CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

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Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Aerobic digestion of sewage sludge in Pingdingshan-Shi sewage treatment plants

A.2. Description of the small-scale project activity:

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Pingdingshan-Shi sewage treatment plant is one of the largest sewage treatment plants in China. This project activity will be based in a 250,000 m^3/day sewage treatment plant located in Pingdingshan-Shi, Henan Province.

There is sludge type of biomass waste from sewage treatment plants, namely sewage sludge with high total organic carbon (TOC) content.

Sewage sludge is currently sent to landfill site for unmanaged dumping which will cause anaerobic digestion. There could be potential methane emission from this activity and then methane gas is generated and emitted to the atmosphere.

This project is aimed to reduce the methane emission from anaerobic digestion and decay of sewage sludge by avoiding the current unmanaged dumping. Instead sewage sludge will be applied in an aerobic composting technique. Composting is a process of controlled biological decomposition of organic materials. Sewage sludge will be mixed with culture medium of aerobically growing bacterium (hereinafter referred to as YM aerobes) which decomposes organic materials at high temperature.

The subsequent process is aerobic due to mechanical aeration as well as strict control of key parameters – oxygen levels of the compost mounds, temperature and moisture content – to ensure that the aerobic process proceeds optimally. The compost product is ready within 6 weeks time. Subsequently the compost will be used as an organic fertilizer in the agricultural fields or landscaping materials. As the anaerobic process in the unmanaged dumping of sewage sludge is avoided, the potential methane generation is eliminated. The system will both reduce methane generation and minimize the risk of soil and water contamination from the landfill site. Thus the project will further minimize the air, soil and water pollution problems in the baseline scenario.

The composting will reduce the negative environmental impact of sewage treatment in terms of anaerobic decay of organic materials in landfill sites and it will make the fertilizer and soil condition values of the composting application in the agricultural fields and landscaping works. In addition, the use of compost will reduce the use of inorganic fertilizer.

The project is a waste management project that will lead to sustainable development through reduced pollution from sewage sludge as well as reduced methane emissions from anaerobic digestion of sewage sludge. The sewage treatment plants will be encouraged to adopt cleaner technology that facilitates the reuse and regeneration of new materials from waste. The project satisfies the environment sustainability by improving air, soil and water quality and minimizing the waste from sewage treatment plants by reusing and regenerating it into a fertilizer product and soil conditioner.

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)
People's Republic of China, (host)	Private entity: PENYAO Environment Protection Group	No
Japan	Private entities: Sanyu and Kubota-gumi	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 small-scale project activity:

A.4.1. Location of the small-scale project activity:

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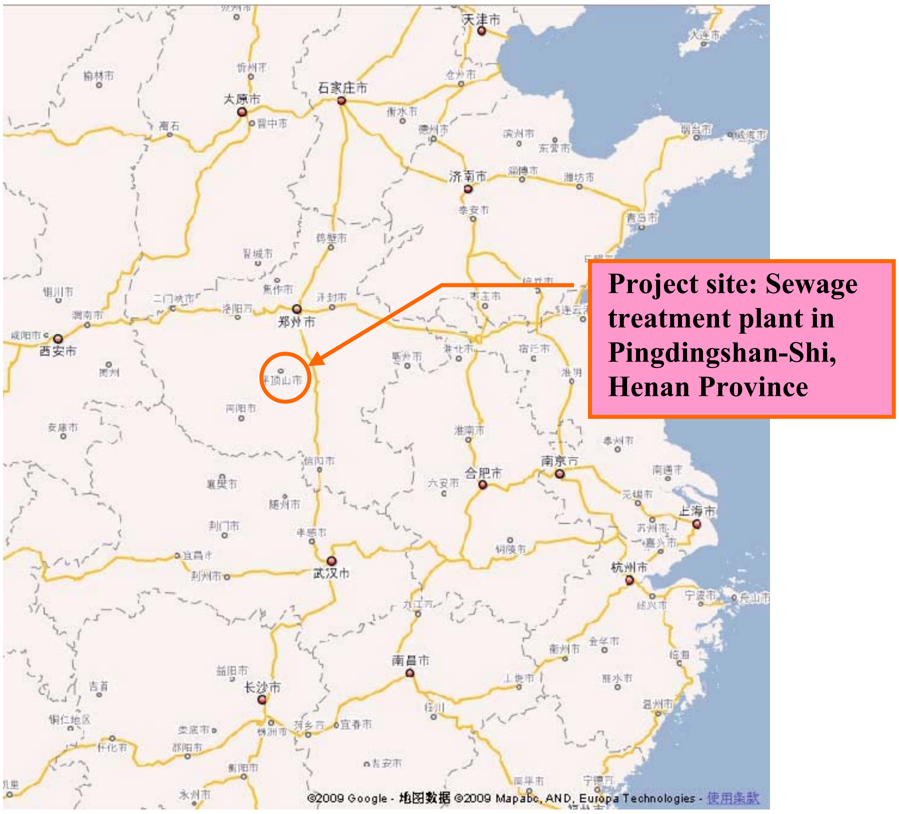
The project location is shown in the China map given below.



A.4.1.1. Host Party(ies):

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The host country is People's Republic of China.

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

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Henan Province / China

A.4.1.3. City/Town/Community etc:

>>
Pingdingshan-Shi

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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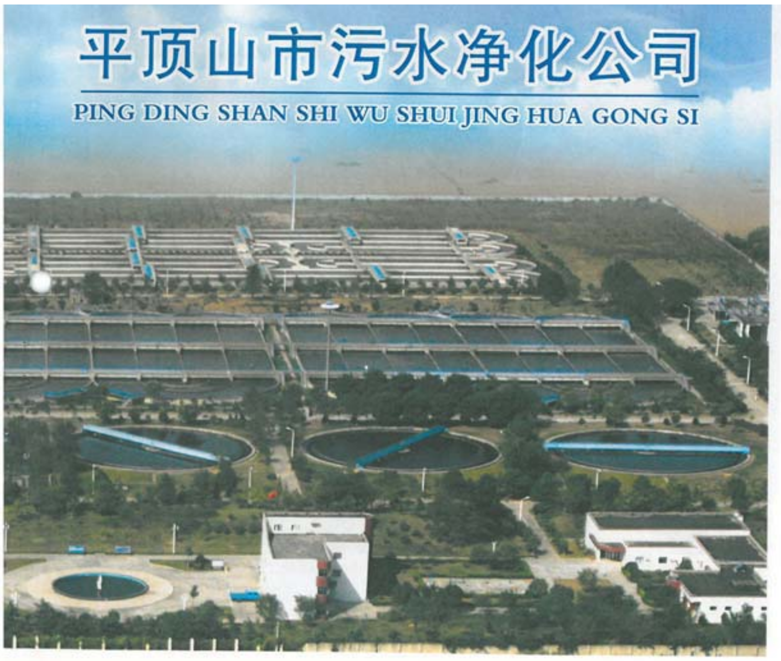
The name and address of the operations manager of Pingdingshan-Shi sewage treatment plant to be involved in this project is given below.

Pingdingshan-Shi Wushui Jinghua Gongsi
13th floor, #27 Construction Building, Heping Road, Xinhua District, Pingdingshan-shi, Henan Province
TEL: +86-375-299-7701
FAX: +86-375-325-2330
GPS coordinates:
+33.767732°N
+113.308868°E



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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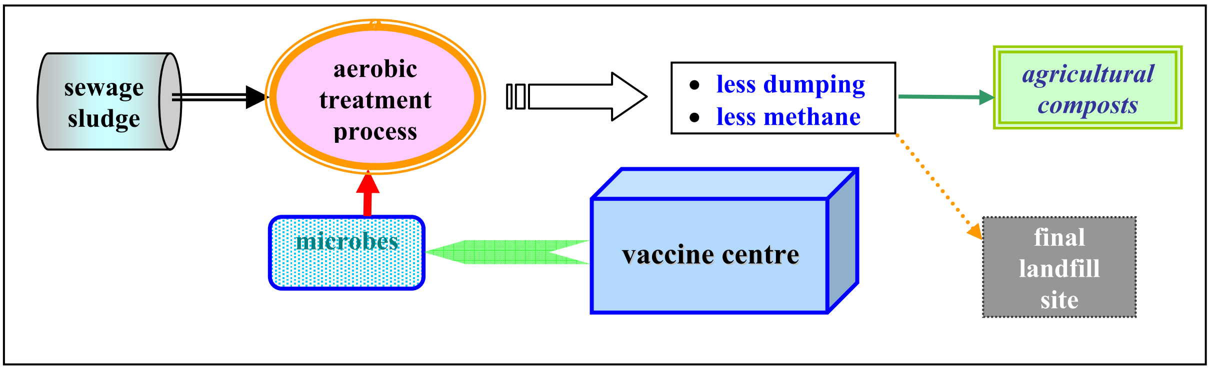
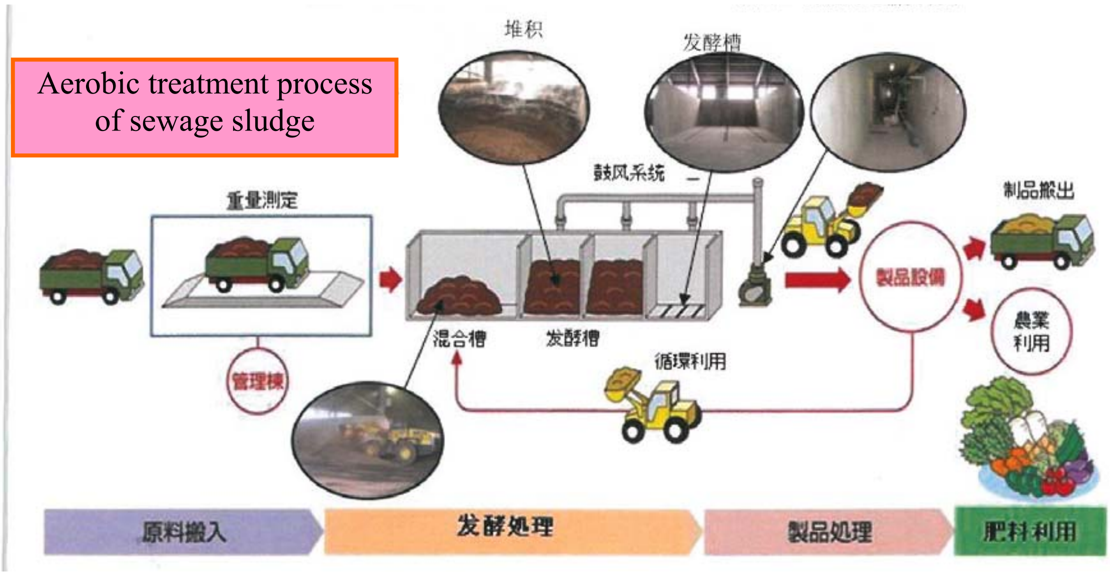
The project is a small scale project activity and falls under the category **III.F.** according to the Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities. It is an "***Avoidance of methane emissions through controlled biological treatment of biomass***" project, avoiding unmanaged sewage sludge dumping. The sewage sludge will be composted aerobically in a YM aerobes composting system.

