CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

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Organic Waste Composting at Jianping County, Chaoyang City, Liaoning Province, P. R. China.
Version 2. Dec. 3, 2006.

A.2. Description of the project activity:

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The project comprises the design of a composting plant for waste from the local corn stalks and cow and chicken dung, with a maximum daily input capacity of 165 tonnes, according to proven technology. Apart from compost, the project will realise methane reductions by diverting high organic waste from dumping at waste heaps or landfill (where anaerobic process occurs) to a composting plant (aerobic process). Most landfills in China are poorly controlled sites with no coverage or landfill gas extraction, particularly in this region of China.

Based on investigations and calculations the project will realise 1,835,172 tonnes CO_2 equivalent of emission reductions over the 7-years period 2007 – 2014 (first crediting period). The investments will be realised during the period 2006 till 2007. Delivery of CERs will start from 2007.

The animal waste has high moisture content, making it heavy and unsuitable for incineration or long-distance transport, and it also contains substantial amount of degradable organic carbon (DOC). The moisture content of 60% and carbon-nitrogen ratio of 35-50% is optimum for aerobic composting. As such, composting of this waste is an attractive option for resource recovery and environmental improvement. The corn stalks are produced in abundance in the area, were previously open burned, but are now piled to decompose since open burning has been discouraged locally as a disposal option. Uncontrolled dumping is prevented and highly demanded compost fertilizer is generated that combats soil degradation that is a severe problem in Liaoning and Inner Mongolia. The project therefore contributes to sustainable development of the agricultural sector in the region.

The plant will be semi-mechanised, but will still create a large number of jobs, in particular for less educated workers.

Composting might cause some local environmental impact, mainly odour emission. The composting plant is located near the existing corn fields and animal raising operations. Odour filters will be applied when required.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (*) (as applicable)**	**Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)**
China (host)	Liaoning YuanHeng Biologic Technology Ltd. (private company)	No
Canada	LFGC Corporation (private company)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

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P. R. China

A.4.1.2. Region/State/Province etc.:

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Liaoning Province

A.4.1.3. City/Town/Community etc:

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Jianping County, Chaoyang City

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The project site is located at Sanjia industrial park, Jianping County, Chaoyang City, Liaoning Province, Postal Code: 122404

Figure 1. Liaoning Province in China

Figure 2. Project Site in Liaoning Province

A.4.2. Category(ies) of project activity:

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Project Activity: 13-Waste handling and disposal

A.4.3. Technology to be employed by the project activity:

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The technology proposed for the composting plant is proven technology but relatively new to China. A number of similar plants exist in Philippines and China, but none using corn stalk waste. International standards and good labour conditions will be taken into account. Technological or technical constraints are not expected. The chosen process can be characterized as follows:

• the first phase of the composting plant is designed for a processing capacity of 50 to 80 tonnes of organic waste input per day (2007),

scaled up to 165 tonnes/day (2008)[1].
• composting process in two stages: composting followed by maturing;
• the pretreatment area and the composting area will be completely roofed, but the sides may be open.
• the maturing area will be open, but preparations have been made (foundation) for a completely roof maturing area, in case this is necessary for process control (i.e. humidity, dust):
• use of static pile system, with extended piles;
• type of aeration: forced blowing (overpressure);
• centrally established aerators with (removable) piping that are on a concrete apron.
• regulation of air flow by means of valves;
• material transport in the reception area by means of front loaders;
• material transport and material handling after the shredding line is done semi-mechanically;
• concrete hardening is provided with a drainage system;
• nitrogen – fixing microbes are added to enhance the performance of the fertilizer.

Process step

An overall scheme of the process is presented in the Figure 3 on the next page.

[1] One tonne of net input will result in approximately 700 kg of compost. The planned total gross input of 165 tonnes per day (60,000 tonnes per year) results in approximately 115 tonnes of compost per day(42,000 ton per year) These figures are continuously monitored (see monitoring plan).

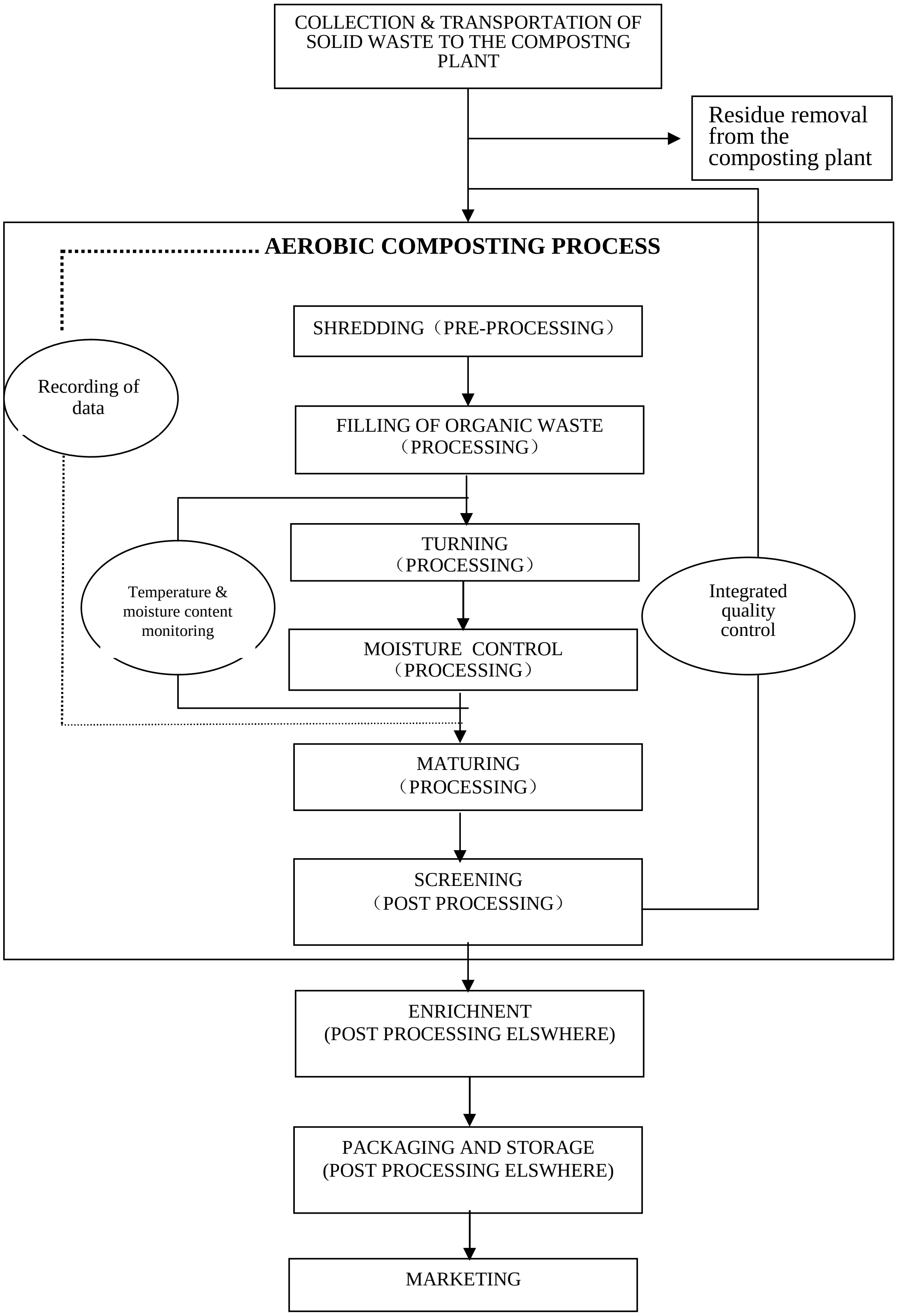
COLLECTION & TRANSPORTATION OF SOLID WASTE TO THE COMPOSTNG PLANT
Residue removal from the composting plant
AEROBIC COMPOSTING PROCESS
SHREDDING（PRE-PROCESSING）
Recording of data
FILLING OF ORGANIC WASTE （PROCESSING）
TURNING （PROCESSING）
Temperature & moisture content monitoring
Integrated quality control
MOISTURE CONTROL （PROCESSING）
MATURING （PROCESSING）
SCREENING （POST PROCESSING）
ENRICHNENT (POST PROCESSING ELSWHERE)
PACKAGING AND STORAGE (POST PROCESSING ELSWHERE)
MARKETING

Figure 3. Different steps in the composting process

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

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Table - Estimated emission reductions from the project

Year	Annual estimation of emission reductions in tonnes of CO_2e
2007	180,889
2008	182,407
2009	273,602
2010	274,654
2011	275,544
2012	276,098
2013	277,098
2014	94,880
Total estimated reductions (tonnes of CO_2e)	1,835,172
Total number of crediting years	7
Annual average over the crediting period of Estimated reductions (tonnes of CO_2e)	262,167

A.4.5. Public funding of the project activity:

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There is no public funding in this project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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Baseline Methodology: The approved AM0025, version 5 “Avoided emissions from organic waste through alternative waste treatment processes”

Monitoring Methodology: “Avoided emissions from organic waste through alternative waste treatment processes”.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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For Baseline Methodology: The approved AM0025, version 5 “Avoided emissions from organic waste through alternative waste treatment process” is used, because there is no viable alternative for the corn stalks and waste dung to be used except for disposal on a landfill, which is the current practise.

For Monitoring Methodology: The corn stalk wastes are currently landfilled to piles accumulating at farm sites in heights of 5-10 m. The liquid cow dung is now disposed in pits dug into the ground and covered to decompose , so that it can be dug up later to apply as a fertilizer. If applied before decomposing, it will burn the plants because it is too strong. Also, the chicken dung flows to pits dug into the ground to similarly decompose, generating large amounts of methane, which can be seen bubbling up through the waste. This project will divert these wastes to a modern composting plant utilizing a customized mix of aerobic microbes to accelerate the composting process and yield a high quality compost fertilizer that assists in fixing nitrogen in the soil, thus avoiding N_2O emissions and enhancing the growth promotion of the nutrient program.

B.3. Description of the sources and gases included in the project boundary

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The project boundary is the composting site where waste is treated. Possible CO_2 emissions resulting from fuel combustion and electricity consumption in the operation of the project activity will be accounted as project emissions. Methane emissions are avoided by the aerobic composting activity. Some methane may be produced from anaerobic pockets in the compost. N_2O emissions will be produced during the composting process.

The flow chart in Figure 4 shows the main components and connections including system boundaries of the project.

