CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

October 2005

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Nanjing Tianjingwa Landfill Gas to Electricity Project

A.2. Description of the project activity:

The Nanjing Tianjingwa Landfill Gas to Electricity Project (hereafter, the Project) developed by Nanjing Green Waste Recovery Engineering Co., Ltd (hereafter referred to as the Project Developer) is a landfill gas collection and utilization project in the Pukou District, Nanjin City, China. The Project will have an electricity component with maximum installed capacity reaching 6 MW.

Tianjingwa Landfill is one of the three landfills in Nanjing City. It is receiving an average of 700 tonnes of waste per day and 95% is domestic waste from Pukou, Liuhe and Xiaguan Districts. The current size of the area used for landfilling waste is 58,200 m^2 and will expand to 240,000m^2 in subsequent phases. In order to reduce environmental pollution and hidden danger caused by uncontrolled landfill gas, in 2003, the Project Developer was granted a 20-year concessional licence by Municipal Waste Administrative Office to collect and utilize the landfill gas. The licence can be renewed if the landfill gas can still be utilized after 20 years. The Project Developer is a Chinese funded limited company with 53% of shares controlled by Wei Yuanzhou Industry Limited. Its core business is urban waste treatment, waste treatment machinery and equipment, production and sales of environmental protection equipment.

The objective of the Project is to collect and utilize the landfill gas of this landfill. This will involve investing in a gas collection system, leachate drainage system, flaring equipment and a modular electricity generation plant. The generators will combust the methane in the landfill gas to produce electricity for export to the grid. Excess landfill gas, and all gas collected during periods when electricity is not produced, will be flared. The Project Develop draws on the rich experience of some European countries in landfill gas projects and works closely with Nanjing University in project technology design and operation. The generator will be procured from Caterpillar and auxiliary equipment will be sourced from domestic market. Nanjing Power Company has approved the electricity generated by the Project to be connected to the grid.

The main social and environmental impacts of the Project will be a positive effect on health and amenity in the local area. Contaminated leachate and surface run-off from landfills can affect down-gradient ground and surface water quality consequently affecting the local environment. The uncontrolled release of landfill gas can also impact negatively on the health of the local environment and the local population and lead to risks of explosions in the local surroundings. By managing this landfill properly the environmental health risks and the potential for explosions is greatly reduced. Economic benefits include the Project acting as a clean technology demonstration project, encouraging less dependency on grid-supplied electricity and better management of landfills throughout China, which could be replicated across the region.

The Project is helping China fulfil its goals of promoting sustainable development. Specifically, the Project:

- Increases employment opportunities in the area where the Project is located;
- Diversifies the sources of electricity generation;

- Uses clean and efficient technologies, and conserves natural resources;
- Acts as a clean technology demonstration project, providing an example that can be used by others that may want to develop modern and more efficient generation of electricity using landfill gas throughout China;
- Optimises the use of natural resources, avoid uncontrolled waste management.

A.3. Project participants:

- Project Developer and Operator: Nanjing Green Waste Recovery Engineering Co., Ltd, to be authorised by the Chinese DNA
- Carbon Buyer: EcoSecurities Ltd (UK), to be authorised by the UK DNA.

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

China

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

Jiangsu Province

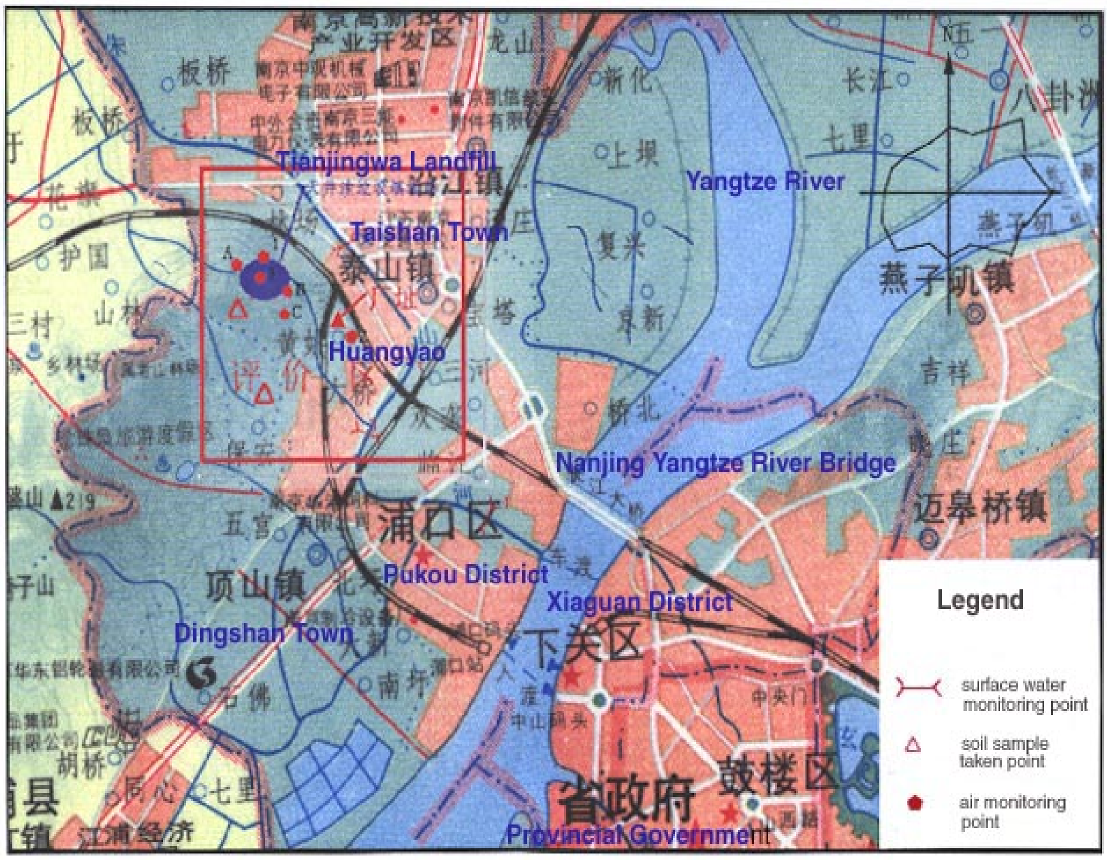
A.4.1.3. City/Town/Community etc:

North Gate Street, Huangyao Village, Taishan Town, Pukou District, Nanjing City

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

The project site is 18km northwest from Nanjing city center. The transportation is very convenient. It can be reached by bus or car from Nanjing City Center through CityWest Main Road and Nanjing Yangtze River Bridge. To the north is the east end of Lao Mountain of Jiangpu County and to the south is 1.5km from East Gate Village. This hilly area belongs to the north subtropical monsoonal climate zone with annual even precipitation of 1,106mm and maximum average humidity of 81 percent.