The project activity will change the conventional way of waste management for sewage sludge. The process in the baseline scenario to treat the sewage sludge is sending to landfill site for unmanaged dumping and the methane emissions from sewage sludge decay are considered significant in this project activity. The emission reduction for this project comes from avoiding methane emissions from the anaerobic sewage sludge decay.





The composting system offers an improved solution to the sewage treatment plant's waste management. The composting system utilises sewage sludge and uses a technically advanced method to convert these waste matters into organic fertiliser and soil conditioner. Sewage sludge is firstly weighed by using a truck scale and then stacked into retaining structure for fermenting mound in a confined composting barn. The fermenting mound is turned regularly by using a wheel loader for better mixing, aeration and temperature control.

The compost is mature after approximately 6 weeks and is ready for use. The compost, being an organic fertiliser, is capable of replacing a major portion of the inorganic fertilisers. In addition it makes it possible to use the compost as a soil conditioner in landscaping works.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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Years	Annual estimation of emission reductions in tonnes of CO_2e
1	145
2	4,988
3	9,548
4	13,844
5	17,889
6	21,698
7	25,286
8	28,664
9	31,846
10	34,843
Total estimated reductions (tonnes of CO_2e)	188,750
Total number of crediting years	10 Years
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	18,875

Note: Please refer to section C.2.1.1. for the starting date of the crediting period

Detail calculations are given Annex 3.

A.4.4. Public funding of the small-scale project activity:

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There is no public funding involved in this project activity.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

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The project activity is not a debundled component of a larger project activity and there is no registered small-scale CDM project activity and will not be applied to register another small-scale CDM project activity:

- With the same project participants; and
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point of a large project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Title of baseline methodology: "***Avoidance of methane emissions through controlled biological treatment of biomass***", **Type III.F./Version 06**, in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities.

B.2 Justification of the choice of the project category:

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Small-scale methodology III.F. is applicable to this project activity as it is composting of sludge biomass in the form of sewage sludge and avoids the generation of methane from sewage sludge decay from unmanaged dumping. The characteristic of the anaerobic decay in the landfill site satisfies the following applicability criteria:

Applicability Criteria in AMS III.F./Version 06	Project Condition
Paragraph 1.: Comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site.	Sewage sludge would have been sent for unmanaged dumping in a solid waste disposal site and left to decay in the absence of the project activity.
Paragraph 1.(a): Aerobic treatment by composting and proper soil application of the compost.	Composting of sewage sludge from sewage treatment plant with proper soil application in agricultural fields and landscaping works.
Paragraph 2.: The project activity does not recover or combust landfill gas from the disposal site (unlike AMS III.G).	This project activity does not recover methane.
Paragraph 2.: The project activity does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS III.E).	This project does not undertake controlled combustion of the waste.
Paragraph 3.: Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	This project activity's overall emission reductions do not exceed 60 ktCO2e as shown in section A.4.3.

B.3. Description of the project boundary:

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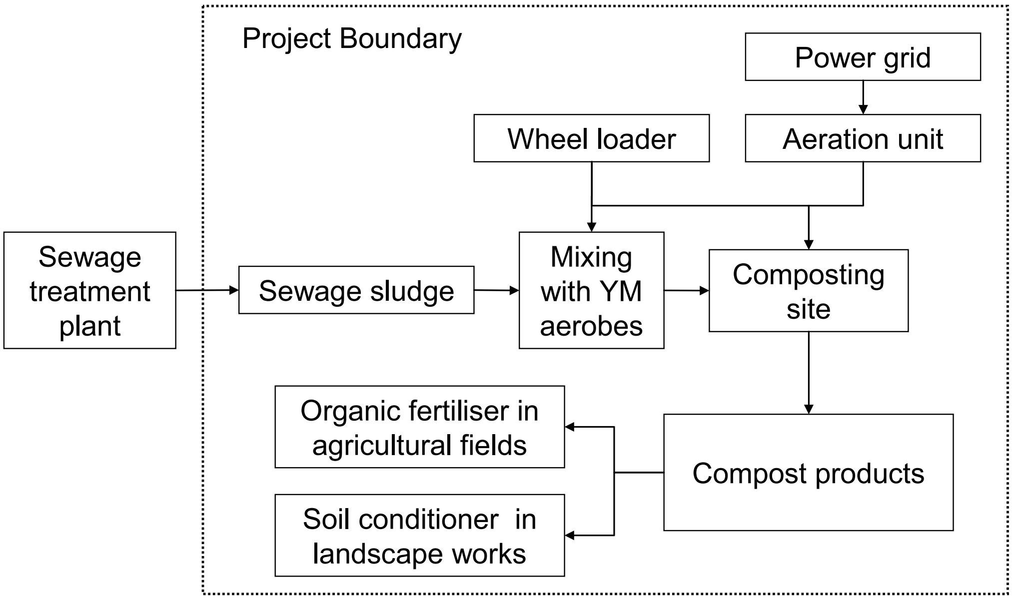
The project boundary is the physical, geographical site, thus it is confined to the project site where the composting is taking place. The GHG and their sources as related to the baseline methodology are:

Sources and types of GHG emissions in baseline and project scenarios

	Source	Gas	Included?	Justification/Explanation
Baseline	Anaerobic decay of unmanaged dumping of sewage sludge in the solid waste disposal site	CO_2	No	Emission originating from biogenic sources are considered carbon-neutral.
		CH_4	Yes	Methane generated from the anaerobic decay of unmanaged sewage sludge dumping.
		N_2O	No	Excluded for simplification. Expected to be minimal.
Project Activity	Transportation	CO_2	Yes	The composting plant is within sewage treatment plant vicinity and sewage sludge is generated from the plant. Thus there will be no incremental transportation for waste. The compost weight will be reduced to less than half of the original waste. This will reduce the baseline transportation of unmanaged sewage sludge dumping. To be conservative emission reduction from reduced transportation is not considered in this project activity.
		CH_4	No	Excluded for simplification. Expected to be minimal.
		N_2O	No	Excluded for simplification. Expected to be minimal.
	Power	CO_2	Yes	The electricity consumption for the additional machineries used in the project activity such as aeration unit is received from the grid. Thus there will be some project emissions from the electricity consumption. Besides there will be some project emissions from diesel consumption for compost turners such as wheel loader.
		CH_4	No	Excluded for simplification. Expected to be minimal.
		N_2O	No	Excluded for simplification. Expected to be minimal.
	Runoff water	CO_2	No	CO_2 emissions from runoff water are carbon neutral. Excluded for simplification. Expected to be minimal.
		CH_4	Yes	The runoff water will be minimal because sewage sludge will be dewatered by dewatering process. The project emission from this source will be monitored before composting process.
		N_2O	No	Excluded for simplification. Expected to be

				minimal.
	Composting process	CO_2	No	CO_2 emissions from composting process are carbon neutral. Excluded for simplification. Expected to be minimal.
		CH_4	Yes	The methane emissions from the composting process will be monitored in this project activity.
		N_2O	No	Excluded for simplification. Expected to be minimal.



Emission reductions

The project boundary is the physical composting plant. Waste products such as sewage sludge generated from the sewage treatment plant will be sent to composting plants located within the sewage treatment plant. Emission reductions are achieved by avoiding anaerobic digestion of sewage sludge in landfill site. The composting process will be aerobic. The fermenting mound will be turned periodically to ensure high oxygen levels in the fermenting mound to promote aerobic decomposition.

Sewage sludge would have been sent for unmanaged dumping in the baseline scenario. There would have been some methane emissions from anaerobic decomposition of sewage sludge.

Project emissions

Project emissions from composting process
The composting process is a controlled process, where mechanical aeration is carried out to ensure aerobic digestion and optimum composting conditions. Anaerobic digestion is not desirable as this will reduce the quality of the final compost e.g. reduced PH level and increased bacterial pathogen.

Nevertheless there might be some anaerobic pockets in the fermenting mound where potential methane could be generated. Thus the project takes into account the methane emission from composting of sewage sludge as per the requirement in the approved small-scale methodology AMS III.F Version 06.

Project emissions from transportation
The collection point of sewage sludge and the composting plant as compared to the baseline: As described earlier, the composting plant is within the sewage treatment plant compound and there is no significant increment in distance and emissions compared to the baseline.

Transportation of compost to the soil application site: The transportation for applying compost will be less than the transportation used for sending sewage sludge for unmanaged dumping into landfill sites. In the baseline sewage sludge is transported on transit vehicles such as dump truck to the landfill site, which incur emissions from combustion of diesel. In the project activity the compost will be transported in a similar manner, but as the compost is reduced to about less than half the volume and weight compared to whole sewage sludge and the amount of transport is reduced, thus the emissions are reduced. To be conservative the reduced emissions from transportation of compost compared to sewage sludge is not included in the project activity.

Project emissions from power consumption
The sewage sludge need to be mixed with YM aerobes before it can be used for composting by using a fossil fuel powered turning machine. The fossil fuel is supplied from the vicinity's existing gas station. This power source is considered to lead to increase in emissions. Mechanical aeration of compost is done by turning the fermenting mound of mixed sewage sludge and YM aerobes periodically with compost shuffling machines such as wheel loader to be powered by diesel fuel.
Besides aerated flow by using an electrical powered aeration device will utilize electricity to be supplied from the local electricity grid.

The project emission from the diesel consumption and the electricity consumption will be monitored for this project activity.

Project emissions from runoff water
The composting plant will have a perimeter drain to collect leachate from sewage sludge and the water from the perimeter drain is defined as runoff water. Nevertheless the runoff water will be minimal because sewage sludge will be dewatered by dewatering process. To make assurance double sure, the project emission from runoff water will be monitored.

Leakage

The technology and machinery for the project activity is not transferred from another activity, thus no leakage is considered to take place.

B.4. Description of baseline and its development:

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Sewage treatment plants defecate sewage sludge from sewage water in the sewage purification treatment process. Sewage sludge contains a high level of TOC, which need to be reduced before dumping to the local solid waste disposal sites. The sewage sludge would have been sent for unmanaged dumping into the landfill sites and the source for anthropogenic emission is the anaerobic decay of organic waste in the baseline scenario.

The project will divert the sewage sludge from the landfill sites to the composting plant. With CDM support, PENYAO Environment protection Group (hereinafter referred to as PENYAO) will be able to use the income from CERs sales to the project in the Pingdingshan-Shi sewage treatment plant which is operated and managed by Pingdingshan-Shi Wushui Jinghua Gongsi. PENYAO management would not have invested in the project if no revenue from CDM to be contributed to the project. The baseline scenario of unmanaged sewage sludge dumping would have continued.

