



## Monitoring report form (Version 03.1)

### Monitoring report

<b>Title of the project activity</b>	Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation
<b>Reference number of the project activity</b>	1406
<b>Version number of the monitoring report</b>	Version 02
<b>Completion date of the monitoring report</b>	06/03/2013
<b>Registration date of the project activity</b>	27/08/2008
<b>Monitoring period number and duration of this monitoring period</b>	It's the 4 <sup>th</sup> monitoring period and the duration of this monitoring period is 01/01/2012 to 31/12/2012
<b>Project participant(s)</b>	Tianjin Clean Energy and Environmental Engineering Co., Ltd. Spanish Carbon Fund; International Bank for Reconstruction and Development ("World Bank") as Trustee of the Spanish Carbon Fund;
<b>Host Party(ies)</b>	People's Republic of China
<b>Sectoral scope(s) and applied methodology(ies)</b>	1: Energy industries (renewable -/ non – renewable sources) 13:Waste handling and disposal Applied methodology(ies) AMS – I.D. ver.10 – Grid connected renewable electricity generation (December 2006) ACM0001 VER. 5 – Consolidated methodology for landfill gas project activities (December 2006)
<b>Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD</b>	<b>157,639 t CO<sub>2</sub>e</b>
<b>Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period</b>	<b>83,478 t CO<sub>2</sub>e</b>

**SECTION A. Description of project activity****A.1. Purpose and general description of project activity**

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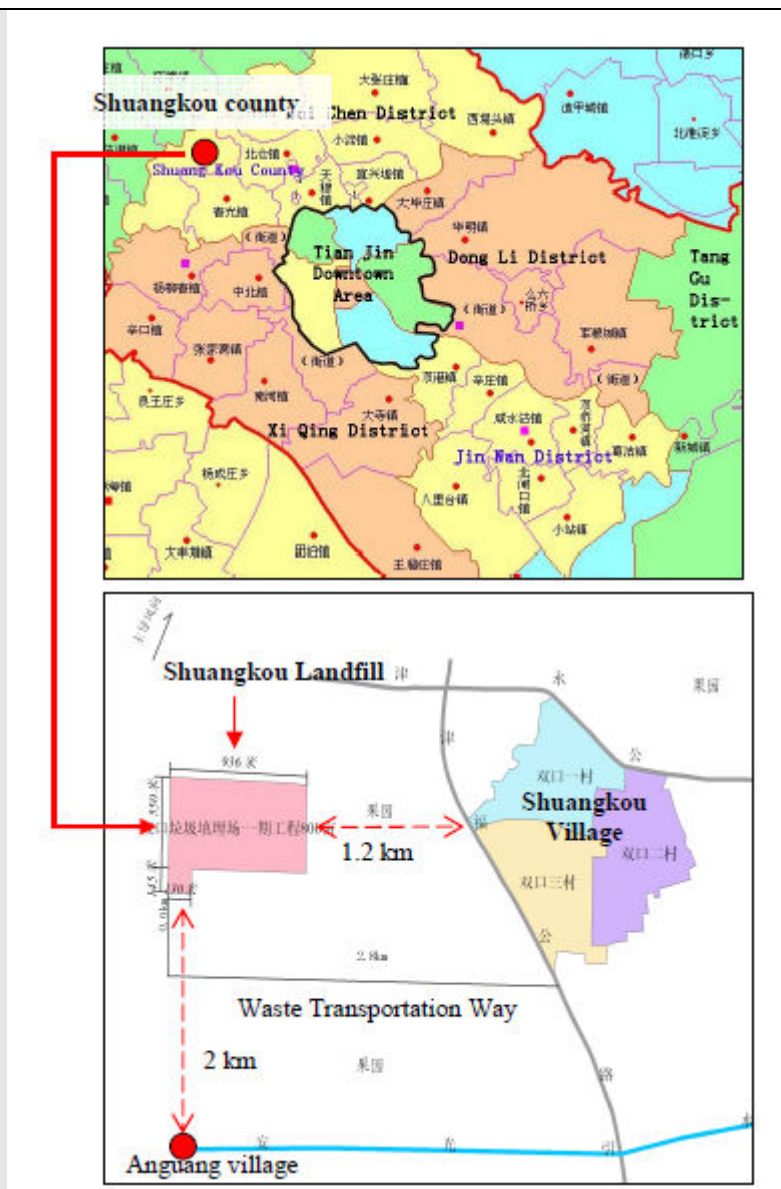
The project is designed to reduce greenhouse gas emissions generated from the landfill, including power generation offsets, by a total of approximately 913,108 tonnes of carbon dioxide equivalents (tCO<sub>2</sub>e) during the first 7-year crediting period, from 2008 to 2015, 95% of which will be sent to the grid while the remaining 5% will be used on-site ex ante. Excess LFG, as well as all gas collected during periods when electricity is not generated, will be flared.