Below is a map showing the physical location of the project site:



The Site's Geographical Location, Water System and Monitoring Points Layout (Ratio: 1:95000)

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

Sectoral Scope 13, Waste Handling and Disposal

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

Landfill gas collection system:

The Project Developer uses state-of-the-art gas collection technology by drawing on the rich experience of some European countries and working closely with domestic technology providers and researchers. Since 2001, the Project Developer has started collaboration with Energi Gruppend Jylland A/S, a Danish company on development of landfill gas collection and utilisation technology. Although the collaboration stalled in 2002, technology exchange from foreign partner has laid solid foundation for further exploration. Based on several years' experience of research and development of municipal waste treatment and long-term cooperation with Environmental Engineering College of Nanjing University and other universities, the Project Developer decided to develop their own complete set of landfill management technology and equipment. This includes:

- landfill cells coated with the clay layers
- water residues channelled and treated in a wastewater treatment plant;
- vertical wells used to extract gas with function of separating gas with water;
- optimal well spacing for maximum gas collection whilst minimizing costs;
- gas pipe designed to prevent air and reduce the risks of explosion
- condensate extraction and storage systems designed at strategic low points throughout the gas system.

All efforts will be made to minimize problems in condensate management.

Energy generation technology:

As and when the Project secures a power purchase agreement sufficient to enable the generation of electricity, a modular reciprocating engine facility will be installed. Small modular reciprocating engine generator units make it possible to adapt the equipment to the site-specific gas volumes. The generator will be procured from Caterpillar US, the world's largest manufacturer of industries engines, which promotes transfer of advanced technology to China. All the auxiliary equipment will be sourced from the domestic market.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The Project is based on two complementary activities, as follows:

- The collection and flaring of combustion of landfill gas, thus converting its methane content into CO_2, reducing its greenhouse gas effect; and,
- The generation and supply of electricity to the regional grid, thus displacing a certain amount of fossil fuels used for electricity generation.

The baseline scenario is defined as the most likely future scenario in the absence of the proposed CDM project activity. Establishing this future scenario requires an analysis and comparison of possible future scenarios using a comparison methodology that is justified for the project circumstances. Based on this analysis (see section B below), the baseline scenario is the continued uncontrolled release of landfill gas to the atmosphere, similarly to most landfills in China.

The project is additional, as the emission reductions will not occur in the absence of the CDM activity. Waste began to be dumped at the site in 1995, and the Tianjingwa landfill site was officially designed and approved in 1996 according to National Emission Standard GB16297-1996 II so it is not subject to new standard GB16889—1997 set forth in 1997. Besides the National standard for pollution control of landfill sites for domestic waste GB16889-1997, a so-called technical code for municipal solid waste CJJ 17 -1988 has been in place since 1988 and is therefore applicable to the project. This code states that flaring should be done if possible. However, in China, this technical code CJJ 17 -1988 is not enforced.

The Project requires high initial investment, operation and maintenance cost. The Project has significant environmental benefit, however, based on the financial analysis (see section B3 below), the Project IRR is negative without carbon revenue. Clearly, the Project is not the economically most attractive course of action and therefore is not part of the baseline scenario. It can be concluded that emission reductions resulted from the Project are additional to any that would occur in absence of the Project.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

This Project is expected to avoid 246,107 tCO_2e of emissions per year and 1,722,746 tCO_2e during the first 7 years.

Refer to section E for further details on the quantification of GHG emission reductions associated with the project.

A.4.5. Public funding of the project activity:

No public funding from Annex I countries is involved in the project.

SECTION B. Application of a baseline methodology

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

ACM0001 “Consolidated baseline methodology for landfill gas project activities”, together with Approved Baseline Methodology for Small-scale Activities Type I.D-Renewable Electricity Generation for a Grid.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The methodology ACM 0001 allows for the development of projects falling under 3 options. Option a) refers to landfill projects that capture gas but this is simply flared. Option b) refers to projects that use the gas to produce energy (e.g. electricity/thermal energy), but do not claim emission reductions from displacing or avoiding energy from other sources. Option c) refers to projects where the captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources.

As previously described, the Project is based on two complementary activities, as follows:

- The collection and flaring of combustion of landfill gas, thus converting its methane content into CO_2, reducing its greenhouse gas effect; and,

- The generation and supply of electricity to the regional grid, thus displacing a certain amount of fossil fuels used for electricity generation.

The Project therefore fulfils the conditions of Option c (i.e. the captured landfill gas is used to produce electricity and reductions are claimed for displacing electricity generation from other sources) so ACM0001 was considered the most appropriate methodology for the Project.

In this case a baseline methodology for electricity and or thermal energy displaced shall be provided or an approved one used, including the ACM0002 “Consolidated Methodology for Grid-Connected Power Generation from Renewable Sources”. If capacity of electricity generated is less than 15MW, and or thermal energy displaced is less than 54 TJ (15GWh), small-scale methodologies can be used.

As the generation component of the Project is smaller than 15 MW, simplified methodologies for small-scale projects will be used to calculate reductions for displacing electricity generation from other sources. The small-scale methodology to be used is Type I.D-Renewable electricity generation for a grid as the Project will sell its generated electricity to the grid under its Power Purchase Agreement.

B.2. Description of how the methodology is applied in the context of the project activity:

The methodology will be applied using Option c of the Consolidated Methodology ACM 0001, where the gas captured is used for electricity generation and emission reductions are claimed for displacing or avoiding energy from other sources. The amount of credits for these sources will be calculated using the Methodology for Small Scale Activities Type 1.D-Renewable Electricity Generation for a Grid., as the generation component of the Project is smaller than 15 MW installed capacity and the electricity generated by landfill gas will be sold to the grid.

Specifically, the emission reductions the will be calculated as follows:

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EG_y * CEF_{electricity,y} + ET_y * CEF_{thermal,\,y}$$

The above equation is that of the **Consolidated Methodology for Landfill Projects ACM 0001**, where:

> ER_y: greenhouse gas emission reduction achieved by the Project activity during a given year *"y"* (t CO_2e).
> $MD_{project,y}$: amount of methane actually destroyed/combusted during the year *"y"* (tCH_4).
> $MD_{reg,y}$: amount of methane that would have been destroyed/combusted during the year *"y"* in the absence of the Project activity (tCH_4).
> GWP_{CH4}: approved Global Warming Potential value for methane (21 t CO_2e / tCH_4).
> EG_y: net quantity of electricity displaced during the year *"y"* (MWh).
> $CEF_{electricity,y}$: CO_2 emissions intensity of the electricity displaced during year *"y"* (tCO_2e/MWh).
> ET_y: quantity of thermal energy displaced during the year *"y"* (TJ).
> $CEF_{thermal,\,y}$: CO_2 emissions intensity of the thermal energy displaced during year *"y"* (tCO_2e/TJ).

As the Project will not include a thermal energy component, this factor will be excluded from the overall equation.

The $CEF_{electricity,y,}$ for the grid will be calculated according to the equations for small scale electricity project (**Methodology for Small Scale Activities Type 1.D-Renewable Electricity Generation for a Grid**), as shown below. **The carbon emissions factor ($CEF_{electricity}$)** is calculated according to option (b), the weighted average emissions (in kg CO_2equ/MWh) of the current generation mix. This method is used as sufficient data for the calculation of the operating margin and build margin of the Jiangsu grid is not available in China. The carbon emissions factor of the grid (EF_y) is therefore calculated according to the equation below.