Key information, assumption and data to determine the baseline scenario and the project scenario are presented in the table below.

The key assumption figures

No	Parameters	Value	Unit	Source	Justification
1	Operation time	2,555	hr/yr	PENYAO	Only used in the PDD for estimation of sewage sludge from the plant.
2	Sewage sludge generation	200	tons/day	PENYAO	Only used in the PDD for estimation of sewage sludge from the plant.
3	$COD_{ww,untreated}$	0.080	$kg\text{-}COD/m^3$	PENYAO	Only used in the PDD for emission reduction estimation. The actual lab measurement value from the respective plant will be used during monitoring and verification of CERs.
4	Methane generation, $B_{o,ww}$	0.21	$kg\text{-}CH_4/kg\text{-}COD$	AMS III.F/Ver.06	IPCC default value for domestic wastewater
5	GHG factor	21	-	IPCC	-
6	$MCF_{ww,runoff}$	0.8	-	AMS III.F/Ver.06	Runoff water is treated in anaerobic ditch in the baseline scenario
7	Diesel density, D_{diesel}	0.85	kg/liter	PENYAO	Data of one of the major diesel supplier in China

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 small-scale CDM project activity:

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This section describes how the emissions are reduced below those that would have occurred in the absence of the project activity. Additionality is demonstrated through an investment barrier, i.e. a financially more viable alternative to the project activity would have led to higher emissions, in accordance with Attachment A to Appendix B of simplified modalities and procedures for small-scale CDM project activities. The demonstration of investment barriers is guided by the use of the "Tool for the demonstration and assessment of additionality", Version 05.2, EB 39, Annex 10.

Preliminary screening based on the starting date of the project activity

Chronology of Events

Sanyu, Kubota-gumi and PENYAO have been cooperating on CDM since early 2009. The cooperation with the Japanese Government started on 15 July 2009, where Sanyu and Kubota-gumi proposed to the Japanese Government to work on CDM with PENYAO. This was during the period Japanese mission to China was carried out to identify the need for CDM capacity building and potential for project development.

The evidence to indicate the initiatives to develop a CDM composting project can be clearly seen in a document named "Letter of Intent (LoI)" which was signed on 15 December 2009 between Sanyu, Kubota-gumi and the project developer, PENYAO.

The turnkey agreement to develop composting project at Pingdingshan-Shi sewage treatment plant was signed on 01 July 2010 which constitutes the project starting date.

Please refer to section C.1.1 for the full chronology of events of the CDM project development.

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

Sub-step 1a: define alternatives to the project activity

If the composting project is not undertaken as CDM project activity, it could be a realistic alternative. Besides reducing methane emission, the composting project will be able to provide a better use for the abundantly available sewage sludge. The Chinese technology policy recommends proper disposal and the best way to dispose sewage sludge would be composting it in fermenting mound. Even though the project involves some capital investment, it can be easily shown feasible with its CDM contribution in investment analysis.

An alternative that would deliver approximately the same services as the proposed project activity is to dispose into closed landfill sites to collect generated biogas (methane) and flare it. However this is not a likely scenario, as there is no law or regulation to direct sewage treatment plants to capture the gas and flare it from closed solid waste disposal sites. The other option is to generate electricity from biogas to be generated from anaerobic decay of sewage sludge in landfill sites and supply it to the grid. However this will require huge investment in biogas capture, gas scrubber, gas engine and transmission line to inject the power to the local grid. This alternative could be another CDM project if investment analysis shows positive result.

Another alternative is to build up in-situ aeration of landfill sites to avoid methane generation from anaerobic decay of sewage sludge in the baseline. Again this is not a likely scenario as this would require large land area improvement and energy consumption for aeration etc., which would be more feasible to remain unmanaged dumping of organic waste.

The continuation of current situation is to treat sewage sludge in unmanaged open dumping. Most of the sewage treatment plants in China are treating sewage sludge in unmanaged open dumping. In the absence of the CDM project activity, the current situation will continue as this is an effective way of treating the sewage sludge and there are no laws and regulations being opposing anaerobic treatment and emission of methane to the atmosphere.

Sub-step 1b: Enforcement of applicable laws and regulations
The project activity and all the alternatives are in compliance with existing laws and regulations since both are capable of reducing environmental impacts of the baseline scenario. Even in the baseline scenario, the unmanaged dumping of sewage sludge is already complying with the local environmental standards.

Step 2: Investment analysis

Sub-step 2a: Determine appropriate analysis method
A benchmark analysis has been carried out with and without CDM support to demonstrate additionality. Option 1 is applied as the project generates economic benefits as described below.

Sub-step 2b: Option I. Apply simple cost analysis
This step is not applicable as the project generates economic benefits from the produced compost other than CDM related income.

Sub-step 2b: Option II. Apply investment comparison analysis
This option is not selected and benchmark analysis is applied.

Sub-step 2b: Option III. Apply benchmark analysis
A benchmark analysis was done to calculate the financial feasibility at different CER price with a financial indicator Internal Return Rate (IRR). The project proponent will only invest in a project with a positive cash flow and an IRR of more than 6% per annum.

The benchmark used for the calculation is based on the expected return on investment by the PENYAO. This benchmark is verified by the interest rate of credit for investment by commercial banks in China. Under the benchmark analysis, the IRR of the project activity should be compared with a reasonable benchmark. The selected benchmark is the interest rate of credit for investment by commercial banks in China, which is thought to be appropriate considering of the project activity characteristics.

That value at the time of the PDD completion is 5.94-7.72%, according to the open-to-public website by the People's Bank of China, the China's central bank. However the 6% benchmark will be the company targeted figure for new investments in order to achieve a higher target for the group for the following years. Thus the benchmark of 6% is deemed to be appropriate to be used for this project activity.

Sub-step 2c: Calculation and comparison of financial indicators
The summary of the feasibility study results are tabulated below.

CER Price (USD/tCO_2e)	0	6	12
IRR (%)	5.4%	7.7%	9.7%

The results from the table above indicate that without CDM the project has a 5.4% IRR. To meet the investment criteria of the project proponent, the CER price must be above \$6/tCO_2e. The investment analysis was made for 10 years based on depreciation rates adopted according to PENYAO accounting policies.

The critical input values to the investment analysis are given in the table below with justifications.

No.	Input Value	Justification
1	Revenue from the compost	Annual revenue from compost is derived by multiplying the quantity of compost produced and the compost price. 60ton/day * 365day/year * 100yuan/ton = 2,190,000yuan/year The price of compost is calculated based on substitution of the value of inorganic fertiliser. The price of 100yuan/ton was determined by using average price from year 2007-2009.
2	Saving of sewage sludge disposal cost	The cost of sewage sludge is considered to be zero since the value of sewage sludge is not able to be anticipated in waste trade market. On the other hand the saving of sewage sludge disposal cost for waste receiving business is derived by multiplying the quantity of sewage sludge and the disposal price. 200ton/day * 365day/year * 145yuan/ton = 10,585,000yuan/year
3	Cost of inoculum YM aerobes	The cost of inoculum YM aerobes is based on the contract price with the supplier Sanyu which is 25yuan/ton. Source of the price is "Composting Accelerant YM aerobes Purchase Agreement" between PENYAO and Sanyu. 200t-sludge/day * 365day/year * 25yuan/t- sludge = 1,825,000yuan/year
4	Cost of electricity	Cost of electricity was calculated based on the tariff of 0.6yuan/kWh. 2,630kWh/day * 365day/year * 0.6yuan/kWh = 576,000yuan/year
5	Cost of fuel	Cost of fuel was calculated based on the price of 6yuan/liter. 388liter/day * 365day/year * 6yuan/liter = 850,000yuan/year

The detailed investment analysis spreadsheets with and without CDM are attached in Annex 5.

Sub-step 2d: Sensitivity analysis
The project sensitivity analysis is made for 4 scenarios as given below and the discussion on why it is not possible for the variations to reach the project IRR benchmark is described in the paragraphs below.

a) Compost production

b) Investment cost
c) Compost price
d) Operation & maintenance cost

a) Compost production
The project is sensitive to the amount of compost produced. The IRR calculation in the baseline uses maximum amount of compost which can be produced in a year based on the project design capacity.

However to reach to the benchmark of 6% the compost production need to be increased by 108%. Since the plant is already operating at 365days of operation. Increasing 108% is impossible even with no shut down for maintenance. Thus this situation is unlikely to happen.

Compost production (%)	100%	108%
Compost production (ton/day)	60ton/day	65ton/day
IRR (%)	5.4%	6%

b) Investment cost
Even with 95% of predetermined investment cost the project IRR is still under 6%. It will be impossible to build a composting plant with 95% of predetermined investment by project proponent, PENYAO. This is a very unlikely scenario as the technology provider will not be able to design and deliver the same capacity of composting plant for 95% of cost.

Investment (%)	100%	95%
Investment (million yuan)	39 million yuan	37 million yuan
IRR (%)	5.4%	6%

c) Compost price
Increase in 110% of the compost price will make the project to reach the project proponents benchmark of 6%. However in reality there was no market for organic fertiliser at the point where decision was made to go ahead with the CDM project activity. The compost price was estimated based on the displacement cost of inorganic fertiliser. Thus a sharp increase in the compost price is indicated by a sharp increase in the demand for compost within a short period.

This is a very unlikely scenario as there is not so much demand for organic fertiliser within the country. The compost produced in the project activity is to be sold to the local market as organic fertilisers in agricultural fields and/or soil conditioner in landscaping works. However additional investment needs to be made for compost drying and packing facilities to export the compost products. Thus this is a very unlikely scenario without CDM support.

Compost price (%)	100%	110%
Compost price (yuan/ton)	100yuan/ton	110yuan/ton
IRR (%)	5.4%	6%

d) Operation & maintenance cost
The operation cost (e.g sewage sludge, YM aerobes, electricity, diesel and labour cost) is directly linked to the quantity of compost products. Decrease in the operation cost will also indicate decrease in compost products. It is very unlikely that O&M cost decreases until 88%. O&M cost is likely to increase due to inflation and unlikely to decrease (e.g increment salaries to be paid, wear and tear of spare and so forth).

Furthermore, during the first few years of project implementation, there will be additional cost incurred due fine turning process of operation and unexpected breakdowns or more frequent maintenance of composting plant. The compost turner is a customised machine assembled by the technology provider, Kubota-gumi. Thus the spares and maintenance cost for such equipment will be usually high. Lower O&M cost is an unlikely situation to occur.

Investment (%)	100%	88%
Operation cost (million yuan)	1.6 million yuan	1.4 million yuan
IRR (%)	5.4%	6%

Step 3: Barrier analysis
The proposed project activity, aerobic digestion (i.e. composting) of sewage sludge by using YM aerobes, faces a barrier that prevents the implementation of this type of proposed project activity. The barrier due to prevailing current practice, unmanaged open dumping of sewage sludge in solid waste disposal sites, is extensively observed in China.