**A.2. Location of project activity**

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The project is located at Shuangkou landfill site in China's metropolis of Tianjin. Situated between 38.57-40.25 north latitude and 116.71-118.67 east longitude. Tianjin is by the Bohai Gulf and in the eastern part of North China Plain. Flat land covers 94.2% of land area, and between 2.2 to 50 meters above sea level. Tianjin has a coastline of 113.4 kilometres long. Covering a jurisdiction area of 11,305 square kilometres, 186 kilometres from north to south and 101 kilometres from east to west, and with a population of more than 10.2 million ( data of year 2004), it enjoys the semi-humid continental monsoon climate of warm temperate zone.

Shuangkou landfill is located in the Shuangkou town, west of Beichen District. There are several villages in the vicinity of the landfill, among which Shuangkou village is the closest, located 1.2 km to the east, and Anguang village is 2 km to the south. See below for the project location.



### A.3. Parties and project participant(s)

Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Party A (host) People's Republic of China	Private entity A Tianjin Clean Energy and Environmental Engineering Co., Ltd.  Public entity A	No

<b>Party B</b>	<b>Private entity B</b> <b>Spanish Carbon Fund</b> <b>International Bank for Reconstruction and Development (World Bank) as Trustee of Spanish Carbon Fund</b> <b>Public entity B</b>	
...	...	

**A.4. Reference of applied methodology**

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- ACM0001 Consolidated baseline and monitoring methodology for landfill gas project activities (version 05)
- AMS-I.D. Grid connected renewable electricity generation (version 10)
- Tool for demonstration and assessment of additionality (version 03)
- Methodological Tool to determine project emissions from flaring gases containing methane (adopted by EB28 meeting, December 2006)

**A.5. Crediting period of project activity**

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Start Date on 27/08/2008 and 7 years, renewable

**SECTION B. Implementation of project activity****B.1. Description of implemented registered project activity**

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*1. The starting date of operation of the project activity*

Two CAT generators have been installed on site with the capacity 2 X 1.03 MW at present. The landfill gas capture system, the flare and the first generator were officially commissioned on 27/05/2008. The gas capture system and the flare system had been completed prior to the completion of the power plant. Trial operation of flare was commissioned to test the gas capture system by 25/05/2008. The starting date of the second CAT generator was 17/11/2010

*2. The information regarding the actual operation of the project activity during this monitoring period*

The operating hours of the first generator: 8365 hours

The operating hours of the second generator: 8409 hours

Net power generation during this monitoring period: 14,609.81 Mwh

*3. Events or situations that occurred during the monitoring period*

There were no special events during the monitoring period. The total overhaul time of the first generator is 184 hours, and the downtime due to insufficient supply of landfill gas is 235 hours. The total overhaul time of the second generator is 211.5 hours, and the downtime due to equipment failure is 163.5 hours. Detailed information on the specific downtime of the generating unit (Generator #1 and #2) is provided in Annex 2. The flaring system has not been used during this monitoring period and no emission reduction is claimed.

**B.2. Post registration changes****B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

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N/A

**B.2.2. Corrections**

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N/A

**B.2.3. Permanent changes from registered monitoring plan or applied methodology**

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A revision has been requested by the verifier for the first 7-year crediting period, the reason being that three pieces of monitoring equipment differ from the description that was included in the Monitoring Plan on the registered PDD.

Within the registered monitoring plan, a gas flow meter should automatically and continuously measure the gas flow, as well as temperature and pressure. The meter should also be able to express LFG volumes in normalized cubic meters. However at the site three separate pieces of equipment are used to measure gas flow, temperature and pressure, and data is instantly sent to a computer system where LFG volumes are expressed in normalized cubic meters and LFG mass is calculated accordingly.

The request for revision of the monitoring plan of the CDM project activity: "Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation" (1406) has been approved on 01/07/2011. Please refer to <http://cdm.unfccc.int/Projects/DB/JQA1193375340.58/view> at UNFCCC website.