EF_y is calculated using the using the weighted average emissions of the current generation mix as shown in the following equation:

$$EF_y\ (tCO_2 / MWh) = \frac{\sum_{i,j} F_{i,j,y} * COEF_{i,j}}{\sum_j GEN_{j.y}}$$

Where:

> $F_{i,j,y}$ is the amount of fuel *i* (in GJ) consumed by power sources *j* in year *y*;
> *j* is power sources delivering electricity to the grid
> $COEF_{i,j,y}$ is the carbon coefficient of fuel *i* (tCO_2/GJ);
> $GEN_{j.y}$ is the electricity (MWh) delivered to the grid by source *j*.

The most recent year for which sufficient data for the calculation of the average emissions factor of the Jiangsu grid is available is 2002 (China Electric Power Yearbook, 2003). The data available for 2003 includes fuel consumption data for coal plants only, and does not include information on the fuel consumption of oil and gas fired plants. Therefore, for conservativeness, both the average emissions factor for the grid in 2002, and the average emissions factor for the grid in 2003 (only including coal fired generation) have been calculated, and the lowest of these two values is used (the 2003 value of 0.875 tCO_2/MWh). The data used for the calculation of the average emissions factor of the Jiangsu Grid is shown in Annex 3 of this document. The main source of data is China Electric Power Yearbook[1]. The defaults used for the calculation of calorific values for fuel types and fuel oxidization came from the IPCC GHG Gas Inventory Reference Manual[2] and the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories[3].

The Project supplies electricity to the Jiangsu Province Power Grid. Although Jiangsu Province Grid interconnects with East China Grid, there is no significant importation and exportation in the past three years. As shown in the table below, Jiangsu Province is basically balanced in power supply and demand in 2002. With the rapid economy growth, there were small energy shortages in 2003. However, Jiangsu Province has kept pace with increasing demands by significant addition of new capacities and transfer of energy from areas of surplus to those in deficit within the province.

Jiangsu Province Grid Importation and Exportation 2001-2003			
	2003	2002	2001
Power supply (GWh)	142,211	116,820	101,100
Power generation (GWh)	133,677	116,876	104,100
Import/export	6%	0%	-3%

Source: China Electric Power Yearbook 2002, 2003 and 2004

Therefore, Jiangsu Province Power Grid has been selected as the grid boundary for the project. The main source of data is China Electric Power Yearbook[4].

For the Year 2003, the value of the average emission factor was 0.874 tCO2 / MWh (see details in Annex 3).

Baseline Emissions Rate (tCO_2/MWh) = 0.874

[1] China Electric Press, 2002

[2] IPCC,1996

[3] IPCC, 2000

[4] China Electric Press, 2004

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

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

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

The starting date of the Project is July 2004, when plans for the gas collection system were finalized and the electricity generating engines were ordered. CDM finance was considered from the beginning and the Project Developer signed the Letter of Intent with Chinese Renewable Energy Industries Association to explore CDM potentials of the Project in December 2003. The starting date of the Project is before the date of the registration of a first CDM project. The crediting period selected by the project developer will start in May 2005.

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

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

Alternative 1: The landfill operator could continue the current business as usual practice of not collecting and flaring landfill gas from the waste management operations. In this case, no power would be generated at the sites and China power system would remain unaffected.

Alternative 2: The landfill operator would invest in a landfill gas collection system of high effectiveness, as well as a high efficiency flaring system and in LFG power generation equipment (the proposed project activity). The operation would reduce the generation of power for other grid-connected sources.

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

In China, the legislation regulating the use of landfill gas has evolved during the past 20 years and it is difficult to judge, which legislation applies to a landfill. For example, the technical code CJJ 17 -1988, which states that landfill gas should be flared if possible, is not enforced. Almost all landfills which started operation before 1997, when the "National standard for pollution control of landfill sites for domestic waste GB16889—1997" entered into force, do not collect or flare landfill gas. The new law requires landfill operators to collect and if possible utilise landfill gas, and to flare landfill gas that cannot be used, however, even if it were applicable to the project, the law is not adequately enforced and common practice demonstrates that landfills in the region, regardless of whether they are covered by the law or not, do not capture and flare or utilise their landfill gas. According to the "National Action Plan for Recovery and Utilization of landfill Gas (12/2001)[5]":

> "A*t present, in China the municipal refuse is disposed using the technology of traditional landfill, without consideration of recovery and utilization of landfill gas. Almost all landfills do not have landfill gas recovery systems, except a few newly built landfills, and the landfill gas is emitted to the atmosphere openly...About 10 sanitary landfills have been set up in a few cities. However, there*

[5] Energy Research Institute, State Development Planning Commission, China, 2001

was no landfill gas recovery system in these sanitary landfills. In 1997, the first system of landfill gas recovery and utilization in China was built is Hangzhou, Zhejiang Province, and the landfill gas is utilized for power generation. However, there is no mechanism and policy to guide the whole country to have landfill gas recovery and utilization systems. Therefore it is still a blank paper for landfill management to establish landfill gas recovery and utilization systems. "

As mentioned earlier, the echnical code CJJ 17 -1988 is not enforced. Thus neither alternative listed in 1a is hindered by applicable regulations or laws.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the methodology for determination of additionality, the project developer has to select one of three alternative financial analysis for this step. If the project does not generate any financial or economic benefit other than CDM-related, than Option I should be used. Option 1 is not applicable to this project because it does generate electricity-sales revenue. Option II is based on the comparison of returns of the project investment with the investment required for an alternative to the project. In this case, the alternative to the CDM project activity is simply not to install flaring and generation equipment in the site, and therefore does not involve investments of comparable scale to the project. Consequently, Option II is not applicable to this project. Therefore, Option III must be used, where the returns of the investment in the project activity is compared to benchmark returns that are available to any investors in the country.

Sub-step 2b: Option III - Apply benchmark analysis

The likelihood of development of the Project, as opposed to the continuation of current activities (i.e., no collection and combustion of landfill gas) will be determined by comparing its IRR with the benchmark of interest rates available to a local investor. In May 2005, interest rates for a five-year term of local banks in China are 3.60% and government bonds are 4.50 %. The benchmark rate of return on construction or similar risks involved projects is commonly set at 12%. The average returns from stock market and private equity funds are higher, which are about 13% and 15% respectively.

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

The Table below shows the financial analysis for the project activity. As shown, the project IRR (without carbon) is 7.31 %, lower than the benchmark rate of return on construction projects in China. Clearly, without carbon revenue, the project will face substantial financial hurdles and would not happen. This is even more evident if we compare these returns with the returns from stock market and private equity funds in China (see above).
Table: Financial results of the Project (Alternative 2) with and without carbon finance. NPV uses 8% discount rate.

	with carbon	**without C**
Net Present Value (US$)	6,116,076	-364,233
IRR	26.58%	6.61%
Discount rate	8%	8%

Summary of results of project analysis. Details provided in a separate document made available to validators and DNA.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Increase in project revenue (price of electricity sold to the grid). Even though this is currently fixed, the analysis provides for the results in case this value was to be changed in the future;
- Reduction in project capital (CAPEX) and running costs (Operational and Maintenance costs).

Those parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 10 %, and assessing what the impact on the project IRR would be (see Table below).

Net Present Value (US$)	**IRR (%)**	**NPV (US$) (optional)**
Original	6.61%	-364,233
Increase in project revenue	11.72%	937,001
Reduction in project costs	11.52%	828,129

Note: NPV uses 8% discount rate.