Besides the project activity is the “first of its kind” in terms of disposal technology of sewage sludge by using YM aerobes in China. Skilled and/or properly trained labour to operate and maintain the technology is not available in China, which leads to an unacceptably high risk of equipment disrepair and malfunctioning or other underperformance. Lack of infrastructure for implementation and logistics for maintenance of the technology and risk of technological failure is significantly greater compared to prevailing current practice.

Thus the project proponent will not be able to implement the project activity unless the aerobic digestion technology of sewage sludge by using YM aerobes is transferred from Sanyu and Kubota-gumi with the support of CDM

Step 4: Common practice analysis
The common practice in the industry is to send the sewage sludge into solid waste disposal sites for unmanaged open dumping and left to decay naturally. There is no similar composting activity prior to the proposed project activity. The proposed project type has demonstrated to be first-of-its kind according to Step 3 mentioned above.

Based on the step by step additionality analysis mentioned above the project is proven to be additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The formula applied to estimate the emission reductions are obtained from description on paragraph 4, 5, 6, 8 and 9 in Appendix B of category III.F, "Avoidance of methane emissions through controlled biological treatment of biomass" Version 06.

Below are the formulae extracted from the Appendix B of category III.F for calculations of project emissions, leakage, baseline emissions and emission reductions.

Baseline emissions

$$BE_y = BE_{CH4,SWDS,y} - (MD_{y,reg} * GWP\_CH_4) + (MEP_{y,ww} * GWP\_CH_4) \qquad (1)$$

Where:

$BE_{CH4,SWDS,y}$	Yearly methane generation potential of the sewage sludge to be composted by the project activity during the years "x" from the beginning of the project activity (x=1) up to the year y estimated as per the 'Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site' (tCO_2e)
$MD_{y,reg}$	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne)
$MEP_{y,ww}$	Methane emission potential in the year y of the wastewater co-composted. The value of this term is zero if co-composting of wastewater is not included in the project activity (tonne)
GWP_CH_4	GWP for CH_4 (value of 21 is used)

<u>Methane generation potential of the sewage sludge to be composted</u>
The sewage sludge is sent for unmanaged open dumping in the solid waste disposal sites in the baseline scenario. The methane emissions from unmanaged open dumping of sewage sludge is calculated by using "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site", Version 04, EB41.

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-kj(y-x)} \cdot (1-e^{-kj}) \qquad (2)$$

Where:

$BE_{CH4,SWDS,y}$	Methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e)
ϕ	Model correction factor to account for model uncertainties (0.9)
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH4}	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)

DOC_f Fraction of degradable organic carbon (DOC) that can decompose
MCF Methane correction factor
$W_{j,x}$ Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons), in other words, quantity of sewage sludge to be treated aerobically in the year x (tons)
DOC_j Fraction of degradable organic carbon (by weight) in the waste type j
K_j Decay rate for the waste type j
i Waste type category (index)
x Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)
y Year for which methane emissions are calculated

<u>Amount of methane that would have to be captured and combusted</u>
No methane is captured and combusted from landfill sites in the baseline scenario to comply with the prevailing regulations. Methane is released from landfill sites without methane capture and combustion as this practice still comply with prevailing regulations in China.

$$ME_{y,reg} = 0 \quad (3)$$

<u>Methane emission potential of the wastewater co-composted</u>
Methane emission potential of co-composted wastewater is estimated as:

$$MEP_{y,ww} = Q_{y,ww,in} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,treatment} * UF_b \quad (4)$$

Where:
$Q_{y,ww,in}$ Volume of wastewater entering the co-composting facility in the year y (m^3)
$COD_{y,ww,untreated}$ Chemical oxygen demand of the wastewater entering the co-composting facility in the year y ($tonnes/m^3$)
$B_{o,ww}$ Methane producing capacity for the wastewater (IPCC default value for domestic wastewater of 0.21 kg CH_4/kg.COD)
$MCF_{ww,treatment}$ Methane correction factor for the wastewater treatment system in the baseline scenario (MCF value as per table III.F.1)
UF_b Model correction factor to account for model uncertainties (0.94)

The Methane Correction Factor (MCF) shall be determined based on the following table:

Table III.F.1. IPCC default values3 for Methane Correction Factor (MCF)

Type of wastewater treatment and discharge pathway or system	MCF value
Discharge of wastewater to sea, river or lake	0.1
Aerobic treatment, well managed	0
Aerobic treatment, poorly managed or overloaded	0.3
Anaerobic digester for sludge without methane recovery	0.8
Anaerobic reactor without methane recovery	0.8
Anaerobic shallow lagoon (depth less than 2 metres)	0.2
Anaerobic deep lagoon (depth more than 2 metres)	0.8
Septic system	0.5

However, co-composting of wastewater is not included in the project activity. Thus methane emission potential in the year y of the wastewater co-composted is zero.

$MEP_{y,ww} = 0$ (5)

The formula for calculating baseline emissions for this project activity can be simplified as shown below.

$BE_y = BE_{CH4,SWDS,y}$ (6)

Project emissions

$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,phy\ leakage} + PE_{y,comp} + PE_{y,runoff} + PE_{y,res\ waste}$ (7)

Where:

PE_y	Project activity emissions in the year y (tCO_2e)
$PE_{y,transp}$	Emissions from incremental transportation in the year y (tCO_2e), which is considered to be zero as described section B.3
$PE_{y,power}$	Emissions from electricity or fossil fuel consumption in the year y (tCO_2e)
$PE_{y,phy}$	leakage In case of anaerobic digestion: methane emissions from physical leakages of the anaerobic digester in year y (tCO_2e)
$PE_{y,comp}$	In case of composting: methane emissions during composting process in the year y (tCO_2e)
$PE_{y,runoff}$	In case of composting: methane emissions from runoff water in the year y (tCO_2e)
$PE_{y,res\ waste}$	In case residual waste/slurry/products are subjected to anaerobic storage or disposed in a landfill: methane emissions from the anaerobic decay of the residual waste/products (tCO_2e)

Project emissions from incremental transportation

The project emissions from transportation of compost to agricultural fields or landscaping works will be lower than the emissions from baseline transportation. The baseline transportation is accumulative distance from Pingdingshan-Shi sewage treatment plant to landfill sites for unmanaged open dumping.

Quantity of final compost will be approximately less than half of the quantity of sewage sludge. Thus there will be net reduction in transportation due to the project activity. More justification is given in the section B.3.

$PE_{y,transp} = (Q_{y,s/s} / CT_y) * DAF_w * EF_{CO2} * (Q_{y,compost} / CT_{y,compost}) * DAF_{compost} * EF_{CO2}$ (8)

Where:

$Q_{y,s/s}$	Quantity of sewage sludge to be treated aerobically in the year y (tonnes)
CT_y	Average truck capacity for sewage sludge transportation (tonnes/truck)
DAF_w	Average incremental distance for sewage sludge and/or wastewater transportation (km/truck)
EF_{CO2}	CO_2 emission factor from fuel use due to transportation ($kgCO_2$/km, IPCC default values or local values may be used)
$Q_{y,compost}$	Quantity of compost produced in year y (tonnes)
$CT_{y,compost}$	Average truck capacity for compost transportation (tonnes/truck)
$DAF_{compost}$	Average distance for compost transportation (km/truck)

To be conservative the emission reductions from transportation is considered to be zero as the project emissions from transportation will be lower than baseline emissions from transporting sewage sludge due to lower volume and weight of compost.

$PE_{y,transp} = 0$ (9)

Project emissions from power consumption (electricity/diesel)
The power supplied to the fermenting mound aeration equipment is supplied from the local electricity grid. Besides there will be some diesel consumption by machineries such as wheel loader at the composting plant.

Emission factors for grid electricity used shall be calculated as described in AMS I.D. For project activity emissions from fossil fuel consumption the emission factor for the fossil fuel shall be used (tCO_2/tonne). Local values are to be used, if local values are difficult to obtain, IPCC default values may be used. The project emission from diesel source will be monitored in this project activity. The formulae for project emissions from power (electricity & diesel fuel) consumption will be as shown below.

$$PE_{y,power} = PE_{y,elec} + PE_{y,diesel} = Q_{y,elec} * CEF_{grid} + Q_{y,diesel} * D_{diesel} * EF_{diesel} * 10^{-3} \quad (10)$$

Where:

$PE_{y,elec}$	Project emission from electricity consumption in the year y (tCO_2e)
$PE_{y,diesel}$	Project emission from diesel oil consumption in the year y (tCO_2e)
$Q_{y,elec}$	Amount of electricity used at the composting plant in the year y (MWh)
CEF_{grid}	CO_2 emission factor for electricity consumed (tCO_2e/MWh)
$Q_{y,diesel}$	Amount of diesel oil used at the composting plant in the year y (liter)
D_{diesel}	diesel oil density at standard temperature and pressure (kg/liter)
EF_{diesel}	CO_2 emission factor for diesel engines ($kgCO_2e$/kg)

Project emissions from physical leakages of the anaerobic digester
In case of the controlled anaerobic digestion of biomass methane emissions due to physical leakages from the digester and recovery system (PEy,phy leakage) shall be considered in the calculation of project emissions. The physical leakage emissions are estimated as follows:

$$PE_{y,phy\ leakage} = Q_{y,s/s} * EF_{anaerobic} * GWP\_CH_4 \quad (11)$$

Where:

$EF_{anaerobic}$	Emission factor for anaerobic digestion of organic waste (t CH4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default values are 2 g CH_4/kg waste treated on a dry weight basis and 1 g CH_4/kg waste treated on a wet weight basis

However, sewage sludge is not treated in any biodigesters in this project activity. Thus, project emissions from physical leakages of anaerobic digester are not applicable for this project activity.

$PE_{y,phy\ leakage} = 0$ (12)

Project emissions during composting process
Methane emissions during composting ($PE_{y,comp}$) shall be calculated as follows:

$PE_{y,comp} = Q_{y,s/s} * EF_{composting} * GWP\_CH_4$ (13)

Where:

$EF_{composting}$ Emission factor for composting of organic waste (t CH_4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default values are 10 g CH_4/kg waste treated on a dry weight basis and 4 g CH_4/kg waste treated on a wet weight basis

Project emissions from runoff water

The runoff water will be minimal because sewage sludge will be dewatered by dewatering process. To make assurance double sure, the project emission from runoff water will be monitored.

