

(c) Use of biomass residues

- The biomass residues are dumped or left to decay under mainly aerobic conditions（B1）

Sub-step 1b：Consistency with mandatory laws and regulations

All alternative scenarios (P1, P4, H1, H7 and B1) are consistent with related laws and regulations in China.

Step 2. Barrier analysis

Possible barriers to alternative scenarios include (a) Investment barrier, (b) Technological barrier, (c) Lack of prevailing practice. None of those barriers would prevent alternative scenarios.

Step 3: Investment analysis

Benchmark analysis was applied for investment analysis. In "Economical Assessment and parameters for Construction Project (3rd edition)"which was jointly announced by NDRC and Construction Department, it is stated that the project is able to obtain permission when IRR of the project is higher than departmental benchmark. Benchmark IRR of power generation project is 8% which is stated in "Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects"[1]. Thus the project has little value to be invested when IRR is lower than 8%.

As shown in Table 7, IRR of the project without CER income was 4.51% which is lower than 8% and thus the project has investment barrier without CDM.

Table 7　IRR of the project

	IRR
Without CER revenue	4.51%
With CER revenue	12.03%

Step 4：Common Practice Analysis

All similar biomass power generation projects in Jiangsu Province need support from CDM. And the large-scale grid-connected biomass power generation is by all means a new technology at its early stage of development in China. Therefore, the proposed project activity is not common practice in Jiangsu Province.

In conclusion, P1 and H1 has investment barrier and thus cannot be alternative scenario. Remaining scenarios are P4＋H7＋B1 which are the baseline scenario and thus the project has additionality.

[1] State power company generation and transmission operating department, 2003

(12) Feasibility

As a result of the feasibility study, it was confirmed that the project has additionality and large GHG emission reduction (270,000tCO_2e/year) is expected. Result of economic analysis also showed that the project can be profitable if it was implemented as CDM project.

The biggest problem of the project is to find the investment partner. During this feasibility study, the project has been introduced to Japanese investors. The project was valued by investors in the point of utilization of agricultural wastes and provision of additional income to the farmers. Investors also valued the project in the point of large GHG emission reduction. Currently disscution regarding termes of contract is underway.

4. Study results on Co-benefit

(1) Evaluation of pollutants emissions reduction in the host country

Co-benefits of the project evaluated in this study are reduction of air pollution by replacement of grid electricity and reduction of wastes by utilization of biomass residues. "SO_2" and "Wastes" are chosen as evaluation items.

(a) SO_2

The baseline scenario is electricity generation in East China Power Grid and the project scenario is supply of electricity generated by the project to the grid. As for baseline emission, SO_2 emission factor of East China Power Grid based on data collected from published literature was multiplied by amount of electricity replaced by the project. For project emission, monitoring of fuel consumption at the plant and sulfur content of biomass fuel will be carried out. Estimated SO_2 emission reduction is shown below.

【SO_2 Emission Reduction】

= (Baseline Emission) – (Project Emission)

= 1,850.4 t/yr – 386.4 t/yr = 1,464.0 t/yr

(b)Wastes

Baseline scenario is dumping of agricultural residues and the project scenario is utilization of agricultural residues in the project plant. For the calculation of reduction of agricultural residues, the amount of agricultural resides used by the project is equivalent to the amount of waste reduced. Therefore, monitoring parameter is annual consumption of biomass residues by the project. In ex-ante estimation, the project will consume 420,000t/year of biomass residues.

5. Study results on Sustainable Development

In addition to reduction of environmental pollution, the project will contribute to sustainable development of the project area and China as follows.

(1) Utilization of agricultural residues and improvement of energy self-sufficiency

Biomass fuel used in the project is agricultural wastes such as straws collected from surrounding farmland. The

project therefore utilizes waste as energy resource. Utilization of biomass residues can not only reduce wastes but also contribute to improvement of energy self-sufficiency of the area.

(2) Improvement of living standard of farmers

Since the project purchases agricultural residues from farmers, this would provide additional income to farmers. Disparity in income levels between city and rural area and stagnation of economic and social development in rural area are important issue in China. Increase in income of farmers must play important role in development of rural area.

(3) Creation of employment

Increase in employment opportunity for local people is expected as the construction and operation of the project starts. Operation of the plant will require about 120 staffs.

(4) Development of local industry

As the heat supply will be switched from dispersed coal-fired boilers to centralized heat supply which is more stable, further development of industry in the area is expected.

Attachment

Table 1 Financial Plan 【Unit: 10thousand RMB】

		Construction	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cash in	Brought Forward	0	582	1,107	1,632	2,157	2,681	3,206	3,731	4,256	4,781	5,306	5,830	6,355	6,880	7,405	7,930
	Bank Loan	26,680	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Equity	11,434	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Income	0	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601
Total Cash in		38,114	32,183	32,708	33,233	33,757	34,282	34,807	35,332	35,857	36,382	36,906	37,431	37,956	38,481	39,006	39,531
Cash out	Construction cost	−37,532	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	O&M	0	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475
	Tax	0	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221
	Repayment	0	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380	−3,380
Total Cash out		−37,532	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076	−31,076
Balance		582	1,107	1,632	2,157	2,681	3,206	3,731	4,256	4,781	5,306	5,830	6,355	6,880	7,405	7,930	8,455

Table 2 Cash flow 【Unit: 10thousand RMB】

		Construction Period	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Outgo	Initial investment	−38,114															
	O&M Cost		−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475	−24,475
	Tax		−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221	−3,221
Total outgo		−38,114	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696	−27,696
Income	Electricity sales		22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769	22,769
	Heat sales		8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832	8,832
Total balance		0	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601	31,601
Current balance		−38,114	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905	3,905
Corporate tax		0	−345	−345	−345	−345	−345	−345	−345	−345	−345	−345	−377	−377	−377	−377	−377
Current income (without CDM)		−38,114	3,560	3,560	3,560	3,560	3,560	3,560	3,560	3,560	3,560	3,560	3,528	3,528	3,528	3,528	3,528
CER sales		0	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471	2,471	0	0	0	0	0
Current income (with CDM)		−38,114	6,031	6,031	6,031	6,031	6,031	6,031	6,031	6,031	6,031	6,031	3,528	3,528	3,528	3,528	3,528

IRR (without CDM)	4.51%
IRR(with CDM)	12.03%