In conclusion, the project IRR remains low even in the case where these parameters change in favour of the Project. Even though these numbers are higher than the risk free returns of government bonds, these are still too low for a risky enterprise such as the construction and operation of a landfill gas-to-energy project, and fairly lower than private equity investments such as 15%. Consequently, the Project cannot be considered as financially attractive.

Step4. Common Practice Analysis

This section of the PDD reinforces this by showing that the common practice in the region is indeed to not flare or use landfill gas.

To date there has been limited development of landfill gas to energy projects in China. Most of the waste sites are open pits located on the urban fringes, in streams, river valleys or wetlands. This uncontrolled dumping has seriously polluted the environment and affected the health of the surrounding population. With the growing population, China has recognized the need to improve its waste management and has set a goal of disposing of 60 percent of municipal refuse in sanitary landfills by 2000.

With the increasing of population and the organic content of the waste, methane emissions from landfills have become one of the fastest growing sectoral sources of greenhouse gases in China. The Ministry of Construction developed a comprehensive technical standard on municipal solid waste management in 1988. However, in general the standards were not followed due to investment and technological barriers. At present, there are about 300 landfills in China, but most of the landfills have no leachate collection system, have inappropriate or no cover system, have limited or no compaction, have no gas control system, and have no waste screening systems in place. [6]

[6] Source: Environmental Resource Management 2004, *China Waste Management Working Paper*

So far, very few of landfills have been designed to collect and utilize (or even flare) the full amount of gas generated. The table below shows the current status of some main landfills in East China region.

Landfill	Waste deposition rate (t/day)	Current status
Shanghai Laogang	4000	not collecting and/or utilizing landfill gas
Suzhou Qizishan	2500	not collecting and/or utilizing landfill gas
Wuxi Solid waste	1700	capturing and utilising landfill gas but not successful
Hangzhou Tianzilin	1600	not collecting and/or utilizing landfill gas
Nanchang Maiyuan	1800	not collecting and/or utilizing landfill gas
Fuzhou Hongmiaoling	1800	not collecting and/or utilizing landfill gas
Hefei Solid waste	1300	not collecting and/or utilizing landfill gas
Wuhu Solid waste	700	not collecting and/or utilizing landfill gas
Nanjing Shuige	1000	capturing and utilising landfill gas as demonstration project, funded by GEF and foreign company
Anqing Solid waste	400	not collecting and/or utilizing landfill gas
Sanming Solid waste	200	not collecting and/or utilizing landfill gas

Most of the landfills above are currently not capturing and/or flaring landfill gas except for safety purposes. Among all the landfills in Jiangsu Province, only two landfills started to utilise the gas-Nanjing Shuige and Wuxi Taohuashan. The Nanjing Shuige landfill gas for power generation project was a demonstration project in Jiangsu Province. It was fully funded by an Australian company with the support of GEF. Wuxi Taohuashan also made an attempt, but the project was not very successful. In summary, the passive venting method is still a common practice in today's China landfills. Although the new legislation with regards to reforming landfill management is already in place, there is still a gulf between stated regulation and actual implementation.

Step 5. Impact of CDM registration

As shown in Step 2 above, the Project is unlikely to move forward without the additional financial support of the CDM. If the developers were able to sell emission reduction credits from the Project activity at an assumed price of U$ 5.50 dollars per tonne of CO_2e, the additional revenue generated by carbon sales would be sufficient to make the Project go ahead (see Table in Step 2c above).

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project boundary shall encompass all anthropogenic emissions by sources of greenhouse gases (GHG) under the control of the project participants that are significant and reasonably attributable to the CDM project activity. According to ACM0001 baseline methodology, the project boundary is the site of the project activity where the gas will be captured and destroyed/used. According to I.D of small-scale CDM methodology, project boundary should encompass the physical, geographical site of the renewable generation source.

The following project activities and emission sources are considered within the project boundaries:

- CH_4 emissions from the un-recovered landfill gas liberated from the landfill site. It is estimated that only 55% of LFG generated will be captured meaning the remaining 45% is released as fugitive emissions.

- CO_2 from the combustion of landfill gas in the flares and electricity generator. When combusted, methane is converted into CO_2. As the methane is organic in nature these emissions are not counted as project emissions. The CO_2 released during the combustion process was originally fixed via biomass so that the life cycle CO_2 emissions of landfill gas are zero. The CO_2 released is carbon neutral in the carbon cycle.

- Electricity required for the operation of the project activity should be accounted in the project emissions and monitored. However, as the project activity involves electricity generation and uses electricity generated from landfill gas, only the net quantity of electricity fed into the grid should be used to account for emission reductions due to displacement of electricity in other power plants.

A full flow diagram of the project boundaries is presented in the figure below. The flow diagram comprises all possible elements of the landfill gas collection systems and the equipment for electricity generation.