Project emissions from runoff water from the composting facility ($PE_{y,runoff}$) are calculated as follows:

$PE_{y,runoff} = Q_{y,runoff} * COD_{y,runoff} * B_{o,ww} * MCF_{ww,treatment} * UF_b * GWP\_CH_4$ (14)

Where:

$Q_{y,ww,runoff}$ Volume of runoff water in the year y (m^3)

$COD_{y,runoff}$ Chemical oxygen demand of the runoff water leaving the composting facility in the year y (tonnes/m^3)

$B_{o,ww}$ Methane producing capacity of the wastewater (IPCC default value for domestic wastewater of 0.21 kg CH_4/kg COD)

$MCF_{ww,runoff}$ Methane correction factor for the wastewater treatment system where the runoff water is treated (MCF value as per table III.F.1)

UF_b Model correction factor to account for model uncertainties (1.06)

To be conservative, the MCF value of 0.1 is selected as the water is discharged to river of lake. The total project emissions from runoff water will be monitored in this project activity even though the amount is insignificant.

Project emissions from the anaerobic decay of the residual waste/products

Methane emissions from anaerobic storage and/or disposal in a landfill of the residual waste/products/compost from the biological treatment ($PE_{y,res\ waste}$) are calculated as per the “Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site”.

However, the final compost will be evenly applied in agricultural fields or landscaping works. Thus it is unlikely that the final compost will be subject to anaerobic storage or disposal in landfill sited which may cause methane emissions from anaerobic decay of final compost thus the project emissions from this source are considered insignificant for this project scenario.

$PE_{y,res\ waste} = 0$ (15)

The formulae for project emissions can be summarized as shown below based on the arguments presented earlier in this section:

$PE_y = PE_{y,power} + PE_{y,comp} + PE_{y,runoff}$ (16)

Leakage

There will be no leakage in composting project as all equipments to be used in the project activity are brand new and bought for the purpose of the project activity. No equipment or treatment technology will be transferred from another activity or no existing equipment will be transferred to another activity.

Emission reduction

In the case of construction of new composting facilities, the emission reduction achieved by the project activity will be measured as the difference between the baseline emission and the sum of the project emission and leakage.

$ER_y = BE_y - (PE_y + LE_y)$ (17)

Where:

ER_y Emission reduction in the year y (tCO2e)

LE_y Leakage emissions in year y (tCO2e)

Since there is no significant leakage in this project activity, the emission reduction can be calculated by using simplified formula given below.

$ER_y = BE_y - PE_y$ (18)

No other additional formula will be used for calculating emission reduction other than those provided in this section.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$B_{o,ww}$
Data unit:	kg CH_4/kg COD
Description:	Methane production capacity for the runoff water
Source of data used:	AMS III.F
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value as defined in AMS III.F
Any comment:	-

Data / Parameter:	$MCF_{ww,runoff}$
Data unit:	-
Description:	Methane correction factor for the wastewater treatment system where the runoff water is treated
Source of data used:	AMS III.F
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	To be conservative the MCF higher value is selected as defined in AMS III.F.
Any comment:	-

Data / Parameter:	**GWP_CH_4**
Data unit:	-
Description:	The global warming potential (GWP) for CH_4
Source of data used:	AMS III.F
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value as defined in AMS III.F
Any comment:	-

Data / Parameter:	CEF_{grid}
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for electricity consumed
Source of data used:	Official data from National Development and Reform Commission (NDRC), People's Republic of China

Value applied:	0.9735
Justification of the choice of data or description of measurement methods and procedures actually applied :	The project activity will use electricity from the Chinese grid. Calculation of CEF_{grid} is realized according to the latest version of "Tool to calculate the emission factor for an electricity system".
Any comment:	Value will be adjusted at the beginning of each crediting period.

Data / Parameter:	$\mathbf{D_{diesel}}$
Data unit:	kg/liter
Description:	Diesel oil density at standard temperature and pressure
Source of data used:	Data of one of the major diesel supplier in China
Value applied:	0.85
Justification of the choice of data or description of measurement methods and procedures actually applied :	Adopted from material data of one of the major diesel supplier in China
Any comment:	-

Data / Parameter:	$\mathbf{EF_{diesel}}$
Data unit:	gCO_2/kg diesel
Description:	CO_2 emission factor for diesel engines
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	3,186
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Table 1.2, page 1.18 and Table 3.2.1, page 3.16, default net calorific value, NCV for diesel is 43 TJ/Gg and default emission factor for diesel is 74,100kg/TJ. Multiplying both values will result in the emission factor given above. 43(TJ/Gg diesel) * 74,100($kgCO_2$/TJ) = 3,186(gCO_2/g diesel) To be conservative it is estimated that the wheel loader to be used in the composting plant will be heavy duty diesel engines.
Any comment:	-

Data / Parameter:	$\mathbf{EF_{composting}}$
Data unit:	kg CH_4/tonne sludge
Description:	Emission factor for composting of organic waste
Source of data used:	2006 IPCC (Table 4.1, Chapter 4, Volume 5, IPCC Guidelines for National Greenhouse Gas Inventories)
Value applied:	10
Justification of the choice of data or description of measurement methods and procedures actually	This value is selected as weight of sewage sludge is measured on dry basis before sent to the composting plant with taking into account both weight of sewage sludge on wet basis and moisture content of sewage sludge.

applied :	
Any comment:	-

Data / Parameter:	φ
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41.
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41.
Any comment:	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. 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% is applied to the model results.

Data / Parameter:	**OX**
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41.
Value applied:	Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Use 0 for other types of solid waste disposal sites.
Justification of the choice of data or description of measurement methods and procedures actually applied :	Conduct a site visit at the solid waste disposal site in order to assess the type of cover of the solid waste disposal site. Use the IPCC 2006 Guidelines for National Greenhouse Gas Inventories for the choice of the value to be applied.
Any comment:	-

Data / Parameter:	**F**
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41.
Value applied:	0.5
Justification of the choice of data or description of measurement methods	IPCC 2006 Guidelines for National Greenhouse Gas Inventories

and procedures actually applied :	
Any comment:	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.

Data / Parameter:	**DOC_f**
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41.
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Any comment:	-

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane correction factor
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41.
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	The sewage sludge is dumped in an unmanaged open waste disposal site. The dumping of sewage sludge do meet the criteria of managed SWDS according to the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41" the dumpsite have depth of greater than 5 meters. According to IPCC 2006 Guidelines for National Greenhouse Gas Inventories, use the following values for MCF: • 1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste; • 0.5 for semi-aerobic managed solid waste disposal sites. These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system; • 0.8 for unmanaged solid waste disposal sites - deep and/or with high water table. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters and/or high water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by

	waste; • 0.4 for unmanaged-shallow solid waste disposal sites. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres.
Any comment:	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.

Data / Parameter:	**k_j**
Data unit:	-
Description:	Decay rate for the waste type j
Source of data used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41. IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value applied:	0.06
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the Tool, project participants should apply the following default values for the different waste types j:

Waste type j		**Boreal and Temperate (MAT≤20°C)**		**Tropical (MAT>20°C)**	
		Dry (MAP/PET <1)	**Wet (MAP/PET >1)**	**Dry (MAP< 1000mm)**	**Wet (MAP> 1000mm)**
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.04	0.06	0.045	0.07
	Wood, wood products and straw	0.02	0.03	0.025	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.05	0.10	0.065	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.06	0.185	0.085	0.40

NB: MAT - mean annual temperature, MAP - Mean annual precipitation, PET - potential evapotranspiration. MAP/PET is the ratio between the mean annual precipitation and the potential evapotranspiration.

If a waste type, prevented from disposal by the proposed CDM project activity, can not clearly be attributed to one of the waste types in the table above, project participants should choose among the waste types that have similar

	characteristics that waste type where the values of DOC_j and k_j result in a conservative estimate (lowest emissions), or request a revision of / deviation from this methodology. In the case of empty fruit bunches (EFB), as their characteristics are similar to garden waste, the parameter values correspondent of garden waste shall be used. The characteristic of the sewage sludge is the same as “sewage sludge” in the Table, the parameter value correspond to “sewage sludge” is used where the decay will be at rapid rate. The project site is located in a boreal climate with MAT under 20°C and MAP/PET <1.
Any comment:	Document in the CDM-PDD the climatic conditions at the SWDS site (temperature, precipitation and, where applicable, evapotranspiration). Use long-term averages based on statistical data, where available. Provide references.

B.6.3 Ex-ante calculation of emission reductions:

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Please refer to Annex 3 for detailed calculation of baseline emissions, project emissions and emission reductions.

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

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Year	Estimation of baseline emissions (tCO_2e)	Estimation of project activity emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
1	5,142	4,997	0	145
2	9,985	4,997	0	4,988
3	14,546	4,997	0	9,548
4	18,841	4,997	0	13,844
5	22,886	4,997	0	17,889
6	26,695	4,997	0	21,698
7	30,283	4,997	0	25,286
8	33,662	4,997	0	28,664
9	36,844	4,997	0	31,846
10	39,840	4,997	0	34,843
Total (tCO_2e)	**238,724**	**49,974**	**0**	**188,750**

** please refer to section C.2.1.1 for the starting date*

Detailed calculation is given in the Annex 3.

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

Title of the approved monitoring methodology is ***"Avoidance of methane emissions through controlled biological treatment of biomass",*** **Type III.F, Version 06,** in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities.

The justification of the applicability of this methodology has been discussed in section B.2.

B.7.1 Data and parameters monitored:

Data / Parameter:	**$Q_{y,s/s}$ (i.e. $W_{j,x}$)**
Data unit:	tonne
Description:	Quantity of sewage sludge to be treated aerobically in the year y (i.e. amount of organic waste type j prevented from disposal in the SWDS in the year x)
Source of data to be used:	Sewage treatment plant truck scale station
Value of data	73,000
Description of measurement methods and procedures to be applied:	The quantity of sewage sludge will be calculated based on weight to be measured by using a truck scale at the sewage treatment plant. The data will be measured and recorded in both hardcopy and softcopy format. The composting plant technician will calculate and record the tonnes of sewage sludge to be composted daily in a log sheet.
QA/QC procedures to be applied:	The composting plant manager will verify the log sheets and all the data is kept in both softcopy and hardcopy at the composting plant for at least 2 years after the crediting period. The load cells will be calibrated as required by the manufacturer's recommendations.
Any comment:	-

Data / Parameter:	**f**
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
Source of data to be used:	Written information from the operator of the solid waste disposal site and/or site visits at the solid waste disposal site
Value of data	0
Description of measurement methods and procedures to be applied:	Monitoring frequency: Annually
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**GWP_CH_4**
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential (GWP) of methane, valid for the relevant commitment period