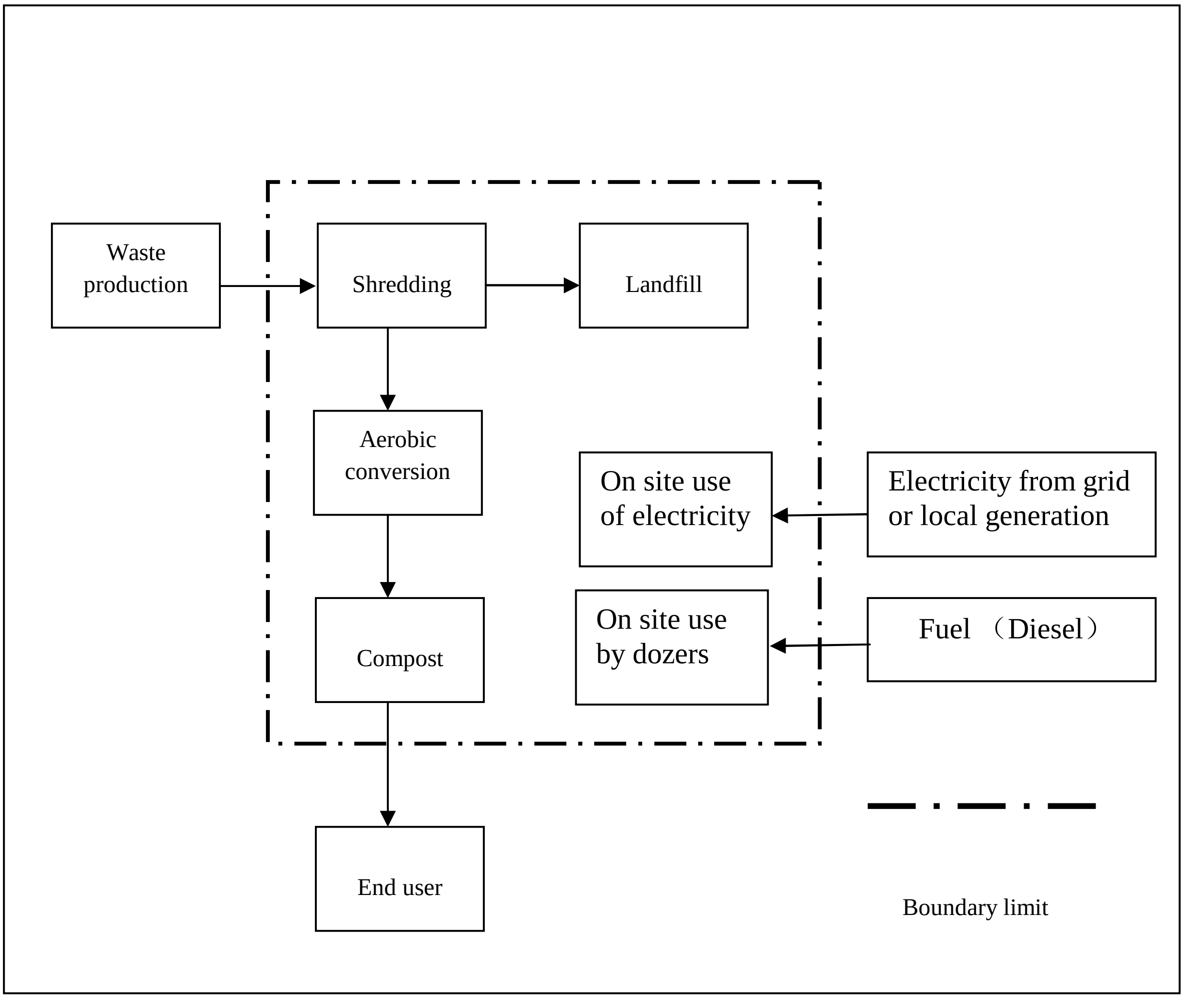

Figure 4. Material Movements Within and Without the Project Boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Organic Matter	CO_2	No	From renewable source
		CH_4	Yes	Methane Avoidance
		N_2O	No	Difficult to measure
	Mobile Equipment	CO_2	No	Difficult to determine and measure, will ignore
		CH_4	No	
		N_2O	No	Negligible
		CO_2		
		CH_4		
		N_2O		
Project Activity	Electricity	CO_2	Yes	Either local production or from grid
		CH_4	No	
		N_2O	No	
	Mobile Equipment	CO_2	Yes	From diesel fuel –IPCC default value used
		CH_4	No	
		N_2O	No	Negligible
	Organic Matter	CO_2	No	
		CH_4	Yes	From anaerobic pockets in compost
		N_2O	Yes	Default IPCC value used for production when composting

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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The project will divert organic waste from waste piles or landfilling towards a composting plant. Instead of anaerobic conversion, resulting in – amongst others – methane production, the organic waste is aerobically degraded, producing only non-fossil CO_2 , into a reusable product (compost fertilizer). Landfilling results in landfill gas production that emits to the atmosphere in case the landfill gas is not recovered, which is the case at present. By converting organic waste from land filling towards aerobic composting, landfill gas methane emissions are 100% prevented. The prevented methane emission from the landfill that otherwise would occur is claimed as emission reductions (ER's).

Positive Leakage – The produced compost is used in the agricultural sector, replacing some (fossil derived) fertilizers. The emission reduction from displacing fertilizers and the emissions in the fertilizer production process are not claimed. The CERs related to the increased crop production (N_2 fixing) from the use of compost are not claimed either. This project will also use microbes to assist in the decomposition and add nitrogen –fixing properties to the end fertilizer product.

AM0025 is used as the guideline for determining avoided methane emissions.

Diverting organic waste from landfilling prevents the production and escape of 100% of the methane emissions to the atmosphere. This amount is calculated by using the Multi Phase First Order Decay Model.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

The determination of project scenario additionality is done using the CDM consolidated tool for demonstration of additionality, which follows the following steps:

Step 0. Preliminary screening based on the starting date of the project activity

The project is expected to start operation just prior to registration with the UNFCCC, but emission reduction credits will be claimed only for the period after registration. As will be demonstrated in the following steps, CDM revenue has been considered from the early stages of development of the project, and it is an integral part of the financial package for the project.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Alternative 1: The proposed CDM project activity: “Organic Waste Composting”, not undertaken as a CDM project activity.

Methane production would be avoided by breaking down organic matter through aerobic processes.

Alternative 2: Continuation of the current situation.

Currently waste is dumped onto piles or pits near the farms or into the municipal landfill, where organic matter is broken down through uncontrolled anaerobic processes, releasing all produced methane into the atmosphere.

Alternative 3: Gather the corn stalks and construct a biomass –to- energy plant or Refuse Derived Fuel (RDF) plant.

The biomass energy plant is possible for the corn stalks, but not for the animal dung because of the high moisture content. However, this is a very remote area so the energy from the plant does not have a viable market. Also, the RDF option is not used in China since coal is readily available in the area, and the price for fuel does not allow an investment in RDF fuel production.

Alternative 4: Disposal of the waste on a landfill with electricity generation using landfill gas captured from the landfill site.

No landfills in the area even collect gas produced from the landfill, so this is not an option for existing landfills. The amount of waste treated by this project is not enough to establish a standalone landfill gas – to – energy plant, so this option is not realistic.

Alternative 5: Disposal of the waste on a landfill with delivery of landfill gas captured from the landfill site to nearby industry for heat generation.

This is a very remote area, comprising of corn fields and some chicken and cattle raising. No industry exists near landfills that can accept the wastes and have enough organic waste to be able to generate the volume of gas needed to justify collection, treatment, compression and pipelines to deliver the gas to an end-user.

Alternative 6: Disposal of the waste on a landfill where landfill gas captured is flared.

There are no landfills in the entire region that capture and flare the gas.

Sub-step 1b. Enforcement of applicable laws and regulations:

All the alternatives comply with the laws and regulatory requirements for the project location.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the methodology for determination of additionality, if the alternative to the CDM project activity does not include investments of comparable scale to the project, then Option III (of the methodology tool) must be used. As this is the case for the project, Option III is applied here.

The Alternatives presented are not commercially used in the area, and possibly not in China, so were not included in the analysis.

Sub-step 2b: Option III - Application of benchmark analysis

The likelihood of development of this project, as opposed to the continuation of its baseline will be determined by comparing its NPV and IRR with the benchmark of interest rates available to a local investor; i.e., those provided by local banks in the Host Country, which averages 3.81% for August, 2006 as in the referenced footnote.

Financial analysis conducted for the Project (see Annex 3 for the input details and Tables showing the results of the Financial Analysis) using assumptions that are the best cases from an investment decision point of view, shows that the Internal Rate of Return of the project without carbon finance is negative.

A financial analysis was undertaken using assumptions that are highly conservative from the point of view of analysing additionality; i.e., the best case scenario IRR was calculated. It was assumed that the average waste rate at the project site was equal to 165 tonnes per day. Sales of compost product were assumed to be at current market prices, so the increased supply would not depress prices. These best case assumptions were inputted into the model and financial analyses to calculate the IRR. In addition, a sensitivity analysis was conducted that increased the selling price by 10% and also one that reduced operating and maintenance costs by 10%. Both cases still resulted in a negative IRR, since the cash flow does not offer any positive investment returns for either case.

The rate of return of 2006 China National Bonds，which is issued on Sep 1, is 3.81%[2]. A conservative risk factor of 2% would bring the project rate of return required to 5.8%. This would be the minimum hurdle rate for the Project.

Sub-step 2c: Calculation and comparison of financial indicators

The Table below shows the financial analysis for the project activity. As shown, the project IRR (without carbon) is negative, lower than the interest rates provided by local banks or government bonds in the Host Country.

Table B.1: Financial results of the project (Alternative 1) without carbon finance. NPV uses 5% discount rate.

	without CER
Net Present Value (US $)	-19,243
IRR	negative
Discount rate	5%

Summary of results of project analysis. Details in Annex 3 and the financial model will be made available to Validator.

Table B.2 Impact on CDM registration (to 2012 project duration)

	with CER
Net Present Value(US $)	-1,722
IRR	23.9%
Discount Rate	5%

Assumptions:

- Discount rate: related to historical commercial lending fees are approx 3.8%. In addition a technology and market risk factor of 2% is taken into account, since the composting on such large scale and the associated technology used is new to the country and to local operators. These two factors add up to a 5.8% discount rate.
- Inflation: based on historical data (Source: World Economic Outlook -- September 2004 -- Statistical Appendix) an average inflation rate of 3% has been assumed.
- Project duration: to 2012
- Revenue streams: Taken into account are the expected revenues: sale of compost fertilizer. Investments: Taken into account are the composting plant, equipment and working capital.
- Costs: Taken into account are the associated operational expenses (mainly labour, energy costs, microbes, additives, etc.)