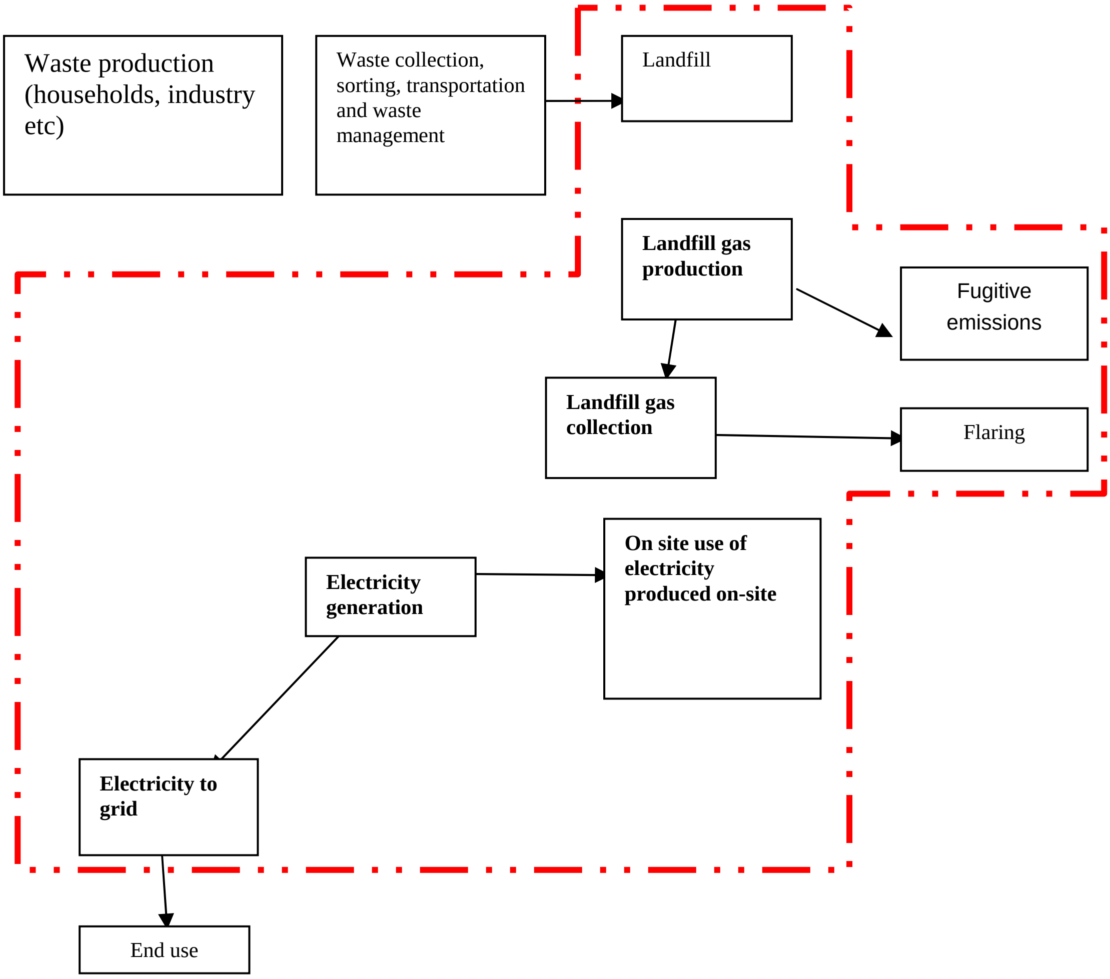


Figure: Flow chart of project boundaries (staggered line indicates boundaries)

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

The baseline study was concluded in May 2005. The entities determining the baseline and participating in the Project as the Carbon Advisors are EcoSecurities Ltd., UK, Chinese Renewable Energy Industries Association and Chubu Electric Power Company Inc, Japan.

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:

01/07/2004

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

More than 20 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:

01/05/2005

C.2.1.2. Length of the first crediting period:

7 (seven) years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

ACM0001 "Consolidated monitoring methodology for landfill gas project activities", together with Approved Monitoring Methodology for Small-scale Activities Type ID-Renewable Electricity Generation for a Grid.

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

The methodology ACM 0001 allows for the development of projects falling under 3 options. Option a) refers to landfill projects that capture gas but this is simply flared. Option b) refers to projects that use the gas for the generation of electricity but do not claim the credits from displacing energy from other sources. Option c) refers to projects where the captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources.

As previously described, the Project is based on two complementary activities, as follows:

- The collection and flaring of combustion of landfill gas, thus converting its methane content into CO_2, reducing its greenhouse gas effect; and,

- The generation and supply of electricity to the regional grid, thus displacing a certain amount of fossil fuels used for electricity generation.

The Project therefore fulfils the conditions of Option c (i.e. the captured landfill gas is used to produce electricity and reductions are claimed for displacing electricity generation from other sources) so ACM0001 was considered the most appropriate methodology for the Project.

In this case a baseline methodology for electricity and or thermal energy displaced shall be provided or an approved one used, including the ACM0002 "Consolidated Methodology for Grid-Connected Power Generation from Renewable Sources". If capacity of electricity generated is less than 15MW, and or thermal energy displaced is less than 54 TJ (15GWh), small-scale methodologies can be used.

As the generation component of the Project is smaller than 15 MW, simplified monitoring methodologies for small-scale projects will be used to monitor reductions for displacing electricity generation from other sources. As described in the Simplified Procedures for SSC Projects for Type I.D projects-Renewable Electricity Generation for a Grid, measuring and recording the amount of electricity supplied to the grid is the most accurate method of monitoring the Project.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

Not applicable.

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1. $LFG_{total,y}$	Total amount of landfill gas captured	m^3	m	Continuously	100%	electronic	During the crediting period and two years after	Measured by a flow meter. Data to be aggregated monthly and yearly.
2. $LFG_{flared,y}$	Amount of landfill gas flared	m^3	m	Continuously	100%	electronic	During the crediting period and two years after	Measured by a flow meter. Data to be aggregated monthly and yearly.
3. $LFG_{electricity.y}$	Amount of landfill gas combusted in power plant	m^3	m	Continuously	100%	electronic	During the crediting period and two years after	Measured by a flow meter. Data to be aggregated monthly and yearly.
4. $LFG_{thermal.y}$	Amount of methane combusted in boiler	m^3	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	not applicable as the Project will not include a thermal energy component
5. FE	Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)	%	m/c	Quarterly, monthly if unstable	n/a	electronic	During the crediting period and two years after	(1) Periodic measurement of methane content of flare exhaust gas. (2) Continuous measurement of operation time of flare (e.g. with temperature)
6. $W_{CH4,y}$	Methane fraction in the landfill gas	m^3 CH_{4}/ m^3 LFG	M	Continuously	100%	electronic	During the crediting period and two years after	Measured by continuous gas quality analyser.

7. T	Temperature of the landfill gas	ºC	m	Continuously	100%	electronic	During the crediting period and two years after	Measured to determine the density of methane D_{CH4}
8. p	Pressure of the landfill gas	Pa	m	Continuously	100%	electronic	During the crediting period and two years after	Measured to determine the density of methane D_{CH4}
9.	Total amount of electricity and/or other enegy carriers used in the project for gas pumping and heat transport (not derived from the gas)	MWh	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable as the Project will use electricity generated from the landfill gas
10.	CO_2 emission intensity of the electricity and/or other energy carriers in ID 9.	tCO_2/ MWh	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable as the Project will use electricity generated from the landfill gas
11.	Regulatory requirements relating to landfill gas projects	Text	n/a	At the beginning of each crediting period	100%	electronic	During the crediting period and two years after	Required for any changes to the adjustment factor (AF) or directly $MD_{reg,y}$
12. EGy	Net Electricity supplied to the grid	MWh	m	Hourly measured and monthly recording	100%	electronic	During the crediting period and two years after	This takes into account electricity use for the operation Double checked with receipts of sales.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

The source of emissions from the Project is the combustion of landfill gas in the flares and electricity generator. When combusted, methane is converted into CO_2. As the methane is organic in nature these emissions are not counted as project emissions. The CO_2 released during the combustion process was originally fixed via biomass so that the life cycle CO_2 emissions of landfill gas are zero. The project, however, does not collect all the methane that is generated. Consequently, these emissions are excluded from the projections of emission reductions expected from the project.

Therefore the only emissions associated with the project are related to the electricity used for the operation of the flare pumps and other auxiliary equipment. Project emissions in tCO_2e during a given year 'y' (PE_y) are equal to the net amount of electricity used by the project in any given year in MWh (EG_y), multiplied by a carbon emissions factor ($CEF_{electricity\ y}$) for the grid from which electricity is taken (tCO_2e/MWh):

$$PE_y = EG_y * CEF_{electricity,y}$$

Total electricity used *for* the project will be deducted from the amount of electricity produced *by* the project, thus emissions reductions will only be claimed for the *net* electricity supplied to the grid. Project emissions are therefore accounted for in the formula for emissions reductions in section D.2.4 below.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable as no leakage effects need to be accounted under both the ACM 0001 and Small-scale activities Type I.D-Renewable Electricity Generation for a Grid methodologies.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

No leakage effects have to be accounted for under both the ACM 0001 and Small-scale activities Type I.D-Renewable Electricity Generation for a Grid methodologies.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EG_y * CEF_{electricity,y} + ET_y * CEF_{thermal,y}$$

Where:

ER_y: greenhouse gas emission reduction achieved by the Project activity during a given year *"y"* (t CO_2e).
$MD_{project,y}$: amount of methane actually destroyed/combusted during the year *"y"* (tCH_4).
$MD_{reg,y}$: amount of methane that would have been destroyed/combusted during the year *"y"* in the absence of the Project activity (tCH_4).
GWP_{CH4}: approved Global Warming Potential value for methane (21 t CO_2e / tCH_4).
EG_y: net quantity of electricity displaced during the year *"y"* (MWh) (this is net of any electricity use for the operation of flares and pumps, see section D.2.2.2 above).
$CEF_{electricity,y}$: CO_2 emissions intensity of the electricity displaced during year *"y"* (tCO_2e/MWh).
ET_y: quantity of thermal energy displaced during the year *"y"* (TJ).
$CEF_{thermal,y}$: CO_2 emissions intensity of the thermal energy displaced during year *"y"* (tCO_2e/TJ).