Source of data to be used:	Decisions under UNFCCC and the Kyoto Protocol (a value of 21 is to be applied for the first commitment period of the Kyoto Protocol)
Value of data	21
Description of measurement methods and procedures to be applied:	Monitoring frequency: Annually
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**DOC_j**
Data unit:	%
Description:	Fraction of degradable organic carbon (by weight) in the waste type j
Source of data to be used:	Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04, EB41. IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value of data:	24
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the Tool, project participants should apply the following values for the different waste types j: (see table below) If a waste type, prevented from disposal by the proposed CDM project activity, can not clearly be attributed to one of the waste types in the table above, project participants should choose among the waste types that have similar characteristics that waste type where the values of DOC_j and k_j result in a conservative estimate (lowest emissions), or request a revision of / deviation from this methodology. In the case of empty fruit bunches (EFB), as their characteristics are similar to garden waste, the parameter value correspondent of garden shall be used. However, the characteristic of sewage sludge is not similar to any waste type in the Table, the parameter value determined by conducting laboratory analysis during the implementation of the project activity is used. The sewage sludge weight is taken as wet waste.
QA/QC procedures to be applied:	The composting plant manager will verify the log sheets and all the data is kept in both softcopy and hardcopy at the composting plant for at least 2 years after the crediting period. The load cells will be calibrated as required by the manufacturer's recommendations.
Any comment:	-

Waste type j	**DOC_j (% wet waste)**	**DOC_j (% dry waste)**
Wood and wood products	43	50
Pulp, paper and cardboard (other than sludge)	40	44
Food, food waste, beverages and tobacco (other than sludge)	15	38
Textiles	24	30
Garden, yard and park waste	20	49
Glass, plastic, metal, other inert waste	0	0

Data / Parameter:	MC_j
Data unit:	%
Description:	Moisture content (by weight) in the waste type j
Source of data to be used:	Project participants
Value of data:	70
Justification of the choice of data or description of measurement methods and procedures actually applied :	With taking into account the characteristic of sewage sludge, the parameter value determined by conducting laboratory analysis during the implementation of the project activity is used. The sewage sludge weight is taken as wet waste.
QA/QC procedures to be applied:	The composting plant manager will verify the log sheets and all the data is kept in both softcopy and hardcopy at the composting plant for at least 2 years after the crediting period. The load cells will be calibrated as required by the manufacturer's recommendations.
Any comment:	-

Data / Parameter:	**Temperature, T**
Data unit:	°C
Description:	The temperature of sewage sludge and YM aerobes mixture in a fermenting mound
Source of data to be used:	Measured
Value of data	60°C-100°C
Description of measurement methods and procedures to be applied:	A handheld thermometer will be used and data will be monitored daily with one reading per mound and will be taken by composting technician. The data will be recorded in a daily log sheet and kept in both softcopy and hardcopy at the plant until 2 years after the crediting period.
QA/QC procedures to be applied:	The records will be verified by the composting plant manager and kept in both hardcopy and softcopy format at the composting plant. The thermometer will be calibrated according to manufacturer's recommendations.
Any comment:	-

Data / Parameter:	**Oxygen, O_2**
Data unit:	%
Description:	The oxygen content in sewage sludge and YM aerobes mixture in a fermenting mound
Source of data to be used:	Measured
Value of data	3%-21%
Description of measurement methods and procedures to be applied:	A handheld oxygen analyzer will be used and data will be monitored daily with one reading per mound and will be taken by composting technician. The data will be recorded in a daily log sheet and kept in both softcopy and hardcopy at the composting plant until 2 years after the crediting period.

QA/QC procedures to be applied:	The records will be verified by the composting plant manager. The oxygen analyzer will be calibrated according to manufacturer's recommendations.
Any comment:	-

Data / Parameter:	$Q_{y,compost}$
Data unit:	tonnes
Description:	Quantity of compost produced in year y
Source of data to be used:	Composting plant truck scale station
Value of data	21,900
Description of measurement methods and procedures to be applied:	The amount of compost production will be measured at the composting plant truck scale station. The composting plant technician will print a summary report from the truck scale software and file them separately for CDM verification audit.
QA/QC procedures to be applied:	The records will be verified by the composting plant manager and kept in both softcopy and hardcopy format at the composting plant until 2 years after the crediting period. The load cells will be calibrated according to manufacturer's recommendations.
Any comment:	-

Data / Parameter:	$Q_{y,elec}$
Data unit:	MWh
Description:	Amount of electricity used at the composting plant for aeration equipment in the year y
Source of data to be used:	Invoices sheets issued from sewage treatment plant to the composting plant
Value of data	960
Description of measurement methods and procedures to be applied:	The amount of electricity used at the composting plant will be measured by the sewage treatment plant and invoiced monthly. The composting plant technician will file the invoices and input the amount of electricity into the excel spreadsheet for CDM verification audit.
QA/QC procedures to be applied:	The records will be verified by the composting plant manager and kept in both hardcopy and softcopy format at the composting plant until 2 years after the crediting period.
Any comment:	-

Data / Parameter:	$Q_{y,diesel}$
Data unit:	liters
Description:	Amount of diesel oil used at the composting plant for wheel loader in the year y
Source of data to be used:	Invoices sheets issued from sewage treatment plant to the composting plant
Value of data	141,650
Description of measurement methods and procedures to be applied:	The volume of diesel oil used at the composting plant will be measured by the sewage treatment plant and invoiced monthly. The composting plant technician will file the invoices and input the volume of diesel oil into the excel spreadsheet for CDM verification audit.
QA/QC procedures to	The records will be verified by the composting plant manager and kept in both

be applied:	hardcopy and softcopy format at the composting plant until 2 years after the crediting period.
Any comment:	-

Data / Parameter:	**$Q_{y,runoff}$**
Data unit:	m^3
Description:	Volume of runoff water in the year y
Source of data to be used:	Measured by using a flowmeter installed at the ditch outlet point to the river where runoff water is discharged.
Value of data	Based on the actual measurement data
Description of measurement methods and procedures to be applied:	Measurement will be taken from an installed flowmeter that will be placed at the outlet point to the river. The composting technician will record the flow meter by daily reading in a log sheet. The monthly and yearly volume of runoff water will be calculated based on the available log sheet data.
QA/QC procedures to be applied:	The composting plant manager will verify the log sheets and all the data kept in both softcopy and hardcopy at the composting plant for at least 2 years after the crediting period. The flowmeter will also be calibrated as required by the manufacturer's recommendations.
Any comment:	-

Data / Parameter:	**$COD_{y,runoff}$**
Data unit:	tonnes COD/m^3
Description:	Chemical oxygen demand of the runoff water leaving the composting facility in the year y
Source of data to be used:	COD sampling at the ditch outlet point from the composting plant to the river where runoff water is discharged
Value of data	Based on the actual measurement data
Description of measurement methods and procedures to be applied:	COD samples will be taken weekly and once a month an additional sample will be taken. In total 5 COD samples will be taken in a month. 4 of them will be used for COD test by in-house laboratory and one will be sent for testing at a third party accredited laboratory. Date, time and place of sampling will be noted. The average of the 5 samples will be calculated to be the monthly COD value. Later the monthly COD value will be used to calculate the monthly project emissions from runoff water based on the monthly volume of runoff water. COD will be measured according to the standard test method used by department of environment of China. All the data will be recorded in a log sheet and kept for at least 2 years after the crediting period in both softcopy and hardcopy at the composting plant.
QA/QC procedures to be applied:	The samples taken by third party accredited laboratory are to counter check the reliability of the in-house data. If either the external sample or internal samples varies from each other, a re-sampling will be done immediately to rectify the problem. In the case where a re-sampling is not done accordingly, the most conservative value from either the external sample or average internal samples will be used in the calculations. The compost plant manager will verify the log sheets periodically. The laboratory test equipment will be calibrated according to

	manufacturer's recommendations.
Any comment:	-

Data / Parameter:	**$MD_{y,reg}$**
Data unit:	tonne
Description:	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations
Source of data to be used:	On-site measurement and the landfill site operation licence from Henan Province department of environment
Value of data	0 (Based on the actual measurement data if available)
Description of measurement methods and procedures to be applied:	The value applied in the PDD is zero. There is no prevailing regulations to capture and combust methane. All the sewage sludge is treated in open dumping landfill sites without any methane capture and combust in the baseline scenario. The landfill site operation licence issued by Henan Province department of environment will be used to determine the prevailing regulations for the sewage sludge treatment annually. If the quantity of methane captured and combusted should be measured, all the data will be recorded in a log sheet and kept for at least 2 years after the crediting period in both softcopy and hardcopy at the composting plant.
QA/QC procedures to be applied:	The composting plant manager will verify the landfill site operation licence annually and the log sheet (if any) periodically. Measuring equipment (if any) will be calibrated according to manufacturer's recommendations.
Any comment:	-

Data / Parameter:	**Assessment of common practices in solid waste disposal sites**
Data unit:	-
Description:	To demonstrate that the amount of sewage sludge to be treated at the composing plant would have been disposed in solid waste disposal sites in the absence of the project activity.
Source of data to be used:	The sewage treatment plant
Value of data	-
Description of measurement methods and procedures to be applied:	To provide evidence that sewage sludge is still disposed in unmanaged solid waste disposal sites. This assessment will be made annually.
QA/QC procedures to be applied:	Date from previous years will be used to compare with the changes in the current year data.
Any comment:	-

Data / Parameter:	**$Q_{y,sales}$**
Data unit:	tonnes
Description:	Sales of delivery of organic fertiliser to the agricultural fields
Source of data to be used:	Delivery orders
Value of data	tonnes/recipient
Description of measurement methods	Records of all delivery orders will be compiled. Delivery orders to be measured in tonnes will be summarized for each individual recipient annually.

and procedures to be applied:	
QA/QC procedures to be applied:	All bills or invoices of compost sales will include information about organic fertiliser end-use destination. All monitoring data will be electronically archived for a period years after crediting period.
Any comment:	-