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

[2] Source: http://money.business.sohu.com/20060825/n244985725.shtml

- Increase in project revenue- Compost fertilizer selling price
- Reduction in running costs (Operational and Maintenance costs)

Those parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 10%, and assessing what the impact on the project IRR would be (see Table below). As can be seen, the project IRR remains lower than its alternative even in the case where these parameters change in favour of the project.

Table B.3: Sensitivity analysis

Scenario	**% change**	**IRR(%)**	**NPV $US**
Original		Negative	-19,243
Increase in project revenue	10	-0.1	-10,513
Reduction in project costs	10	Negative	-15,215

Note: NPV use 5% discount rate

Step 3. Barrier Analysis

Hereafter, the relevant key factors are discussed. Each of the factors described below indicates how it influences the baseline development for the composting project and the GHG emissions at the project activity level.

Key factor 1 – the likely development or adaptation of the legislation regarding landfill management

Legal framework

In China, the traditional way of landfill was just “waste dumps” without consideration of LFG collection and utilization, although there were two national regulations in the past few years to encourage (not force) the collection of LFG from waste dumps, but the fact was still that most of the landfills just vent the gas to air without any exhaust and flaring system (refer to <China Environment Daily> 2002.11.29)

Why is the LFG collection and utilization business not attractive for investors in China? The expert analysis concluded that there are four barriers existing[http://www.gefchina.org.cn/assembly/file/prjin8.htm]: the first barrier is in system; i.e., the functions of the government department and the enterprises which are in charge of waste collection and landfill management are not well co-ordinated, thus there is no base for industrialized operation; the second barrier is in policy; i.e., all the municipal waste treatment cost was born by the city government; the third barrier is in technology; i.e., there is very little experience in landfill gas collection machine manufacture, installation and operation in China, and the fourth barrier is in mechanism; i.e., no clear method for collecting and destroying methane emissions exists, especially financing. In order to change this situation, China State Environment Protection Administration (SEPA), together with UNDP and GEF, jointly funded a project in about 1995 to promote LFG collection and utilization in China. The project focused on the ability construction of three demo bases, one is LFG to power at NANJING city, one is LFG for medical waste incineration, at MAANSHAN city, and the other is LFG for car fuel at ANSHAN, also a UN LFG technology training centre at ANSHAN, all above demo bases were just established in about 2003. As the LFG application technology is still in its infancy, the LFG business activity is still not expanded in China.

In our Project, none of the landfills in a 200 km radius region collect any gas, and only two have even a rudimentary venting system to improve the safety on the site. As the mentioned landfills are relatively small and separated, the local Government has no plan to install any facilities to collect the gas at any of the landfills.

Key factor 2 – Economic Developments

The business of the project partners and financial strength of the project are described extensively by the Financial Model detailed in Annex 3 and represent a factor of relevance that might influence the baseline and the project, since the project finances are non-existent without revenue from CERs. The project location is in a rural part of NE China, comprising farms, dairy cattle and chicken raising in Liaoning and Inner Mongolia Provinces. The owner agreed to proceed with the project only after the compost technology provider agreed to manage and arrange for the CDM program input for the project.

Step 4. Common Practice Analysis

Sub-step 4a. Analyse other activities similar to the proposed activity

To date there has been limited development of composting projects in the Host Country.

Sub-step 4b Discuss any similar options that are occurring

There are a number of small composting operations in the Shenyang area, but none are very profitable and have only sporadic operations. This is the reason that corn straw tended to be open burned a few years ago.

Step 5. Impact of CDM registration

As shown in Step 2 above, the project is unlikely to move forward without the additional financial support of the CDM. If the developer was able to sell emission reduction credits from the project activity at an assumed price of US$ 6.00 dollars per tonne of CO_{2e}, the additional revenue generated by carbon sales would be sufficient to make the project go ahead (see Table in Step 2c above). An integral part of the CER sales agreement includes a prepayment for the credits that pays for the CDM costs and working capital.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The project activity diverts organic waste from landfilling towards composting, where the baseline scenario is landfilling with the methane produced in the landfill totally released into the atmosphere.

The following conditions apply:

-the waste going into the composting plant would be landfilled in the baseline and landfill gas would be released into the atmosphere. No other alternative besides landfilling and the project itself are available. Methane capture from the existing landfill is not financially viable without CER revenue. LFG revenues (gas, electricity and /or heat) alone are insufficient to recover project investments and operational costs. The methane emissions from the landfill would thus be emitted into the atmosphere in the baseline.

The composting meets the following operational requirements:
• The organic material is fully aerated (aerobic process) during the composting process
- conditions required to apply the multi-phase model:
• the net inputs to the composting process are known and can be monitored during the process. Values to be utilized in the Multi-Phase Model are determined for local substrates (corn stalks) or IPCC default values are used (for the animal wastes).

The emission reductions can be calculated using the following formula:

$ER_y = BE_y – PE_y – L_y$

Where:
ER_y: Emissions Reductions (t CO_2e) in year y
BE_y: Emissions in the baseline scenario (t CO_2e) in year y
PE_y: Emissions in the project scenario (t CO_2e) in year y
L_y: Leakage (t CO_2e) in year y

See detail in Annex 3.

B.6.2. Data and parameters that are available at validation:
(Copy this table for each data and parameter)
1.Data to be collected in order to monitor emission from the project activity

2. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs

Data / Parameter:	$A_{in,y}$ ID# 6
Data unit:	tonnes
Description:	Corn stalks, chicken dung and cow dung
Source of data used:	Weighbridge
Value applied:	Estimated for calculations, actual amounts weighed
Justification of the choice of data or description of measurement methods and procedures actually applied :	1. Measured 2. Recording frequency : Discontinue 3.Proportion of data to be monitored: 100% 4. Archived in electronic form
Any comment:	wastes entering composting plant, weighted by type

Data / Parameter:	DOC_y ID#12
Data unit:	% of waste
Description:	Degradable Organic Content
Source of data used:	Analyses
Value applied:	Used to compute methane generation potential
Justification of the choice of data or description of measurement methods and procedures actually applied :	1. Measured 2. Recording frequency : Discontinue 3.Proportion of data to be monitored: One sample per year 4. Archived in electronic form
Any comment:	Determine composition of waste in accordance with table E.2 of the methodology for "Organic Waste Composting"

Data / Parameter:	W_{CH4} ID# 16
Data unit:	% methane (CH_4)
Description:	If any LFG is captured and measured , the value will be used
Source of data used:	Analyser
Value applied:	IPCC default value of 50% , since no measurement available now
Justification of the choice of data or description of measurement methods and procedures actually applied :	1. Measured 2. Recording frequency : Discontinuous, or at the start of the project 3.Proportion of data to be monitored: 100% 4. Archived in electronic form
Any comment:	

3. Data and information that will be collected in order to monitor leakage effects of the project activity

Data / Parameter:	$NO_{vehicles}$
Data unit:	number
Description:	number of vehicles used for transport
Source of data used:	Counting
Value applied:	6,000 - 60,000 tonnes of compost input (from 2008 onwards) - 10 tonne/truck
Justification of the choice of data or description of measurement methods and procedures actually applied :	1. Measured 2. Recording frequency : Weekly 3.Proportion of data to be monitored: 100% 4. Archived in electronic formed
Any comment:	Counted at weighbridge, capacity recorded.

Data / Parameter:	F_{cons} ID# 3
Data unit:	liters
Description:	fuel consumption (ltr.) per kilometre of vehicle
Source of data used:	Expert estimate
Value applied:	15 ltr./100 km
Justification of the choice of data or description of measurement methods and procedures actually applied :	1. Estimated 2. Recording frequency : Yearly 3.Proportion of data to be monitored: 100% 4. Archived in electronic formed
Any comment:	Determined once a year. Assumption to be approved by certified institute/validator

Data / Parameter:	KM_{av} ID# 2
Data unit:	km
Description:	average in kilometres to end-user(s)
Source of data used:	Expert estimate
Value applied:	12 km + 12 km return The assumed average distance is 12 km from the project activity site. This value will be monitored.
Justification of the choice of data or description of measurement methods and procedures actually applied :	1. Estimated 2. Recording frequency : Yearly 3.Proportion of data to be monitored: 100% 4. Archived in electronic formed
Any comment:	Determined once a year. Assumption to be approved by certified institute/validator

B.6.3 Ex-ante calculation of emission reductions:

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B.6.4 Summary of the ex-ante estimation of emission reductions:

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Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
Year 2007	306	181,268	73	180,889
Year 2008	408	182,912	97	182,407
Year 2009	511	274,234	121	273,602
Year 2010	511	275,286	121	274,654
Year 2011	511	276,176	121	275,544
Year 2012	511	276,730	121	276,098
Year 2013	511	277,193	121	277,098
Year 2014	170	95,090	40	94,880
Total (tonnes of CO_2e)	3439	1,838,889	815	1,835,172

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$PE_{elec,y}$ ID# 1
Data unit:	kWh
Description:	the emissions from electricity consumption on-site due to the project activity in year y (tCO_{2e})
Source of data to be used:	kWh meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	1. measured 2. Recording frequency : Continuous 3.Proportion of data to be monitored: 100% 4. Archived in electronic form
QA/QC procedures to be applied:	Meter to be read and maintained by grid company
Any comment:	Data will be aggregated monthly and yearly

Data / Parameter:	F_{cons} ID# 2
Data unit:	liters
Description:	the fuel consumption on site in year y (l or kg)
Source of data to be used:	Invoices for fuel purchase
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	1. calculated 2. Recording frequency : Discontinuous 3.Proportion of data to be monitored: 100% 4. Archived in electronic form
QA/QC procedures to be applied:	
Any comment:	Data will be aggregated monthly and yearly

Data / Parameter:	$A_{non-organic,y}$ ID# 5
Data unit:	Tonnes
Description:	Any material weighed incoming that leaves compost facility
Source of data to be used:	Weighbridge
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	1. Measured 2. Recording frequency : Discontinue 3.Proportion of data to be monitored: 100% 4. Archived in electronic form
QA/QC procedures to be applied:	
Any comment:	Non-organics leaving composting plant

Data / Parameter:	$S_{a,y}$ ID#7
Data unit:	% Oxygen (O_2)
Description:	Oxygen content in air near bottom of windows
Source of data to be used:	Analyser
Value of data applied for the purpose of calculating expected emissions in section B.5	If the value of O_2 is below 10%, the baseline emission reductions can not be claimed for that period and for that part of the composting process.
Description of measurement methods and procedures to be applied:	1. Measured 2. Recording frequency : 2 times/week, adjusted if necessary 3.Proportion of data to be monitored: 100% 4. Archived in electronic form
QA/QC procedures to be applied:	
Any comment:	This data will be taken at the same locations to obtain statistically significant results.