As the Project will not include a thermal energy component, this factor will be excluded from the overall equation.

The $CEF_{electricity,y}$ for the grid will be calculated according to the equations for small scale electricity projects (**Methodology for Small Scale Activities Type 1.D-Renewable Electricity Generation for a Grid**), as shown below. **The carbon emissions factor ($CEF_{electricity}$)** is calculated according to option (b), the weighted average emissions (in kg CO_2equ/MWh) of the current generation mix. This method is used as sufficient data for the calculation of the operating margin and build margin of the Jiangsu grid is not available in China. The carbon emissions factor of the grid (EF_y) is therefore calculated according to the equation below.

EF_y is calculated using the using the weighted average emissions of the current generation mix as shown in the following equation:

$$EF_y\ (tCO_2 / MWh) = \frac{\sum_{i,j} F_{i,j,y} * COEF_{i,j}}{\sum_j GEN_{j.y}}$$

Where:

$F_{i,j,y}$ is the amount of fuel *i* (in GJ) consumed by power sources *j* in year *y*;

j is power sources delivering electricity to the grid
$COEF_{i,j,y}$ is the carbon coefficient of fuel *i* (tCO_2/GJ);
$GEN_{j.y}$ is the electricity (MWh) delivered to the grid by source *j*.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored			
A (Indicate table and ID number e.g. D.4-1; D.4-2.)	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
D.2.2.1-1 $LFG_{total,y}$	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy
D.2.2.1-2 $LFG_{flared,y}$	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy
D.2.2.1-3 $LFG_{electicity,y}$	Low	Yes	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy
D.2.2.1-4 $LFG_{thermal.y}$	Not applicable	Not applicable	Not applicable as the Project will not include a thermal energy component
D.2.2.1-5 FE	Medium	Yes	Regular maintenance will ensure optimal operation of flares. Flare efficiency should be checked quarterly, with monthly checks if the efficiency shows significant deviations from previous values.
D.2.2.1-6 $W_{CH4,y}$	Low	Yes	The gas analyser should be subject to a regular maintenance and testing regime to ensure accuracy.
D.2.2.1-12 EG_y	Low	Yes	This data will be directly used for calculation of emission reductions. These data is the one most accurately measure, as this is measured both by the operator as well as by the grid company that will acquire the electricity generated by the Project. To guarantee QC/QA, it will be double checked by receipts of electricity sales.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

The Project Developer has designated Mr. Pu Shigui, General Manager of Green Waste Recovery Engineering Co., Ltd to be responsible for monitoring activities

- The proven and qualified monitoring equipment including flow meter and gas analyser will be installed in place. The systems will allow automated and continuous recording and reporting of data. These readings will be checked for any anomalies before being filed for future reference.

- The data will be monitored and recorded by qualified technicians according to the monitoring plan. All the technicians will receive proper training to ensure they understand their specific tasks and handling of equipment. The records will be double checked by Mr Pu who will be responsible for accuracy and frequency of the measurements.

- The data will be kept both in computer and hard copy in a transparent system. Receipts of electricity sales will be obtained.

- Proper management process and routine procedures will be put in place to ensure the quality of reports required by verification audits and carbon buyers. In the case of non-conformities in the implementation of the Project with relation to the monitoring plan, an analysis of non-conformity and its causes will be carried out immediately and corrective actions will be implemented.

D.5 Name of person/entity determining the monitoring methodology:

The monitoring study was concluded in May 2005. The entities determining the monitoring methodology and participating in the Project as the Carbon Advisors are EcoSecurities Ltd., UK, Chinese Renewable Energy Industries Association and Chubu Electric Power Company Inc, Japan.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

Project emissions are equal to the amount of electricity used for the operation of the pumps, flares, and other auxiliary equipment, times the appropriate carbon emissions factor for the electricity used. Since the project will generate it's own electricity and supply this to the grid, the amount of electricity used for the pumps, flares etc will be deducted from the amount of electricity supplied to the grid, giving the net electricity supplied to the grid (EG_y in section D.2.4 above). Only emissions reductions for this net electricity supplied to the grid will be claimed, as specified in the methodology ACM0001.

E.2. Estimated leakage:

No leakage needs to be accounted for by this methodology.

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

The sum of E.1 and E.2 is equal to 0 per year.

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

The consolidated methodology for landfill projects uses an equation for calculating the amount of methane destroyed in the baseline scenario, as opposed to the amount of methane emitted in this scenario. We will use the convention established in the consolidated methodology and use this section to describe the amount of methane destroyed in the baseline scenario. The equation is, as follows:

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

Where:

$MD_{reg,y}$: amount of methane that would have been destroyed/combusted during the year *"y"* in the absence of the project activity (tCH_4).

$MD_{project,y}$: amount of methane actually destroyed/combusted during the year *"y"* (tCH_4).

AF = Adjustment Factor (%)

The methane destroyed by the Project was estimated using the USEPA First Order Decay Model[7], using Lo and k values appropriate for this humid subtropical monsoonal region of China and assuming that only 55% of the landfill gas generated is collected by the gas collection system (average for landfills in developing countries). In any case, as this projection is merely for illustrational purposes only, the precision of these values are not so important (i.e., the actual emissions reductions will be monitored directly). Further information on the USEPA model and the parameters used are shown in Annex 3 of this document.

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[7] On this model, see US EPA manual "Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators" (December 1994).

The AF value used for the Project is 5%. This value is justified based on the fact that there are no regulatory requirements to flare the gas at the landfill, therefore the baseline flaring is 0%. We have adopted 5% in order to be conservative, and to take into account flaring at the pilot wells (see below).

The estimation of the Adjustment Factor for the Project was based on the regulatory requirements imposed on the Project Developer at the time they signed a contractual agreement with the local waste management company to operate the landfill and as outlined in part B.