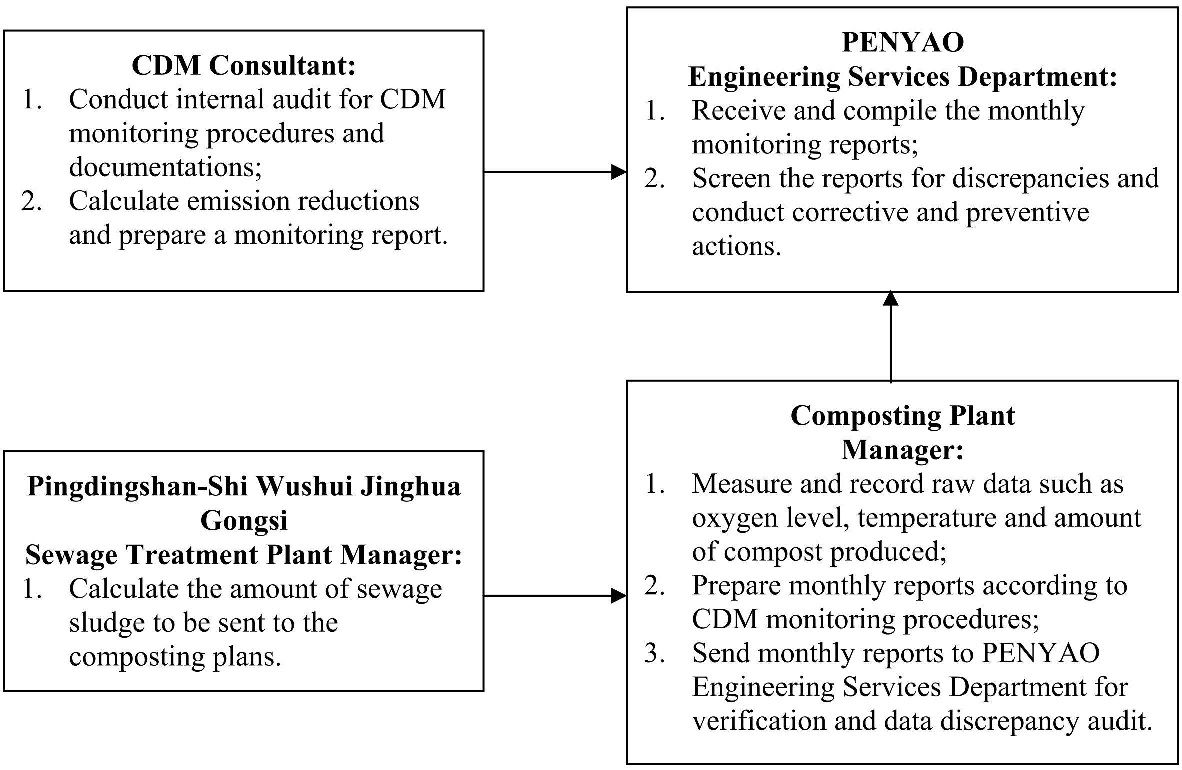
Data / Parameter:	$\mathbf{Q_{y,application}}$
Data unit:	tonnes
Description:	In-situ verification of the soil application of compost to ensure aerobic conditions for further decay
Source of data to be used:	Landscaping works operation records
Value of data	tonnes/hectare
Description of measurement methods and procedures to be applied:	Records of all landscaping works operation will be compiled and the application of compost will be assessed.
QA/QC procedures to be applied:	All records of the soil conditioner end-use destination will be compiled in the landscaping works operation records. All monitoring data will be electronically archived for a period of 2 years after crediting period.
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

PENYAO has an operational and management structure in place to monitor emission reductions from the project activity. Each composting plant will appoint technician team to run the composting plant efficiently. A composting plant manager will be responsible to assign his subordinates to collect and report the monitoring parameters and verify them monthly. All the data will be kept in both hardcopy and softcopy.

PENYAO engineering services department will receive the data from the composting plants and assign a third party consultant or in-house experts to calculate the emission reductions and prepare a monitoring report. All the raw data available at the composting plants will also be available at the head quarter. The flowchart below describes the operational structure of the data collection and compilation.



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

>>

The baseline and monitoring methodology application was completed on 08/03/2010 by the responsible person below.

Mr. Akifumi Nishihata
PC-Institute for Global Environmental Research, Pacific Consultants Co., LTD
1-7-5, Sekido, Tama-shi, Tokyo, Japan
Tel: +81-42-372-7132 / Fax: +81-42-372-1857 / E-mail: akifumi.nishihata@pacific.co.jp

** Pacific consultants Co., LTD is a CDM consultant for the project and is not a project participant.*

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:

>>

01/07/2010

Chronology of events leading to validation of the CDM project

Item	Description	Date
1	Draft PIN prepared by a CDM consultant	25 Jun. 2009
2	Final PIN submitted to Global Environment Centre Foundation of Japan.	15 Jul. 2009
3	PDD development work started	01 Aug. 2009
4	Date of board of directors' meeting to venture into the CDM project and Letter of Intent (LoI) was signed among Sanyu, Kubota-gumi and PENYAO	15 Oct 2009
5	Agreement signed with Designated Operational Entity (DOE)	
6	First draft PDD prepared and submitted for validation	
7	Stakeholder meeting	
8	Second draft PDD prepared and submitted to UNFCCC by DOE for Global Stakeholder Consultation (GSC)	
9	On site validation of PDD by DOE	
10	Project presentation to the CDM secretariat for the Chinese DNA	
11	Letter of Approval (LoA) by DNA of China (host country)	
12	LoA by DNA of Japan	
13	Signing of turnkey agreement with Pingdingshan-Shi Wushui Jinghua Gongsi	(01 Jul. 2010)
14	Date for start of construction at the project site	
15	ERPA was signed with the buyer	
16	Date of expected commissioning of the composting plant	
17	Composting plant commercial operation started	(01 Oct. 2010)

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

>>

10 years.

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:

>>

Not applicable.

C.2.1.2. Length of the first crediting period:

>>

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

The crediting period is expected to start on 01 October 2010, or after registration of the project activity, whichever is later.

C.2.2.2. Length:

>>

10 years.

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

Chinese authorities do not require any environmental impact analysis for sewage sludge composting of the project activity and the environmental impacts are considered insignificant. The project complies with all laws and regulations related to establishment and operation of solid waste and wastewater treatment facilities and composting plants. The project site has been prepared with a suitable drainage facilities for collection and treatment of rainwater and leachate.

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:

>>

Not applicable for this project activity.

SECTION E. Stakeholders' comments

>>

The project activity is within the existing sewage treatment plant premises. As mentioned in the previous section the environmental impact for the project activity is insignificant and on the other hand it improves the quality of surface stream water and under ground water in the surrounding environment. Furthermore this sewage treatment plant is isolated from inhabitant settlement to avoid any form of discomfort to the local community. Thus the project has minimal involvement from the local stakeholders.

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

>>

E.2. Summary of the comments received:

>>

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

>>

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	PENYAO Environment protection Group
Street/P.O.Box:	
Building:	
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URL:	http://www.asiaenv.com/network.html
Represented by:	Oh
Title:	President
Salutation:	Mr.
Last Name:	Oh
Middle Name:	
First Name:	
Department:	Engineering Services Department
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Sanyu Co., LTD.
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URL:	-
Represented by:	Syoichi Yamamura
Title:	President
Salutation:	Mr.
Last Name:	Nagayama
Middle Name:	-
First Name:	Tatsuro
Department:	-
Mobile:	

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the project activity.

Annex 3

BASELINE INFORMATION

Emission reduction calculations

The key assumption figures are presented in section B.4 of the PDD.
Note: Please refer to section C.2.1.1 for the starting date

Baseline emissions

Estimation of methane emission from sewage decay

Year	1	2	3	4	5	6	7	8	9	10
φ	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
1-f	1	1	1	1	1	1	1	1	1	1
GWP	21	21	21	21	21	21	21	21	21	21
1-OX	1	1	1	1	1	1	1	1	1	1
16/12	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.333	1.333
F	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
DOC_f	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MCF	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
$W_{j,x}$	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000	73,000
DOC_j	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
y-x	0	1	2	3	4	5	6	7	8	9
k_j	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
$e^{-kj(y-x)}$	1.000	0.942	0.887	0.835	0.787	0.741	0.698	0.657	0.619	0.583
$1-e^{-kj}$	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058	0.058
$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-kj(y-x)} \cdot (1-e^{-kj})$										
tCO_2e	*5,142*	*4,843*	*4,561*	*4,295*	*4,045*	*3,809*	*3,588*	*3,379*	*3,182*	*2,997*
Total	**5,142**	**9,985**	**14,546**	**18,841**	**22,886**	**26,695**	**30,283**	**33,662**	**36,844**	**39,840**

Project emissions

Electricity and diesel consumption at the composting site

Year	A*	B	C=AxB	D*	E	F	G= DxExF/10^6	H=C+G
	$Q_{y,elec}$ MWh	CEF_{grid} tCO_2/MWh	$PE_{y,elec}$ tCO_2	$Q_{y,diesel}$ liter	D_{diesel} kg/liter	EF_{diesel} gCO_2/kg diesel	$PE_{y,diesel}$ tCO_2	$PE_{y,power}$
1	960	0.9735	935	141,650	0.85	3,186	384	1,318
2	960	0.9735	935	141,650	0.85	3,186	384	1,318
3	960	0.9735	935	141,650	0.85	3,186	384	1,318
4	960	0.9735	935	141,650	0.85	3,186	384	1,318
5	960	0.9735	935	141,650	0.85	3,186	384	1,318
6	960	0.9735	935	141,650	0.85	3,186	384	1,318

7	960	0.9735	935	141,650	0.85	3,186	384	1,318
8	960	0.9735	935	141,650	0.85	3,186	384	1,318
9	960	0.9735	935	141,650	0.85	3,186	384	1,318
10	960	0.9735	935	141,650	0.85	3,186	384	1,318

* Historical data was used only for PDD estimation. Actual data will be measured during the crediting.

Methane emission during composting process

Year	A*	B	C	D	E=AxBxCxD/10^5
	$Q_{y,s/s}$ tonne sludge	MC_j %	$EF_{composting}$ kg CH_4/tonne sludge	GWP_CH_4 tCO_2/tCH_4	$PE_{y,comp}$ tCO_2e
1	73,000	24	10	21	3,679
2	73,000	24	10	21	3,679
3	73,000	24	10	21	3,679
4	73,000	24	10	21	3,679
5	73,000	24	10	21	3,679
6	73,000	24	10	21	3,679
7	73,000	24	10	21	3,679
8	73,000	24	10	21	3,679
9	73,000	24	10	21	3,679
10	73,000	24	10	21	3,679

* Historical data was used only for PDD estimation. Actual data will be measured during the crediting.