Data / Parameter:	MD_{reg} ID# 14
Data unit:	% or amount of methane captured
Description:	methane that would be destroyed in the absence of the project activity
Source of data to be used:	Local and /or national authorities
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	1. Calculated/Estimated 2. Recording frequency : Annually 3.Proportion of data to be monitored: 100% 4. Archived in electronic form
QA/QC procedures to be applied:	
Any comment:	Changes in regulatory requirements, relating to the baseline landfill(s) need to be monitored in order to update the adjustment factor (AF), or directly MD_{reg}. This is done at the beginning of each crediting period.

B.7.2 Description of the monitoring plan:

>>

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

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LFGC Corporation is a CDM advisor to the Project and is a project participant listed in Annex 1 of this document.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

The time line of the project is as follows:

- Project starting date: June 1st 2006
- Construction starting date: September 1st 2006
- Construction finishing date: November 1st 2006 (first phase), middle of 2007 (last phase)
- Start operating of equipment: December 1st 2006 (starting with 50 tonnes input per day (2006), up scaling to 165 tonnes/day (Feb. 2008)

C.1.2. Expected operational lifetime of the project activity:

>>

The composting plant will continue to operate up to at least 2028.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

01/04/2007

C.2.1.2. Length of the first crediting period:

>>

7 Years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Not Applicable

C.2.2.2. Length:

>>

Not Applicable

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

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The project involves the implementation and operation of a composting plant in Liaoning. It does not use any scarce resources (like water); it doesn't produce any solid waste nor emissions to water and soil. The (limited number of) vehicles (one dozer and a shared front – end loader) do produce local combustion gases. The main environmental negative component can be NOx that is an acidifying gas. The electricity used on-site is, however, relatively small.

Composting can have some local environmental impact, mainly odour emissions. Odour reduction techniques are applied. The composting plant is located remote from populated areas and utilization of the corn stalks and dung will reduce the amount piled near the town and farms and rotting presently.

Compost can improve the soil condition and will improve crop production. Compost fertilizer is therefore in demand and contributes to a better environment for the agriculture run-off, as it will be greatly reduced compared to chemical fertilizer use.

The environment impact assessment report was finished in September, 2006. The environment approval was received in October, 2006. The environment impact assessment report and the environment approval are both available during the Validation.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

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In brief, the project might have a slight negative environmental impact during the operational phase, being odour emission. However this emission is compensated by prevented emissions from the landfills.

No impacts during the construction phase are expected

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

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The Stakeholder Meeting was held in the meeting room of Liaoning YuanHeng Biology Technology Ltd, Sanjia Industrial Park on Oct 24, 2006.

E1.1 Official reports announcing a Public Forum of the project in 1 local newspaper.

1. **October 12th,2006**: " Jianping Communication " , " News from Liaoning YuanHeng Biology Technology Ltd"

E 1.2 Public Forum: meeting with the local stakeholders. Present:

No.	From	Name	Contact Number
1.	Jianping County Agriculture & Economy Committee	Liu Guo Liang	13500412982
2.	Jianping County Environment Protection Bureau	Zhang Guo Qi	13842180629
3.	Jianping County TV station	Zhao Wei	13898098896
4.	Sanjia village Fuhe hamlet Committee	Chen You Zhi	13591856998
5.	Sanjia village Agriculture Service Station	Liu Zong Xiang	13842154358
6.	Sanjia village Agriculture Service Station	Yu Chun You	13842133640
7.	Sanjia village Statistics Office	Shen Wan Cheng	13591896687
8.	The representative of Hufe hamlet	Han Shu Fang	0421-7377085
9.	The representative of Hufe hamlet	Zhao Guo Ying	0421-7377020
10.	The representative of Hufe hamlet	Chen Fu Sheng	0421-7377343
11.	Sanjia Village Government	Li Jun	13942160765
12.	Ningcheng County toll-gate	Chi Jian Jun	13451336222

E.2. Summary of the comments received:

>>

Question 1
Why do you decide to do the organic fertilize project? Why do you choose Sanjia Industrial park of Jianping County as the project site?

Question 2
Please let me know any negative and positive effects to the environment due to the project.

Question 3
Please let me know the production technical flow.

Question 4
Will the biologic bacterium medicament used in the production have any negative impacts to the environment?

Question 5
When the cow dung is collected and fermented, will there be any water pollution due to accumulating the cow dung?

Question 6
When the crop stalk is shredded, will there be any air pollution caused by the dust?

Question 7
Will there be any noise pollution during the project?

Question 8
During the project construction period, will there be any impacts to the residents and students attending the schools due to the increased vehicles in the road? Can we work for Liaoning YuanHeng Biology Technology Ltd?

Question 9
I am a peasant in the project location. What kind of benefit will the project bring to us?

Question 10
What impact to the soil structure do the organic products have?

Question 11
What impact to the qualities of the farm produces do the organic products have?

Question 12
What effects to the local economy will the project bring?

Question 13
What safety operations do you take for assuring the safe production?

E.3. Report on how due account was taken of any comments received:

>>

For Question 1:

The reason why doing the organic fertilize project:

(1) The project can help to prevent the water pollution and the air pollution. A big amount of Animal dung is produced when raising animals. The infectious disease spreads easily as long as people drink the water, which is polluted by the animal dung. Also, a lot of ammonia gas and other deleterious gases are produced when the animal dung is accumulated. These gases really pollute the air.

(2) The project realizes sustainable development and helps to treat the environment. In the project, the animal dung and crop stalks, which are waste before, are used to make useful products. The project solves the pollution problem caused by kinds of wastes in the rural area. Due to the project, the CO_{2e} emission is reduced. GHG effect is abated and the balance of the zoology is maintained.

(3) The project can improve the people's life qualities and health levels. With the modern agriculture development, the used amounts of chemical fertilizers and pesticides are increased continually. Residues from the chemical fertilizers and pesticides pollute the land and ground water. Also, the deleterious materials from the residues are brought into the zoology system when absorbed by the crops, and it brings a big hidden trouble to the people's food and health. Our project is to produce the active organic fertilizers. Due to the project, the used amounts of the chemical fertilizers are reduced, deleterious bacteria from the soil are killed and the crops' capabilities of antivirus are improved. Also, due to the project, the used amounts of the pesticides are reduced, so the corps can grow in a natural and harmonious environment. It improves the qualities of the farm produce, so it also improves the people's life qualities and health levels.

(4) The project accelerates the development of the local economy.

The reason why choosing Sanjia industrial park of Jianping County as the project site:

The Sanjia industrial park is far away from the residential areas and schools. In this point, the project does not affect the local residents' lives and students' attending schools. The chosen project site is suitable for the project.

For Question 2

In the project, chicken dung, sheep dung, cow dung and other animals' wastes are harmlessly treated and the negative impact to the environment caused by the animal wastes is eliminated. Also, due to the project, stalks and weeds are degraded to be the part of organic fertilizers. In other words, during the fermenting process, the deleterious bacteria are killed, the odor is eliminated, CO_2 emission is reduced and the air pollution is reduced.

For Question 3

Technical Flow is:

Shredding →Weighing → Making Ingredient → Mixing → Entering the plant → Fermenting → Peroxidating → Checking → Making Granule → Drying → Screening and Separating → Packing

For Question 4

The biologic bacterium medicaments used in the project are all beneficial microbial floras, such as lactobacillus, beer yeast and brown azotobacter, which absorbs N_2 in the air and provides nitrogen for plants' growths. Besides, in the products, there are also 21 biologic bacterium medicaments, which accelerate plants to grow and absorb nutrients. The products from the project do not destroy the environment. On the contrary, due to the products, the used amounts of the chemical fertilizers can be reduced and the GHG effect is abated.

For Question 5
Please do not worry about this. The ground, where we use to collect the cow dung, has been indurated. The aeration windrow is made in brick concrete. During the production, there is not any sewage to discharge, so there is not any pollution to the surface water and the ground water. Also, on the surface of the animal dung, which is stored in the open air in the summer, we will spray deodorizing germicides and eliminate the air pollution.

For Question 6
We are using large kneading machines to shred the stalks. The shredded stalks are directly delivered to the airtight plants, so the dust produced in the process will not spread to the air.

For Question 7
All equipments we use in the production all accord with the requirements from the National environment protection department and the National technology supervising department. We install silencers on the equipments which vibrate greatly and make big noise.

For Question 8
The project site is far away from the residential areas. The vehicles driven in the project never pass by the residential areas and school areas. They are directly driven to the project site. There is no any influence to the residential areas and school areas.

For Question 9
The project will bring 2 benefits to the local residents:
(1) It benefits the environment. The project is to use animals' wastes and crop stalks to produce useful products. The negative impacts to the environment caused by these wastes are all eliminated.

(2) It benefits the local economy. The local people can takes precedence to use the organic fertilizers we produce in the project. Also, we will offer the local people some favorable policies on purchase. After the project starts, we may hire around 100 people for working on our projects. If you are healthy, feel interest in the work and are qualified with our job requirements, we welcome you to work with us.
,
For Question 10
The products produced in the project can activate the soil, increase the fertilizer effect, increase the organic contents in the soil and repair the granular structure of the soil. The problem of the hardened soil, which is caused by using chemical fertilizers in the long term, is effectively solved.

For Question 11
The products produced in the project can improve the quality of the farm produce. In our products, there are many elements, which support the plants' growths, such as nitrogen, phosphorus, kalium, calcium and magnesium. The products also contain a big amount of active materials such as biotin, vitamin and amino acid. These elements and active materials can help to increase the antivirus gene, reduce the used amounts of pesticides, decrease the heavy metal content in the vegetables, reduce the accumulated nitrate in the crops and make competitive and green food.