In 2002, the Project Developer drilled 10 gas wells for gas analysis purposes only and has already a small flare, as a pilot for the gas collection project that will be implemented with carbon finance. Given that the collection system used was not sophisticated enough, only gas collected from a maximum of 2-3 wells could be flared. In the project scenario, 42 wells are currently proposed for the area of 58,200 m^2. The site will expand to 240,000m^2 in subsequent phases and it is planned to have 170 wells in total. The number of gas wells in the baseline scenario represents 2% of the number of wells in the project scenario. Also, more effective gas collection and flaring system will be adopted to maximize extraction and flaring of landfill gas. For this reason, the Adjustment Factor for the Project was fixed at 5%, in order to provide a large enough conservative margin to what could have been flared in the baseline scenario.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The consolidated methodology for landfill projects uses an equation for calculating the amount of methane destroyed in the project scenario, as opposed to the amount of methane emitted in this scenario. We will use the convention established in the consolidated methodology and use this section to describe the amount of methane destroyed in the project scenario. The equation is, as follows:

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y}$$

Where:

$MD_{project,y}$: amount of methane actually destroyed/combusted during the year *"y"* (tCH_4).
$MD_{flared,y}$: quantity of methane destroyed by flaring during the year *"y"* (tCH_4).
$MD_{electricity,y}$:quantity of methane destroyed by generation of electricity during the year *"y"* (tCH_4)
$MD_{thermal,y}$: quantity of methane destroyed by generation of thermal energy (excluded, as no thermal energy will be used).

In order to calculate the quantity of methane destroyed by flaring, the following equation is used:

$$MD_{flared,y} = LFG_{flared,y} * w_{CH4,y} * D_{CH4} * FE$$

Where:

$MD_{flared,y}$: quantity of methane destroyed by flaring flared during the year *"y"* (tCH_4);
$LFG_{flaredy,y}$:quantity of landfill gas flared during the year *"y"* (m^3CH_4);

$w_{CH4,y}$: the average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3 CH_4 / m^3 LFG);
D_{CH4}: the methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4);
FE : the flare efficiency (the fraction of the methane destroyed).

As part of the methane will also be destroyed through combustion in the electricity generation engines, the amount of methane destroyed through this path can be calculated as follows (according to ACM 0001):

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} *D_{CH4}$$

Where:

$MD_{electricity,y}$: quantity of methane destroyed by electricity generation during the year *"y"* (tCH_4);
$LFG_{electricityy,y}$:quantity of landfill gas used for electricity generation during the year *"y"* (m^3CH_4);
$W_{CH4,y}$: the average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3 CH_4 / m^3 LFG) (the same as in the expression above);
D_{CH4}: the methane density expressed in tones of methane per cubic meter of methane (tCH_4/m^3CH_4).

As it can be seen, this expression is the same as the one for the calculation of methane destroyed by flaring, except for not reducing the amount of methane destroyed by using the adjustment factor (FE) related to flare efficiency. Consequently, by assuming that all gas will be flared (as opposed to separating the amount to be flared from the amount used for electricity generation), this will lead to a more conservative analysis. This was the approach used in this PDD, to ensure an additional level of conservatism.

E.6. Table providing values obtained when applying formulae above:

The emissions reductions of the Project were calculated using the following equation:

$$ER_y = (MD_{project,y} – MD_{reg,y}) * GWP_{CH4} + EG_y * CEF_{electricity,y}$$

The summary of estimated results are expressed in the following Table. The actual emission reductions generated by the Project will be measured directly after the Project is operational.

The full results, year by year, are shown in the tables and graphs below.

Table: Projection of landfill gas and methane production and collection at the Nanjing Tanjingwa landfill site, and emission reductions generated.

		2005	2006	2007	2008	2009	2010	2011
Landfill gas emissions								
Total gas emmited (m3/yr)		51,600,726	54,458,498	57,044,317	59,384,064	61,501,153	63,416,776	65,150,102
Methane emissions								
Methane content of gas (%)	50%							
Density of methane (t/m3)	0.0007168							
Total methane produced (t/yr)		18,494	19,518	20,445	21,283	22,042	22,729	23,350
Residual emission factor CH4 to CO2	0	(assuming 100% organic waste)						
Methane GWP	21							
Baseline								
Proportion of methane flared in baseline (%)	5%	(adjusted for combustion efficiency)						
Baseline methane emissions (t/yr)		17,569	18,542	19,422	20,219	20,940	21,592	22,182
CO2 equivalent		368,949	389,383	407,871	424,601	439,738	453,435	465,828
Residual CO2 emissions from flaring		0	0	0	0	0	0	0
Total CO2 emissions baseline		**368,949**	**389,383**	**407,871**	**424,601**	**439,738**	**453,435**	**465,828**
Project								
Flare combustion efficiency (%)	97%							
Proportion of methane collected (%)	53%	(adjusted for combustion efficiency)						
Project methane destroyed (t/yr)		9,866	10,413	10,907	11,355	11,759	12,126	12,457
Project methane emissions (t/yr)		8,627	9,105	9,537	9,929	10,283	10,603	10,893
CO2 equivalent - emissions		181,174	191,207	200,286	208,501	215,935	222,660	228,746
CO2 emissions from combustion		0	0	0	0	0	0	0
Total CO2 Emissions - Project (t/yr)		**181,174**	**191,207**	**200,286**	**208,501**	**215,935**	**222,660**	**228,746**
Emission Reductions (tCO2/yr)		**187,776**	**198,175**	**207,585**	**216,099**	**223,804**	**230,775**	**237,082**
Cummulative (tCO2)		187,776	385,951	593,536	809,636	1,033,439	1,264,214	1,501,296

Table: Projection of emission reductions from grid electricity generation displacement by landfill gas generated electricity.

	2005	2006	2007	2008	2009	2010	2011
Project year	1	2	3	4	5	6	7
CEF (tCO2/MWh)	0,874	0,874	0,874	0,874	0,874	0,874	0,874
MWh per year output (after deducting electricity used in project)	30 625	30 625	38 425	38 425	38 425	38 425	38 425
Grid Electricity Displacement Emission Reductions (tCO2/year)	**26 766**	**26 766**	**33 583**	**33 583**	**33 583**	**33 583**	**33 583**
Cumulative Emission Reductions from electricity (tCO2)	26 766	53 532	87 116	120 699	154 283	187 866	221 450

SECTION F. Environmental impacts

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

An environmental impact assessment (EIA) was completed in accordance with Chinese regulation as part of the feasibility study for the Project and was approved by Environmental Protection Bureau of Nanjing Municipality in December 2002. The objective of this EIA was to identify the effects of the Project activities on both the biophysical components of the environment and socio-economical aspects of local community and provide measure and procedures to mitigate the possible effects.

The outcome of the EIA was favourable and the Project was found to have no significant environmental impacts. The Project not only reduces the hidden danger caused by uncontrolled release of landfill gas, but also reduces the pollution caused by the landfill to the air, soil and water quality in the local area. From environmental protection perspectives, the Project was in compliance with national industry policy, promoting sustainable development and utilisation of waste.

During the Project design and construction, all the mitigation measures proposed by EIA report will be implemented and the following key aspects will be addressed:

- Water Quality

Groundwater and surface water can be contaminated by untreated leachate from landfill sites. Leachate may cause serious water pollution if not properly managed. Leachate mitigation measures will be taken to reduce its impact on ground water quality. With the Project Developer using leachate recirculation as a leachate treatment method, these potential problems should be avoided.