Total project emissions

Year	A	B	C	D=A+B+C
	$PE_{y,elec}$ tCO_2	$PE_{y,diesel}$ tCO_2	$PE_{y,comp}$ tCO_2e	PE_y tCO_2e
1	935	384	6,132	7,451
2	935	384	6,132	7,451
3	935	384	6,132	7,451
4	935	384	6,132	7,451
5	935	384	6,132	7,451
6	935	384	6,132	7,451
7	935	384	6,132	7,451
8	935	384	6,132	7,451
9	935	384	6,132	7,451
10	935	384	6,132	7,451

Emission reductions

Year	A	B	C
	BE_y tCO_2e	PE_y tCO_2e	ER_y tCO_2e
1	5,142	4,997	145
2	9,985	4,997	4,988
3	14,546	4,997	9,548
4	18,841	4,997	13,844

5	22,886	4,997	17,889
6	26,695	4,997	21,698
7	30,283	4,997	25,286
8	33,662	4,997	28,664
9	36,844	4,997	31,846
10	39,840	4,997	34,843
Total	**238,724**	**49,974**	**188,750**

Annex 4

MONITORING INFORMATION

Monitoring and Quality Assurance Information Table

No.	Parameter	Symbol	Unit	Recording Frequency	Measured [m] or calculated [c]	Location	Method	CER Calculation [CER] or Quality Assurance [QA]
1	Diesel consumption	$Q_{monthly, diesel}$	liters	monthly	m	Sewage treatment plant store	Diesel invoices issued to composting plant from sewage treatment plant	CER
2	Electricity consumption	$Q_{monthly,elec}$	MWh	monthly	m	Sewage treatment switchboard	Power invoices issued to composting plant from sewage treatment plant	CER
3	Oxygen content	O_2	%	Before and after turning of fermentin g mound	m	Fermenting mound	Handheld oxygen analyzer	QA
4	Temperature	T	°C	Before and after turning of fermentin g mound	m	Fermenting mound	Handheld thermometer	QA
5	Quantity of compost produced	$Q_{monthly, compost}$	tonnes	monthly	m	Composting plant	Truck scale station	QA
6	Quantity of runoff water	$Q_{daily,runoff}$	m^3	daily	m	Flowmeter at the ditch outlet point	Totalizer reading from flow meter	CER
7	COD of runoff water	$COD_{runoff, INHOUSE}$	Kg COD/ m^3	weekly	m	Sampling at the ditch outlet point	PENYAO laboratory analysis	CER
8	COD of runoff water	$COD_{runoff, 3rd PARTY}$	Kg COD/ m^3	monthly	m	Sampling at the ditch outlet point	Accredited laboratory analysis	CER
9	COD of runoff water	$COD_{monthly, runoff}$	Kg COD/ m^3	monthly	c	Composting plant	Calculated from weekly runoff water COD	CER

No.	Parameter	Symbol	Unit	Recording Frequency	Measured [m] or calculated [c]	Location	Method	CER Calculation [CER] or Quality Assurance [QA]
10	Quantity of sewage sludge used for composting	$Q_{daily,s/s}$	tonnes	daily	m & c	the sewage sludge treatment plant	Truck scale station	CER
11	Quantity of methane that would be captured and combusted	$MD_{y,reg}$	tonnes (if any)	annually	m & c	Sewage sludge plant	Verify the prevailing regulations for methane capture	CER
12	Assessment of common practices in SWDS	-	-	annually	-	PENYAO	Inquiry and site visit	QA
13	Delivery	$Q_{daily,sales}$	tonnes	daily	m	Composting plant office	Invoices	QA
14	Soil application of compost and ensuring aerobic conditions	$Q_{monthly,application}$	tonnes	monthly	m & c	Agricultural fields and landscaping works	Review of manuring records	QA

Annex 5

FINANCIAL ANALYSIS

Financial Analysis without CDM

PENYAO Environment Protection Group												
CDM-Composting Project	200	ton sludge/day		73,000	ton sludge/year		21,900					
Selling Price of CERs	12	USD/tCO_2e		6.831	CNY/USD							
CASH FLOW												
Year			1	2	3	4	5	6	7	8	9	10
Income	CHY/unit	Quantity										
Sales of Product	100	21,900	2,190,000	2,255,700	2,321,400	2,387,100	2,452,800	2,518,500	2,584,200	2,649,900	2,715,600	2,781,300
Emission Reductions												
Sales of CERs			0	0	0	0	0	0	0	0	0	0
Saving of Landfilling Costs	145	73,000	10,585,000	10,902,550	11,220,100	11,537,650	11,855,200	12,172,750	12,490,300	12,807,850	13,125,400	13,442,950
Total Income			12,775,000	13,158,250	13,541,500	13,924,750	14,308,000	14,691,250	15,074,500	15,457,750	15,841,000	16,224,250
Variable Costs												
Sludge Transportation	30	73,000	2,190,000	2,255,700	2,321,400	2,387,100	2,452,800	2,518,500	2,584,200	2,649,900	2,715,600	2,781,300
YM Aerobes	25	73,000	1,825,000	1,879,750	1,934,500	1,989,250	2,044,000	2,098,750	2,153,500	2,208,250	2,263,000	2,317,750
Electricity	600	960	576,000	593,280	610,560	627,840	645,120	662,400	679,680	696,960	714,240	731,520
Diesel	6	141,650	849,900	875,397	900,894	926,391	951,888	977,385	1,002,882	1,028,379	1,053,876	1,079,373
Labour Cost	21	30,000	630,000	648,900	667,800	686,700	705,600	724,500	743,400	762,300	781,200	800,100
Total Variable Costs			6,070,900	6,253,027	6,435,154	6,617,281	6,799,408	6,981,535	7,163,662	7,345,789	7,527,916	7,710,043
Fixed Costs												
Administration Cost	697,000	1	697,000	717,910	738,820	759,730	780,640	801,550	822,460	843,370	864,280	885,190
Maintenance	978,000	1	978,000	1,007,340	1,036,680	1,066,020	1,095,360	1,124,700	1,154,040	1,183,380	1,212,720	1,242,060
Depreciation			3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300
Insurance	308,000	1	308,000	317,240	326,480	335,720	344,960	354,200	363,440	372,680	381,920	391,160
Total Fixed Costs			5,897,300	5,956,790	6,016,280	6,075,770	6,135,260	6,194,750	6,254,240	6,313,730	6,373,220	6,432,710
Total Costs			11,968,200	12,209,817	12,451,434	12,693,051	12,934,668	13,176,285	13,417,902	13,659,519	13,901,136	14,142,753
Pre-tax Profit			806,800	948,433	1,090,066	1,231,699	1,373,332	1,514,965	1,656,598	1,798,231	1,939,864	2,081,497
Taxation		10%	80,680	94,843	109,007	123,170	137,333	151,497	165,660	179,823	193,986	208,150
Profit after Tax			726,120	853,590	981,059	1,108,529	1,235,999	1,363,469	1,490,938	1,618,408	1,745,878	1,873,347
Inflation Factor			1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27
Inflation Rate		3%										
Inflow												
Profit before Tax			806,800	948,433	1,090,066	1,231,699	1,373,332	1,514,965	1,656,598	1,798,231	1,939,864	2,081,497
Depreciation			3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300
Outflow												
Capital Expenditure		39,143,000	0	0	0	0	0	0	0	0	0	0
Major Overhaul/Machinery Replacement			0	0	0	0	0	0	0	0	0	0
Working Capital		0	0	0	0	0	0	0	0	0	0	0
Taxation			80,680	94,843	109,007	123,170	137,333	151,497	165,660	179,823	193,986	208,150
Surplus		-39,143,000	4,640,420	4,767,890	4,895,359	5,022,829	5,150,299	5,277,769	5,405,238	5,532,708	5,660,178	5,787,647
IRR	5%											

Financial Analysis with CDM

PENYAO Environment Protection Group												
CDM-Composting Project	200	ton sludge/day		73,000	ton sludge/year		21,900					
Selling Price of CERs	12	USD/tCO_2e		6.831	CNY/USD							
CASH FLOW												
Year			1	2	3	4	5	6	7	8	9	10
Income	CHY/unit	Quantity										
Sales of Product	100	21,900	2,190,000	2,255,700	2,321,400	2,387,100	2,452,800	2,518,500	2,584,200	2,649,900	2,715,600	2,781,300
Emission Reductions			145	4,988	9,548	13,844	17,889	21,698	25,286	28,664	31,846	34,843
Sales of CERs			11,886	408,876	782,669	1,134,820	1,466,397	1,778,628	2,072,744	2,349,645	2,610,480	2,856,150
Saving of Landfilling Costs	145	73,000	10,585,000	10,902,550	11,220,100	11,537,650	11,855,200	12,172,750	12,490,300	12,807,850	13,125,400	13,442,950
Total Income			12,786,886	13,567,126	14,324,169	15,059,570	15,774,397	16,469,878	17,147,244	17,807,395	18,451,480	19,080,400
Variable Costs												
Sludge Transportation	30	73,000	2,190,000	2,255,700	2,321,400	2,387,100	2,452,800	2,518,500	2,584,200	2,649,900	2,715,600	2,781,300
YM Aerobes	25	73,000	1,825,000	1,879,750	1,934,500	1,989,250	2,044,000	2,098,750	2,153,500	2,208,250	2,263,000	2,317,750
Electricity	600	960	576,000	593,280	610,560	627,840	645,120	662,400	679,680	696,960	714,240	731,520
Diesel	6	141,650	849,900	875,397	900,894	926,391	951,888	977,385	1,002,882	1,028,379	1,053,876	1,079,373
Labour Cost	21	30,000	630,000	648,900	667,800	686,700	705,600	724,500	743,400	762,300	781,200	800,100
Total Variable Costs			6,070,900	6,253,027	6,435,154	6,617,281	6,799,408	6,981,535	7,163,662	7,345,789	7,527,916	7,710,043
Fixed Costs												
Administration Cost	697,000	1	697,000	717,910	738,820	759,730	780,640	801,550	822,460	843,370	864,280	885,190
Maintenance	978,000	1	978,000	1,007,340	1,036,680	1,066,020	1,095,360	1,124,700	1,154,040	1,183,380	1,212,720	1,242,060
Depreciation			3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300
Insurance	308,000	1	308,000	317,240	326,480	335,720	344,960	354,200	363,440	372,680	381,920	391,160
Total Fixed Costs			5,897,300	5,956,790	6,016,280	6,075,770	6,135,260	6,194,750	6,254,240	6,313,730	6,373,220	6,432,710
Total Costs			11,968,200	12,209,817	12,451,434	12,693,051	12,934,668	13,176,285	13,417,902	13,659,519	13,901,136	14,142,753
Pre-tax Profit			818,686	1,357,309	1,872,735	2,366,519	2,839,729	3,293,593	3,729,342	4,147,876	4,550,344	4,937,647
Taxation		10%	81,869	135,731	187,273	236,652	283,973	329,359	372,934	414,788	455,034	493,765
Profit after Tax			736,817	1,221,578	1,685,461	2,129,867	2,555,756	2,964,234	3,356,408	3,733,089	4,095,310	4,443,883
Inflation Factor			1.00	1.03	1.06	1.09	1.12	1.15	1.18	1.21	1.24	1.27
Inflation Rate		3%										
Inflow												
Profit before Tax			818,686	1,357,309	1,872,735	2,366,519	2,839,729	3,293,593	3,729,342	4,147,876	4,550,344	4,937,647
Depreciation			3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300	3,914,300
Outflow												
Capital Expenditure		39,143,000	0	0	0	0	0	0	0	0	0	0
Major Overhaul/Machinery Replacement			0	0	0	0	0	0	0	0	0	0
Working Capital		0	0	0	0	0	0	0	0	0	0	0
Taxation			81,869	135,731	187,273	236,652	283,973	329,359	372,934	414,788	455,034	493,765
Surplus		-39,143,000	4,651,117	5,135,878	5,599,761	6,044,167	6,470,056	6,878,534	7,270,708	7,647,389	8,009,610	8,358,183
IRR	10%											

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