For Question 12

The project really helps to the local economy:
(1) The environment condition is improved.
(2) The project provides enough fertilizer to the base of the nuisance less green organic food.
(3) The project helps to develop carrying trades.
(4) The project is to use animals' wastes and crop stalks to produce useful products. The local peasants and culturists' earnings are increased by selling the raw materials to us.
(5) The project creates working opportunities to the local people.

For Question 13
We have the following operations:
(1) Fireproofing
One of the raw materials we use is corn stalk. Fireproofing is very important when collecting and accumulating the corn stalk. Strict regulations for raw materials' entering the plant and accumulating are set. Non-smoking and fire warning signs are installed. Smoking is not allowed in the plant.

(2) Safety measures are taken and protecting devices are installed on the equipments. Workers can work safely and there is not any hidden trouble to the local residents.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Liaoning YuanHeng Biologic Technology LTD.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This Project has not and will not receive public funding from Annex 1 countries of any kind.

Annex 3

BASELINE INFORMATION

1. Estimation of GHG emissions by sources:

Project emissions

The project emissions in year y are:

$PE_y = PE_{elec,y} + PE_{fuel,\ on\text{-}site,y} + PE_{c,y} + PE_{a,y} + PE_{g,,y}$

where:

PE_y is the project emissions during the year y (tCO_{2e})

$PE_{elec,y}$ is the emissions from electricity consumption on-site due to the project activity in year y (tCO_{2e})

$PE_{fuel,\ on\text{-}site,y}$ is the emissions on-site due to fuel consumption on-site in year y (tCO_2e)

$PE_{c,y}$ is the emissions during the composting process in year y (tCO_2e)

$PE_{a,y}$ is the emissions from the anaerobic digestion process in year y (tCO_2e)

$PE_{g,y}$ is the emissions from the gasification process in year y (tCO_2e)

Emissions from electricity use ($PE_{elec,y}$)

Where the project activity involves electricity consumption, CO_2 emissions are calculated as follows:

$PE_{elec,y} = MWh_{e,y} * CEF_{elec}$

where:

$MWh_{e,y}$ is the amount of electricity generated in an on-site fossil fuel fired power plant or consumed from the grid in the project activity, measured using an electricity meter (MWh)

CEF_{elec} is the carbon emissions factor for electricity generation in the project activity (tCO_2/MWh)

Table 1: Electricity consumption on-site

Machine	Number of machines	Installed electrical capacity [kW]	Load factor	Operating [hours/year]	Electricity consumption [MWh/year]
Sieve	2	15	75%	4,000	90
Blowers	4	20	75%	8,000	480
Lighting etc.		2	100%	4,000	8
				Total	578

Hence the estimated electricity consumption is 578 MWh/year. This value multiplied by the baseline emission factor (default value of 0.8 is used) results in a project specific emission of 462 tonnes of CO_2 per year off-site due to its electricity consumption.

$PE_{fuel, on-site}$ Project emission related to vehicles used on site

The emissions within the project boundary are related to vehicles used on-site. The (GHG) emission is calculated from the quantity of fuel used and the specific CO_2-emisison factor of the fuel. Below the *ex ante* calculations:

$PE_{fuel, on-site} = F_{cons,y} \ x \ CV_{fuel} \ x \ D_{fuel} \ x \ GWP_{fuel}$

$PE_{fuel, on-site}$: CO_2 emission of vehicle (tCO_2e) in year y

Emissions from fuel use on-site ($PE_{fuel, on-site,y}$)

Emissions are calculated from the quantity of fuel used and the specific CO_2-emission factor of the fuel, as follows:

$PE_{fuel, on-site,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel}$

where:

$PE_{fuel, on-site,y}$ is the CO_2 emissions due to on-site fuel combustion in year y (tCO_2)
$F_{cons,y}$ is the fuel consumption on site in year y (l or kg)
NCV_{fuel} is the net caloric value of the fuel (MJ/l or MJ/kg)
EF_{fuel} is the CO_2 emissions factor of the fuel (tCO_2/MJ)

IPCC default values are used for the net calorific values and CO_2 emission factors.

Table 2 Values for emissions calculation related to vehicles used on-site

Parameter	Description	Value
$F_{cons,y}$	Fuel (diesel)consumption (ltr.) on site in year y	18,250 ltr.(One loader will be used.Based on other projects this is estimated to be around 50 ltr.per day during 365 days a year per loader)
CV_{fuel}	Caloric value of fuel (MJ/ltr.)	42.7 MJ/kg
D_{fuel}	Density of fuel (kg//ltr.)	0.85 kg/ltr
GWP_{fuel}	Global Warming Potential of fuel (diesel) (toCO2e/MJ) according IPCC	74.1 kg/GJ

The CO_2 emissions of the project activity on-site are calculated to be 49 tonnes per year. The actual fuel consumptions will be monitored for *ex post* CER calculations.

Emissions from composting ($PE_{c,y}$)

$PE_{c,y} = PE_{c,N2O,y} + PE_{c,CH4,y}$

where:

$PE_{c,N2O,y}$ is the N_2O emissions during the composting process in year y (tCO_2e)
$PE_{c,CH4,y}$ is the emissions during the composting process due to methane production through anaerobic conditions in year y (tCO_2e)

N_2O emissions

During the storage of waste in collection containers, as part of the composting process itself, and during the application of compost, N_2O emissions might be released. Based upon Schenk [3] and others, a total loss of 42 mg N_2O-N per kg composted dry matter can be expected (from which 26.9 mg N_2O during the composting process). The dry matter content of compost is around 65%.

Based on these values, a default emission factor of 0.043 kg N_2O per tonne of compost for $EF_{c,N2O}$ was used .[4] The emissions of N_2O are estimated as follows:

$PE_{c,N2Oy} = M_{compost,y} * EF_{c,N2O} * GWP_{N2O}$

[3] Manfred K. Schenk, Stefan Appel, Diemo Daum, "N_2O emissions during composting of organic waste", Institute of Plant Nutrition University of Hannover, 1997

[4] Assuming 650 kg dry matter per ton of compost and 42 mg N_2O-N, and given the molecular relation of 44/28 for N_2O-N_2, an emission factor of 0.043 kg N_2O / tonne compost results.

where:

$PE_{c,N2Oy}$ is the N_2O emissions from composting in year y (tCO_2e)

$M_{compost,y}$ is the total quantity of compost produced in year y (tonnes/a)

$EF_{c,N2O}$ is the emission factor for N_2O emissions from the composting process (tN_2O/t compost)

GWP is the Global Warming Potential of nitrous oxide, (tCO_2/tN_2O)

CH_4 emissions

During the composting process, aerobic conditions are neither completely reached in all areas nor at all times. Pockets of anaerobic conditions – isolated areas in the composting heap where oxygen concentrations are so low that the biodegradation process turns anaerobic – may occur. The emission behaviour of such pockets is comparable to the anaerobic situation in a landfill. This is a potential emission source for methane similar to anaerobic conditions which occur in unmanaged landfills. Through predetermined sampling procedures the percentage of waste that degrades under anaerobic conditions can be determined. Using this percentage, project methane emissions from composting are calculated as follows:

$$PE_{c,CH4,y} = MB_{compost,y} * GWP_{CH4} * S_{a,y}$$

where:

$PE_{c,CH4,y}$ is the project methane emissions due to anaerobic conditions in the composting process in year y (tCO_2e)

$S_{a,y}$ is the share of the waste that degrades under anaerobic conditions in the composting plant during year y (%)

$MB_{compost,y}$ is the quantity of methane that would be produced in the landfill in the absence of the composting activity in year y (tCH_4). $MB_{compost,y}$ is estimated by multiplying MB_y estimated from equation (9) by the fraction of waste diverted, from the landfill, to the composting activity relative to the total waste diverted from the landfill to all project activities (composting, gasification and anaerobic digestion)

GWP_{CH4} is the Global Warming Potential of methane (tCO_2e/tCH_4)

Calculation of $S_{a,y}$

$S_{a,y}$ is determined by a combination of measurements and calculations. Bokhorst et al [5] and Richard et al[6] show that if oxygen content is below 5% - 7.5%, aerobic composting processes are replaced by anaerobic processes. To determine the oxygen content during the process, project participants shall measure the oxygen content according to a predetermined sampling scheme and frequency.

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[5] Jan Bokhorst. Coen ter Berg – Mest & Compost Behandelen beoordelen & Toepassen (Eng: Manure & Compost – Treatment, judgement and use), Louis Bolk Instituut, Handbook under number LD8, October 2001

[6] Tom Richard, Peter B. Woodbury, Cornell composting, operating fact sheet 4 of 10, Boyce Thompson Institute for Plant Research at Cornell University Cornell University

These measurements should be undertaken for each year of the crediting period and recorded each year. The percentage of the measurements that show an oxygen content below 10% is presumed to be equal to the share of waste that degrades under anaerobic conditions (i.e. that degrades as if it were landfilled), hence the emissions caused by this share are calculated as project emissions *ex-post* on an annual basis:

$S_a = S_{OD} / S_{total}$

where:

S_{OD} is the number of samples per year with an oxygen deficiency (i.e. oxygen content below 10%)

S_{total} is the total number of samples taken per year, where S_{total} should be chosen in a manner that ensures the estimation of S_a with 20% uncertainty at a 95% confidence level.

2.Estimated leakage

Sources of leakage considered in the methodology is CO_2 emissions from off-site transportation of waste materials in addition to CH_4 and N_2O emissions from the residual waste from the anaerobic digestion and gasification processes. Positive leakage that may occur through the replacement of fossil-fuel based fertilizers with organic composts are not accounted for. Leakage emissions should be estimated from the following equation:

$L_y = L_{t,y} + L_{r,y}$

where:

$L_{t,y}$ is the leakage emissions from increased transport in year y (tCO_2e)

$L_{r,y}$ is the leakage emissions from the residual waste from the anaerobic digester or the gasifier in year y (tCO_2e). This value is zero for this Project.

Emissions from transportation ($L_{t,y}$)

The project may result in a change in transport emissions. This would occur when the waste is transported from waste collecting points, in the collection area, to the treatment facility, instead of to existing landfills. When it is likely that the transport emissions will increase significantly, such emissions should be incorporated as leakage. In this case, project participants shall document the following data in the CDM-PDD:
an overview of collection points from where the waste will be collected, their approximate distance (in km) to the treatment facility, existing landfills and their approximate distance (in km) to the nearest end-user.