- Air Quality

Landfill gas electricity generators can also produce nitrogen oxides emissions that vary widely from one site to another, depending on the type of generator and the extent to which steps have been taken to minimize such emissions. Emissions of landfill gas electricity generators will be in compliance with “Boiler Air Pollutant Emissions Standards” (GB13271-2001) set forth in the Chinese environmental guidelines and the location of the flare and generators which constitute the main point of emissions will be placed in accordance with “Jiangsu Province Pollutant Emission Point Location and Standardization Regulation and Management”. However, these emissions are viewed as significantly less harmful than the continued uncontrolled release of landfill gas. The Project will significantly reduce odour and greenhouse gas emissions.

- Noise

There will be some increase in noise from the site associated with energy recovery, although the engines will be strategically placed to reduce noise emissions. The impacts are likely to be marginal given the noise typically associated with operations at the landfills. The equipment selected is state of the art and has low noise levels, and measures of sound insulation and shock absorption will be taken. Noise of the project site will meet standards Category II of “Industry Company and Factory Noise Standards” (GB12348-90 II).

- Visual Impacts

Afforestation of the project site needs to be strengthened and the project construction will be well coordinated with the surrounding environment. The construction of an energy generation facility at the landfill site will increase the visual presence of the project in the site, however the impacts are expected to be marginal given the visual intrusion currently associated with the waste disposal operations. Measures of dust and odour prevention should be implemented during project construction.

- Safety

Safety prevention measures of gas delivery system will be in place to ensure safe delivery of methane gas from Tianjingwa Landfill. Other potential hazardous impacts minimized by appropriate management of the Project site include the risks of fire or explosions, and landfill gas migration.

A copy of EIA report will be provided to the Operational Entity validating the Project.

F.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.

SECTION G. Stakeholders' comments

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

According to the national regulations on environmental management for constructing projects, from National Environmental Protection Administration of China, any construction projects must consult with local stakeholders for their comments and suggestions, as part of Environmental Impact Assessment procedure. In this case, 14experts from the organisations were invited for stakeholders consultation seminar held at meeting room of Tianjingwa Landfill administration office on 2nd August 2002:

- Local Municipality and City Appearance Bureau;
- Environment agencies from the State and Local Authorities;
- Environmental experts.

Local stakeholders were invited to raise their concerns and provide comments on the Project during the seminar. In addition, survey questionnaires were sent to 10 residents in Huangyao Village, East Gate Road and Taishan Town.

G.2. Summary of the comments received:

The Summary of the comments received from the seminar includes:

- The Project construction has no effect on city appearance;
- The Project contributes to waste recovery and utilisation in Nanjing City;
- The Project complies with national industry policy and improves the local environment;
- The Project promotes the local economy and sustainable development.

The results of the questionnaires include:

- The local economy state: good (75%) and very good (22%)
- The main problem of economic development: lack of natural resource (61%) and transportation (18%)
- The main problem of local environment: Water pollution (85%) and dust pollution (19%)
- The necessity of the Project: very necessary (77%) and necessary (22%)
- The Project's impact on utilisation and development of the local environment: very good (27%) and good (73%)
- The Project's contribution to environmental protection: yes (89%)
- The Project's impact on improvement of the local environment: will improve (80%) and improve greatly (9%)

The Summary of the comments received from the questionnaires includes:

- The Project contributes to local environmental protection;
- The Project contributes to waste recovery and utilisation in Nanjing City;
- The Project promotes the local economy and sustainable development.
- The Project contributes to improvement of local environment.

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

All comments received in the context of environment impact assessment process have been incorporated into the executive project. The documentation is available to the public on request.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Developer and Operator:

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project.

Annex 3

BASELINE INFORMATION

Table: Data used for the weighted average emissions factor calculation for the electricity component of the Project.

Emission Factor Jiansu Grid 2002

Fuel Type	TJ/t fuel	tC/TJ	Oxid. fact (%)	tCO2e/t fuel	Source
Natural gas	0.05230	15.3	0.995	2.9220	IPCC 1996
Heavy oil	0.04019	21.1	0.990	3.0811	IPCC 1996
Coal	0.02052	25.8	0.980	1.9041	IPCC 1996

Natural Gas Density (t/m3)	0.00067

Jiangsu Grid FY 2002	Fuel Consumption (for Thermal Plants larger than 600kW)			CO2 emissions			Total Generated Power	Total CO2 emissions
	Coal	Oil	Natural Gas	Coal	Oil	Natural Gas	MWh/yr	tCO2e/yr
	ton/yr	ton/yr	m3/yr	tCO2e/yr	tCO2e/yr	tCO2e/yr		
Jiangsu Province Grid	53,622,700.00	147,100.00	833,360,000.00	102102853.6	453225.559	1631509.919	116,876,000.00	104187589.1

Average Emission factor 0.891436985

Emission Factor Jiansu Grid 2003

Fuel Type	TJ/t fuel	tC/TJ	Oxid. fact (%)	tCO2e/t fuel	Source
Natural gas	0.05230	15.3	0.995	2.9194	IPCC 1996
Heavy oil	0.04019	21.1	0.990	3.0783	IPCC 1996
Coal	0.02052	25.8	0.980	1.9024	IPCC 1996

Natural Gas Density (t/m3)	0.00067

Jiangsu Grid FY 2003								
Fuel Consumption (for Thermal Plants larger than 600kW)				CO2 emissions			Total Generated Power	Total CO2 emissions
	Coal	Oil	Natural Gas	Coal	Oil	Natural Gas	MWh/yr	tCO2e/yr
	ton/yr	ton/yr	m3/yr	tCO2e/yr	tCO2e/yr	tCO2e/yr		
Jiangsu Province Grid	61,427,800.00			116858290.9	0	0	133,677,000.00	116858290.9

Average Emission factor 0.874183972

N.B. The average emissions factor for 2003 was chosen, as the most conservative (lowest) of the two options.

Description of the USEPA model and parameters used

The US EPA first order decay model equation from the US EPA manual ‘Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators' (December 1994) is as follows:

$$LFG=2L_oR(e^{-kc}-e^{-kt})$$

Where

LFG = total landfill gas generated in current year (cf)

L_o = theoretical potential amount of landfill gas generated (cf/lb)

R = waste disposal rate (lb/year)

t = time since landfill opened (years)

c = time since landfill closed (years)

k = rate of landfill gas generation (1/year)

The inputs used were based on emissions factors in the EPA's guidance document, 'Turning a Liability into an Assest: A Landfill gas to Energy Handbook for Landfill owners and Operators'. Appropriate values are used based on the climate of the region, which as described in section A.4.1.4. For a 'wet climate', the handbook suggests and l factor of 2.25-2.88, of which we use 2.56, in the mid range, and a k value of 0.1-0.35, of which we use the lowest, most conservative value.

Main assumptions:

Started operation	1995
Finish operation	2014
Waste in place (tonnes)	2,520,000
Average daily waste rate (t/day)	700.0
Average daily waste rate (lbs/yr)	563,377,500

General defaults and conversion factors

1 cubic foot=	0.0283	m3
1kg=	2.205	lbs
Lo=	2.56	cf/lb
R=	700	t/day
k =	0.1	1/year
methane content of landfill gas=	0.5	
Density of methane=	0.04237	lbm/cf @ 60 deg. F and 14.696 psia
Density of methane=	0.0007168	t/m3 @ 60 deg. F and 14.696 psia

Annex 4

MONITORING PLAN

As in Part D.2.2 of this document.