For calculations of the emissions, IPCC default values for fuel consumption and emission factors may be used. The CO_2 emissions are calculated from the quantity of fuel used and the specific CO_2-emission factor
of the fuel for vehicles i to n, as follows:

$$L_{t,y} = \sum_{i}^{n} NO_{vehicles,i,y} * km_{i,y} * VF_{cons,i} * CV_{fuel} * D_{fuel} * EF_{fuel}$$

where:

$NO_{vehicles,i,y}$ is the number of vehicles for transport with similar loading capacity
$Km_{i,y}$ is the average additional distance travelled by vehicle type i compared to baseline in year y

VF_{cons} is the vehicle fuel consumption in litres per kilometre for vehicle type i (l/km)

CV_{fuel} is the Calorific value of the fuel (MJ/Kg or other unit)
D_{fuel} is the fuel density (kg/l), if necessary
EF_{fuel} is the Emission factor of the fuel (tCO_2/MJ)

For transport of compost to the users, the same formula applies.

Leakages consist of four components, as explained below:

$L_y = L_{fuel,\ off\text{-}site} + L_{N2O} + L_{storage} + L_{compost}$

$L_{fuel,\ off\text{-}site} = NO_{vehicles,y}\ x\ KM_{av,y}\ x\ F_{cons}\ x\ CV_{fuel}\ x\ D_{fuel}\ x\ GWP_{fuel}$
$L_{fuel,\ off\text{-}site}$: CO_2 emission of vehicles (tCO_2e) in year y

The values used:

Table 3: Values for leakage emissions calculation related to transport of compost

Parameter	Description	Value
$NO_{vehicles}$	number of vehicles used for transport	6,000 Based on: - 60,000 tonnes of compost (from 2008 onwards) - 10 tonne/truck
KM_{av}	average in kilometres to end-user(s)	12 km + 12 km return The assumed average distance is 12 km from the project activity site. This value will be monitored.
F_{cons}	fuel consumption (ltr.) per kilometre of vehicle	15 ltr./100 km
D_{fuel}	Density of fuel (kg//ltr.)	0.85 kg/ltr

CV_{fuel}	Caloric value of fuel (MJ/kg)	42.7 MJ/kg
GWP_{fuel}	Global Warming Potential of fuel (tCO_2e/MJ) according IPCC	74.1 kg/GJ

The CO_2 emissions of the project leakage off-site are calculated to be 121 tonnes per year. The actual fuel consumptions will be monitored for *ex post* CER calculations.

$L_{N2O} + L_{storage} + L_{compost}$

Are not considered in accordance with the Baseline Methodology and the description in B.2.

3. The sum of 1 and 2 representing the project activity emissions:

Sum of E1 (49 +462) and E2 (0 + 121) is 632 tonnes of CO_2 per year (from 2008 onwards). In 2007 and 2008 this sum is 379 respectively 505 tonnes of CO_2.

Table 4: Resulting project emissions and leakages in first crediting period

Year	**Total Project Emission and Leakage**
	Tonnes
2007	379
2008	505
2009	632
2010	632
2011	632
2012	632
2013	632
2014	210
Total 2007-2014	4254

4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:
Baseline emissions

To calculate the baseline emissions project participants shall use the following equation:

$BE_y = (MB_y - MD_{reg,y}) * GWP_{CH4} + EG_y * CEF_{baseline,elec,,y} + EG_{d,y} * CEF_d + HG_y * CEF_{baseline,therm,y}$

where:

$BE_{,y}$ is the baseline emissions in year y (tCO_2e)
$MB_{,y}$ is the methane produced in the landfill in the absence of the project activity in year y (tCH_4)
$MD_{reg,y}$ is methane that would be destroyed in the absence of the project activity in year y (tCH_4)
GWP_{CH4le} is the Global Warming Potential of methane (tCO_2e/tCH_4)

EG_y is the amount of electricity in the year y that would be consumed at the project site in the absence of the project activity and which is not consumed anymore due to the implementation of the project activity, (MWh).

$CEF_{baseline, elec,y}$ is the carbon emissions factor for electricity consumed at the project site in the absence of the project activity (tCO_2/MWh)

$EG_{d,y}$ is the amount of electricity generated utilizing the biogas/syngas collected and exported to the grid in the project activity during the year y (MWh)

CEFd is the carbon emissions factor for the displaced electricity source in the project scenario (tCO_2/MWh)

HG_y is the quantity of thermal energy that would be consumed in year y at the project site in the absence of the project activity and which is not consumed anymore due to the implementation of the project activity (MWh).

$CEF_{baseline, therm,,y}$ is the CO_2 emissions intensity for thermal energy generation (tCO_2e/MJ)

In cases where regulatory or contractual requirements do not specify $MD_{reg,y}$, an Adjustment Factor (AF) shall be used and justified, taking into account the project context. In doing so, the project participant should take into account that some of the methane generated by the landfill may be captured and destroyed to comply with other relevant regulations or contractual requirements, or to address safety and odour concerns.

$MD_{reg,y} = MB_y * AF$

where:

AF is Adjustment Factor for MB_y (%)

AF is defined as the ratio of the destruction efficiency of the collection and destruction system mandated by regulatory or contractual requirement to that of the collection and destruction system in the project activity. The ‘Adjustment Factor’ will be revised at the start of each new crediting period taking into account the amount of GHG flaring that occurs as part of common industry practice and/or regulation at that point in the future.

At the present time, most landfills in China do not collect landfill gas, and consequently do not burn it, so the AF is considered zero for the first crediting period.

Methane generation from the landfill in the absence of the project activity

The amount of methane that is generated each year (MB_y) is calculated for each year with a multi-phase model. The model is based on a first order decay equation. It differentiates between the different types of waste j with respectively different decay rates k_j (fast, moderate, slow) and fraction of degradable organic carbon (DOC_j). The model calculates the methane generation based on the actual waste streams $A_{j,x}$ disposed in the most recent year (y) and all previous years since the project start (x=1 to x=y). The amount of methane produced in the year y (MB_y) is calculated as follows:

Formula to Avoid Methane

The formula is applied to calculate the baseline emission from methane avoidance from decaying corn stalk piles, cow and chicken dung pits, using the determined k value for corn stalk and IPCC default values for dung, as below:

The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. Baseline emissions shall exclude methane emissions that would have to be removed to comply with national or local safety requirement or legal regulations:

$$BEy = (MD_{project,y} - MD_{reg,y}) \bullet GWP_{CH4}$$

$MD_{project, y}$
Methane estimated ex-ante in the project design document to be destroyed by flaring or fuelling in the project activity during the year "y" (tonnes of CH_4).

$MD_{y,reg\ y}$
Methane that would be destroyed or removed in the year "y" for safety or legal regulation

GWP_{CH4}
Global Warming Potential for methane (value of 21)

The IPCC default values[7] used for the variables in the equation are as follows:
Methane correction factor – 1.0, since the corn stalk is in a pile higher than 5m and leveled periodically, and the cow and chicken waste is directed to a closed pit that does not allow air ingress – the methane generated provides a slightly positive gas pressure in the pits, so aerobic decomposition does not occur.
Fraction of DOC disseminated to LFG – 0.77
Fraction of CH_4 in LFG – 0.5

The k factor used for the animal waste (.23) is the default value for food wastes. The k factor for corn stalk has been determined in a research laboratory over the past two years (with regression analysis to

[7] Revised 1996 IPCC Guidelines for National GHG Inventories, Reference Manual, Chapter 6, WASTE and Chapter 4, Agriculture for calculating the methane production potential, Bo, from animal dung (70% of DOC was used, to compensate for the uncertainty.)

99% confidence level) and the data will be made available to the validator. The DOC values will be measured at least once a year and used to calculate methane generation potential.

The total baseline emission reduction from the project activity can be calculated by subtracting the baseline project emissions from emission reductions from methane capture:

$$MB_y = \varphi \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j=A}^{D} A_{j,x} \cdot DOC_j \cdot \left(1 - e^{-k_j}\right) \cdot e^{-k_j \cdot (y-x)}$$

.

where:

$MB_{,y}$ is the methane produced in the landfill in the absence of the project activity in year y(tCH_4)
Φ is the model correction factor (default 0.9) to correct for the model-uncertainties
F is the fraction of methane in the landfill gas (default value of 0.5 used)
DOC_j is the per cent of degradable organic carbon (by weight) in the waste type j
DOC_f is the fraction of DOC dissimilated to landfill gas (default value of 0.77 used)
MCF is the Methane Correction Factor (fraction, 1 used)
$A_{j,x}$ is the amount of organic waste type j prevented from disposal in the landfill in the year x (tonnes/year)
k_j is the decay rate for the waste stream type j

j is the waste type distinguished into the specific type or three waste categories, as above
x is the year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year for which emissions are calculated (x=y)
y is the year for which LFG emissions are calculated

Model Correction Factor (φ)

Oonk et el. have validated several landfill gas models based on 17 realized landfill gas projects.[8] The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% should be applied to the model results, i.e. φ = 0.9

The amount of organic waste type *j* ($A_{j,x}$) is calculated based on the total amount of waste collected in the year x (A_x) and the fraction of the waste type in the samples ($p_{n,j,x}$), as follows:

$$A_{j,x} = A_x \cdot \frac{\sum_{n=1}^{z} p_{n,j,x}}{z}$$

where:

[8] Oonk, Hans et al.:Validation of landfill gas formation models. TNO report. December 1994

$A_{j,x}$ is amount of organic waste type j prevented from disposal in the year x (tonnes/year)
A_x is amount of total organic waste collected during the year x (tonnes/year)
$p_{n,j,x}$ is fraction of the waste type j in the sample n collected during the year x

z is number of samples taken during the year x

Calculation of F

The project participant shall determine *F* with the following order of preference**:**

1. Measure *F* on an annual basis as a monitoring parameter, at a landfill in the proximity of the treatment plant, receiving comparable waste as the treatment plant receives.
2. Measure *F* once prior to the start of the project activity at a landfill in the proximity of the treatment plant, receiving comparable waste as the treatment plant will receive.
3. In case there is no access to a landfill, the project participants should apply the conservative default value of 0.5, being the lower end of IPCC range of 0.5 – 0.6.

5. Difference between 4 and 3 representing the emission reductions of the project activity
Emission Reductions

To calculate the emission reductions, the project participant shall apply the following equation:

$ER_y = BE_y – PE_y – L_y$

where:

ER_y is the emissions reductions in year y (t CO_2e)
BE_y is the emissions in the baseline scenario in year y (t CO_2e)
PE_y is the emissions in the project scenario in year y (t CO_2e)
L_y is the leakage in year y (t CO_2e)

6. Table providing values obtained when applying formulae above:

The tables in Annex 3, summarised in Table 6, presents the calculation of the emission reduction (CERs) that will be realised by the composting project during the crediting period up to 2014.

Table 6 Calculated CERs

Year	Total Baseline Emission	Total Project Activity Emission and Leakage	Net total amount of CERs
	Tonnes	Tonnes	Tonnes
2007	181,268	379	180,889
2008	182,912	505	182,407
2009	274,234	632	273,602
2010	275,286	632	274,654
2011	276,176	632	275,544
2012	276,730	632	276,098
2013	277,730	632	277,098
2014	95,090	210	94,880
Total 2007-2014	1,839,426	4254	1,835,172

INFORMATION USED FOR THE ADDITIONALITY ANALYSIS

The following pages are copied from the Financial Model used to determine the IRR, cash flows and NPV for this Project. Without the benefits from the sale of CERs, all cases for the compost project show negative IRR from the cash flows. This is the reason that composting has not been carried out as a commercial business operation in China, but rather as part of a civic waste management operation in the few cases where this is done for the region.

The following excerpts show details for 3 cases – first the case for the project with CER sales, then the IRR and Payback Table at the end for this case, second, the case without CER sales, then third, the case with 10% increase in selling price for the organic fertilizer.

Project : Biomass Waste to Organic Fertilizer	
Capital Outlay required for Project:	USD 2.55 million total
Total Turnover in 5 years:	USD 46 million
Total EBITDA in 5 years:	USD 7 million
IRR for Project:	23.9%
Payback:	3.2 Years
Major Assumptions :	1) CERs generated by this project at full capacity - as projected per year
	2) Fixed Selling price of CERs @ $US 6 / mt
	3) Fertilizers sold at USD 167 / mt
	4) Ordinary Dividend declared at 50% of available profits annually

Project : Biomass Waste to Organic Fertliser

Year			Pre-op	2007	2008	2009	2010	2011	2012
Contract Year			0	1	2	3	4	5	6
US$000	**Mth/yr**			9	12	12	12	12	12
Annual Capacity	**42,000**	mt of Organic Fert.		50%	100%	100%	100%	100%	100%
Annual Hours	**8720**								
CER mta				180,889	182,407	273,602	274,654	275,544	276,098
CDM Program Expenses			(92)	(83)	(83)	(83)	(83)	(83)	(83)
CER Sales	@ **US$6**		0	1085	1094	1642	1648	1653	1657
Sales of Fertiliser		**US$167/mt**	0	2625	7000	7000	7000	7000	7000
Total Revenue			(92)	3627	8011	8558	8565	8570	8573
Operating Expenses									
Biomass ($19/t			81	428	1174	1209	1246	1283	1322
Microbes ($5,834 / mt)			6	459	1225	1225	1225	1225	1225
Mechanical Shovel			4	100	103	106	109	113	116
Bagging			2	263	700	721	743	765	788
Electricity			8	50	52	53	55	56	58
Additive for enhancing fertiliser			0	831	2217	2217	2217	2217	2217
Travelling			21	100	103	106	109	113	115
Staff Accomodation			22	28	29	29	30	31	32
Rental for land			1	50	67	67	67	67	67
Printing , Stationery & Postage			0	7	7	7	7	8	8
Telecomunication Charges			7	17	17	18	18	19	19
Insurance			0	48	104	107	110	114	117
Professional fees			83	83	83	87	90	94	97
Plant Operators wages			28	300	412	424	437	450	464
Plant Maintenance			0	111	114	118	121	125	129
Administrators & mgmt cost			14	250	343	354	364	375	386
Start-up Expenses			75	83	0	0	0	0	0
Total Operating Expenses			351	3208	6750	6848	6949	7053	7159
EBITDA			(443)	419	1261	1711	1616	1517	1414
Debt Service									
Annual Interest			0	104	104	24	0	0	0
Depreciation			0	(225)	(225)	(225)	(225)	(225)	(225)
Tax			0	0	71	307	292	271	250

Table of Assumptions

Biomass Waste (mt/a)	60,000.00
Conversion (ratio)	0.70
Biomass Waste Cost (per mt) in USD	19.00
Full Capacity CER (mt/a)	0.00
Full Capacity Fertilizers (mt/a)	42,000.00
CER Price in USD	6.00
Fert Price in USD	166.67
Annual Hours	8,720.00
Cost of Microbes (per mt) in USD	5,833.33
Inflation of cost (ratio)	1.03
Inflation of Sales Price (ratio)	1.00

Project : Biomass Waste to Organic Fertliser

Year			Pre-op	2007	2008	2009	2010	2011	2012
Contract Year			0	1	2	3	4	5	6
US$000	**Mth/yr**			9	12	12	12	12	12
Annual Capacity	**42,000**	mt of Organic Fert.		50%	100%	100%	100%	100%	100%
Annual Hours	**8720**								
CER mta				0	0	0	0	0	0
CDM Program Expenses			0	0	0	0	0	0	0
CER Sales	@ **US$6**		0	0	0	0	0	0	0
Sales of Fertiliser		**US$167/mt**	0	2625	7000	7000	7000	7000	7000
Total Revenue			0	2625	7000	7000	7000	7000	7000
Operating Expenses									
Biomass ($19/t			81	428	1174	1209	1246	1283	1322
Microbes ($5,834 / mt)			6	459	1225	1225	1225	1225	1225
Mechanical Shovel			4	100	103	106	109	113	116
Bagging			2	263	700	721	743	765	788
Electricity			8	50	52	53	55	56	58
Additive for enhancing fertiliser			0	831	2217	2217	2217	2217	2217
Travelling			21	100	103	106	109	113	115
Staff Accomodation			22	28	29	29	30	31	32
Rental for land			1	50	67	67	67	67	67
Printing , Stationery & Postage			0	7	7	7	7	8	8
Telecomunication Charges			7	17	17	18	18	19	19
Insurance			0	48	104	107	110	114	117
Professional fees			83	83	83	87	90	94	97
Plant Operators wages			28	300	412	424	437	450	464
Plant Maintenance			0	111	114	118	121	125	129
Administrators & mgmt cost			14	250	343	354	364	375	386
Start-up Expenses			75	83	0	0	0	0	0
Total Operating Expenses			351	3208	6750	6848	6949	7053	7159
EBITDA			(351)	(583)	250	152	51	(53)	(159)
Debt Service									
Annual Interest			0	104	104	24	0	0	0
Depreciation			0	(225)	(225)	(225)	(225)	(225)	(225)
Tax			0	0	0	0	0	0	0
Profit/ (Loss) after tax			(351)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table of Assumptions

Biomass Waste (mt/a)	60,000.00
Conversion (ratio)	0.70
Biomass Waste Cost (per mt) in USD	19.00
Full Capacity CER (mt/a)	0.00
Full Capacity Fertilizers (mt/a)	42,000.00
CER Price in USD	6.00
Fert Price in USD	166.67
Annual Hours	8,720.00
Cost of Microbes (per mt) in USD	5,833.33
Inflation of cost (ratio)	1.03
Inflation of Sales Price (ratio)	1.00

Project : Biomass Waste to Organic Fertliser

Year			**Pre-op**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Contract Year			**0**	**1**	**2**	**3**	**4**	**5**	**6**
US$000	**Mth/yr**			**9**	**12**	**12**	**12**	**12**	**12**
Annual Capacity	**42,000**	mt of Organic Fert.		**50%**	**100%**	**100%**	**100%**	**100%**	**100%**
Annual Hours	**8720**								
CER mta									
CDM Program Expenses									
CER Sales	@ **US$6**		**0**	**0**	**0**	**0**	**0**	**0**	**0**
Sales of Fertiliser		**US$167/mt**	**0**	**2888**	**7700**	**7700**	**7700**	**7700**	**7700**
Total Revenue			**0**	**2888**	**7700**	**7700**	**7700**	**7700**	**7700**
Operating Expenses									
Biomass ($19/t			**81**	**428**	**1174**	**1209**	**1246**	**1283**	**1322**
Microbes ($5,834 / mt)			**6**	**459**	**1225**	**1225**	**1225**	**1225**	**1225**
Mechanical Shovel			**4**	**100**	**103**	**106**	**109**	**113**	**116**
Bagging			**2**	**263**	**700**	**721**	**743**	**765**	**788**
Electricity			**8**	**50**	**52**	**53**	**55**	**56**	**58**
Additive for enhancing fertiliser			**0**	**831**	**2217**	**2217**	**2217**	**2217**	**2217**
Travelling			**21**	**100**	**103**	**106**	**109**	**113**	**115**
Staff Accomodation			**22**	**28**	**29**	**29**	**30**	**31**	**32**
Rental for land			**1**	**50**	**67**	**67**	**67**	**67**	**67**
Printing , Stationery & Postage			**0**	**7**	**7**	**7**	**7**	**8**	**8**
Telecomunication Charges			**7**	**17**	**17**	**18**	**18**	**19**	**19**
Insurance			**0**	**48**	**104**	**107**	**110**	**114**	**117**
Professional fees			**83**	**83**	**83**	**87**	**90**	**94**	**97**
Plant Operators wages			**28**	**300**	**412**	**424**	**437**	**450**	**464**
Plant Maintenance			**0**	**111**	**114**	**118**	**121**	**125**	**129**
Administrators & mgmt cost			**14**	**250**	**343**	**354**	**364**	**375**	**386**
Start-up Expenses			**75**	**83**	**0**	**0**	**0**	**0**	**0**
Total Operating Expenses			**351**	**3208**	**6750**	**6848**	**6949**	**7053**	**7159**
EBITDA			**(351)**	**(320)**	**951**	**853**	**752**	**647**	**541**
Debt Service									
Annual Interest			**0**	**104**	**104**	**24**	**0**	**0**	**0**
Depreciation			**0**	**(225)**	**(225)**	**(225)**	**(225)**	**(225)**	**(225)**
Tax			**0**	**0**	**0**	**32**	**110**	**89**	**66**
Profit/ (Loss) after tax			**(351)**	[illegible]	[illegible]	[illegible]	**417**	[illegible]	[illegible]

Table of Assumptions

Biomass Waste (mt/a)	60,000.00
Conversion (ratio)	0.70
Biomass Waste Cost (per mt) in USD	19.00
Full Capacity CER (mt/a)	0.00
Full Capacity Fertilizers (mt/a)	42,000.00
CER Price in USD	6.00
Fert Price in USD	183.34
Annual Hours	8,720.00
Cost of Microbes (per mt) in USD	5,833.33
Inflation of cost (ratio)	1.03
Inflation of Sales Price (ratio)	1.00

IRR Calculator

Project Description : **Biomass Waste to Organic Fertiliser**

IP #: **Biomass Waste to Organic Fertliser**

Prepared By :

Sensitivity Version # : **1** 3-Dec-06

Assumptions :

INCOME FROM OPERATIONS:	Yr 0	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Profit After Tax												
	(443.0)	90.4	861.4	1154.5	1098.9	1021.1	939.3					
Subtotal Operating Income	(443.0)	90.4	861.4	1154.5	1098.9	1021.1	939.3	0.0	0.0	0.0	0.0	0
Less Depreciation								0.0	0.0	0.0	0.0	0
SUBTOTAL TAXABLE INCOME	(443.0)	90.4	861.4	1154.5	1098.9	1021.1	939.3	0.0	0.0	0.0	0.0	0
ITEMS NOT AFFECTING CASH FLOW:												
Add Depreciation		225.0	225.0	225.0	225.0	225.0	225.0					
Other												
SUBTOTAL		225.0	225.0	225.0	225.0	225.0	225.0	0.0	0.0	0.0	0.0	0
OTHER CASH FLOWS:												
Capital Additions - Investment	(2,555.00)											
Income Taxes (21%)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Net Working Capital Changes												
SUBTOTAL CASH FLOWS	(2,555.00)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0
Annual Net Cash Flow	(2998.00)	315.4	1086.4	1379.5	1323.9	1246.1	1164.3	0.0	0.0	0.0	0.0	0
Cumulative Cash Flow	(2998.00)	(2682.6)	(1596.1)	(216.6)	1107.3	2353.5	3517.7	0.0	0.0	0.0	0.0	0

INTERNAL RATE OF RETURN, IRR	**23.90%**	23.90%
PAYBACK PERIOD	**3.16**	3.16
COST OF CAPITAL	**5.8%**	

ASSET TYPE	**USEFUL LIFE**
MACHINERY/EQUIPMENT	**10**
FURNITURE/FIXTURES	
BUILDING	

RATE OF DISCOUNT	0.0%	5.0%	10.0%	15.0%	20.0%	25.0%	30.0%
NPV OF CASHFLOW	(515)	(1,722)	(2,468)	(2,918)	(3,174)	(3,304)	(3,349)
TOTAL VALUE OF PROJECT	-515	-1,722	-2,468	-2,918	-3,174	-3,304	-3,349

Annex 4

MONITORING INFORMATION

This section details the steps taken to monitor on a regular basis the GHG emission reductions from the Project. The main components covered within the monitoring plan (MP) are:

1. Parameters to be monitored, and how the data will be collected
2. The equipment to be used in order to carry out monitoring
3. Operational procedures and quality assurance responsibilities
4. Operational management structure

The requirements of this monitoring plan (MP) are the information routinely collected by companies managing industrial compost systems, so internalising the procedures should be simple and straightforward. If necessary, the MP can be updated and adjusted to meet operational requirements, provided that a Designated Operational Entity approves such modifications during the process of verification.

Monitoring for the Project will begin with the start of operation in December 2006. The monitoring plan details the actions necessary to record all the variables and factors required by the methodology AM 0025, as detailed in Section B.7.1 of the PDD. All data will be archived electronically, and data will be kept for the full crediting period, plus two years.

Table 4a: Data to be collected or used to monitor emissions from the project activity, and how this data will be archived

ID number	Data Variable	Source of data	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Pro-portion of data monitored	How will data be archived? (electronic / paper)	Comment
1. Mwh_e	Electricity consumption	Electricity meter	MWh	M	Continuous	100%	Electronic	Meter owned and maintained by grid electricity supplier
2. CEF_{elec}	Electricity emissions factor	Official utility documents	tCO2e/Mwh	C	Annually or *ex-ante*	100%	Electronic	Calculated according to ACM0002, or as diesel default factor according to AMS1.D.1, or according to data from captive power plant, if any.
3. F_{cons}	Fuel consumption	Purchase invoices	Liters or other quantity unit	C	Annually	100%	Electronic	
4. NCV_{fuel}	Net calorific value of fuel	Reference data or countryspecific data	MJ/quantity	M, C, E	Annually or *ex-ante*	100%	Electronic	IPCC default data or country specific data cited in authentic literature may apply.

5. EF_{fuel}	CO_2 emission factor of fuel	Reference data or countryspecific data	t-CO_2/MJ	M, C, E	Annually or *ex-ante*	100%	Electronic	IPCC default data or country-specific data cited in authentic literature may apply.
6. $M_{compost,y}$	Total quantity of compost produced in year	Plant records	Tonnes	M	Annually	100%	Electronic	The produced compost will be trucked off from site. All trucks leaving site will be weighed. Possible temporary storage of compost will be weighed as well or not used in the back-up calculation
7. S_a	Share of samples anaerobic		%	C	Weekly	See S_{total}	Electronic	Used to determine percentage of compost material that behaves anaerobically.
8. S_{OD}	Number of samples with oxygen deficiency	Oxygen measurement device	Number	M	Weekly	See S_{total}	Electronic	Samples with oxygen content <10%. Weekly measurements throughout the year but accumulated once per year only
9. S_{total}	Number of samples	Oxygen measurement device	Number	M	Weekly	statistically significant	Electronic	Total number of samples taken per year, where S_{total} should be chosen in a manner that ensures estimation of S_a with 20% uncertainty at 95% confidence level.

10. $EF_{c,N2O}$	Emission factor for N_2O emissions from the composting process	Research literature	t-N_2O/t-compost	C	*Ex-ante*	100%	Electronic	default value of 0.043kg-N_2O/tcompost, after Schenk et al, 1997.
11. Ai	Amount of waste type i	Project participants	t/yr	M	Daily	100%	Electronic	To be weighed before coming to plant, by type
12. CCWi	Fraction of carbon content in waste type i	Laboratory Analysis	Fraction	M	Annually	100%	Electronic	DOC analysis to be done annually
13. FCF_i	Faction of fossil carbon in waste type i	Project participants	Fraction	M	Annually	100%	Electronic	Confirm that no fossil carbon in plant feedstocks
14. MD_{reg} or AF	Methane destroyed due to regulatory or other requirements	Local and/or national authorities	% or tonnes	E	Annually	100%	Electronic	Changes in regulatory requirements, relating to the baseline landfill(s) need to be monitored in order to update the adjustment factor (AF), or directly MDreg.. This is done at the beginning of each crediting period.
15. $P_{j,x}$	Share of different types of organic waste	Sampling/ Sorting/ weighing	% of waste	M	Quarterly	see note below	Electronic	Determine fraction of each waste stream of total waste input to the treatment facility

16. F	Methane fraction of landfill gas	Calculated	% by weight	M	Annually	100%	Electronic	Monitoring depends of the accessibility of this data coming from landfill in proximity of the treatment plant. If no suitable landfill-data is available, then a default value of 0.5 should be applied.
17. DOE_f	Fraction of degradable organic carbon dissimilated to landfill gas	IPCC	Number	E	Ex-ante	100%	Electronic	A default factor of 0.77 may be applied from IPCC. Where lignin-C is included, a figure of 0.5 should be used
18. MCF	Methane correction factor	IPCC	Number	E	Ex-ante	100%	Electronic	IPCC default values may be used
19. k	Decay rate	Default or project specific	Number	M or E	Ex-ante	100%	Electronic	Measured value used if available, default value if not
20. $NO_{vehicles}$	Vehicles per carrying capacity per year	Counting	Number	M	Annually	100%	Electronic	Counter should accumulate the number of trucks per carrying capacity
21. km_v	Additional distance travelled	Expert estimate	km	E	Annually	100%	Electronic	Difference in distance from site to source of feedstock and from source to landfill

22. VF_{cons}	Vehicle fuel consumption in litres per kilometre for vehicle type i	Fuel consumption record	liters	M	Annually	100%	Electronic	Expert opinion or vehicle manufacturer data
23.CV_{fuel}	Calorific value of the fuel	IPCC or other reference data	MJ/kg or other unit	M, C, E	Annually or Ex-ante	100%	Electronic	
24. D_{fuel}	Density of fuel	IPCC or other reference data	kg / l	M, C, E	Annually or Ex-ante	100%	Electronic	Not necessary if CV_{fuel} is demonstrated on a per liter basis
25. EF_{fuel}	Emission factor of the fuel	IPCC or other reference data	tCO_2/MJ	M, C, E	Annually or Ex-ante	100%	Electronic	

Table 4b: Equipment used to monitor emission reductions from the project activity

Equipment	**Variables Monitored**	**Operational range**	**Calibration procedures**	**Parties responsible for operating equipment**	**Procedure in case of failure**	**Default value to use in case of failure**	**Comments**
Weigh Scale	Weight of each substrate to plant	Tonnes	Equipment will be calibrated 18-24 months after initial installation by the equipment supplier	Project Developer	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item within one month. Failure events will be recorded in the site events log book.	Daily average of the weight in the previous month minus 5%, per day of weigh scale failure	
Portable Oxygen Gas Analyser	Mol fraction oxygen	0 to 20%	Equipment will be calibrated annually by the owner on site, calibration gases to be supplied by equipment supplier.	Project Developer	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item within one month. Failure events will be recorded in the	Average of the measured oxygen content in the previous month minus 5%, per day of gas analyser failure. If this brings the oxygen below 10%, the relevant PE factor applies	

					site events log book		
Electricity meter	Total amount of electricity generated by the project and electricity consumed		Equipment will be checked monthly by the Lead Engineer	Project Developer	Failure reported to equipment supplier and repairs carried out. If repair is not possible, equipment will be replaced by equivalent item within one month. Failure events will be recorded in the site events log book.	Daily average of the electricity consumed in the previous month	

Table 4c: Operational procedures and responsibilities for monitoring and quality assurance of emission reductions from the project activity (E = responsible for executing data collection, R = responsible for overseeing and assuring quality, I = to be informed)

Task	Regional Manager	Site Engineer	Equipment Supplier	Project Developer	LFGC Corporation
Collect Data	R	E			
Enter data into Spreadsheet	R	E		R	
Make monthly and annual reports	R	E		R	I
Archive data & reports	R	E		R	I
Calibration/Maintenance, rectify faults	I	R	E	I	I