**B.2.4. Changes to project design of registered project activity**

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N/A

**B.2.5. Changes to start date of crediting period**

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N/A

**B.2.6. Types of changes specific to afforestation or reforestation project activity**

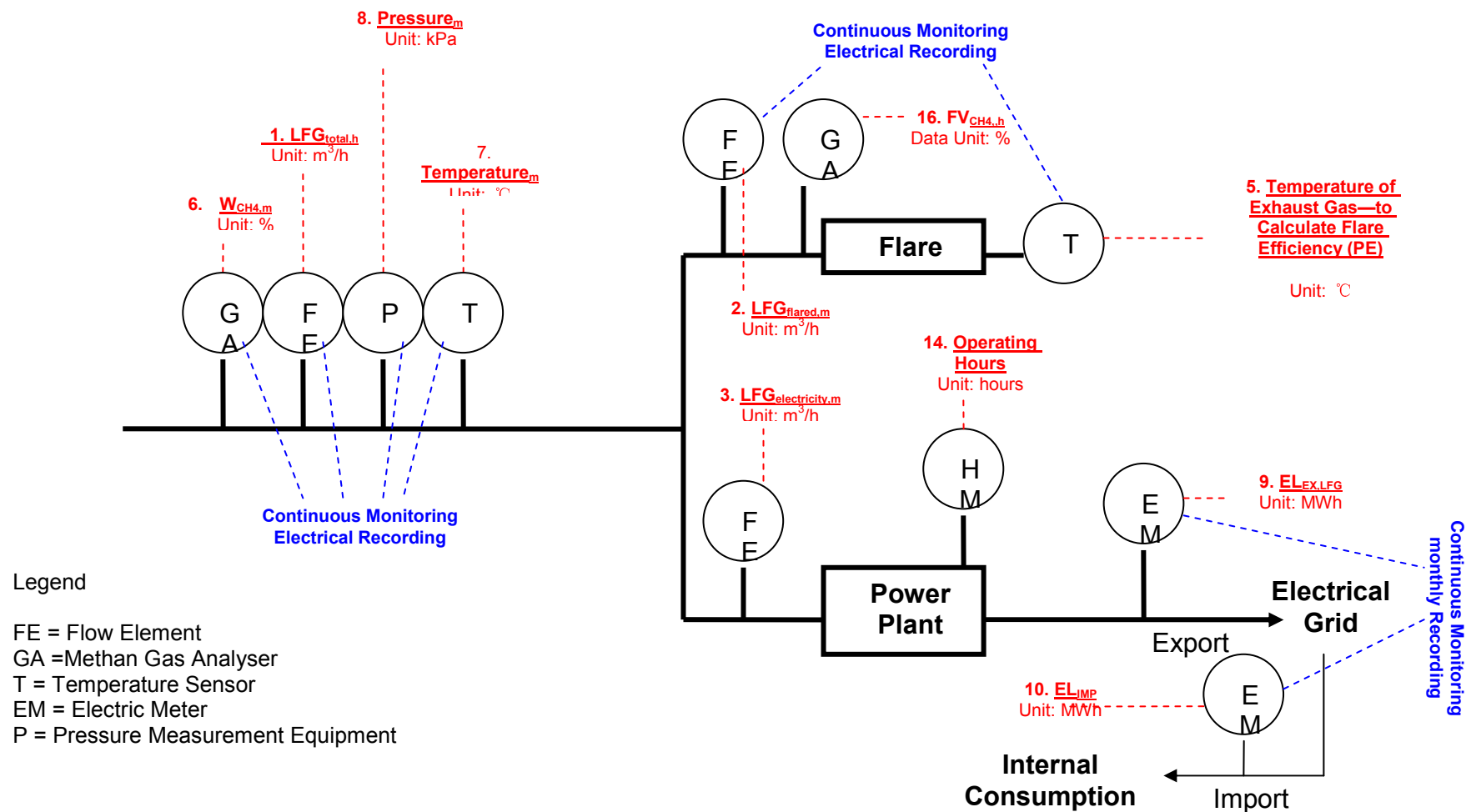
&gt;&gt;

N/A

**SECTION C. Description of monitoring system**

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The monitoring system structure diagram is provided below showing the parameters monitored and the location of measurement devices installed:



**Data collection procedures:***Data generation and recording:*

- Data 1-3, 6-8 and 14 are generated and captured by the computer system and archived electronically every minute in a secure and retrievable storage format, which could be retrieved upon request.
- Data 9-10 are captured electronically and continuously, and recorded every month.
- Data 5 is calculated based on the measurement of the flare temperature and recorded in the hourly report.

All the data will be maintained until 2 years after the close of the crediting period, as required by Section B.7.1 of the PDD.

*Calculation:*

All calculations are done in a programmed computer system. Methane that has been destructed in normalized cubic meter / mass can be read in the computer screen.

*Report Management:*

A document control system (also referred to as an auditing system) has been introduced ensuring that necessary documents are available at the point of requirements.

The hourly, daily and yearly and the other associated documents could be retrieved under the guidance of the document control system.

**Quality Management:**

All data collected on minute-basis is compared from week to week using trend analysis. Any significant deviation can be identified accordingly if any by such analysis.

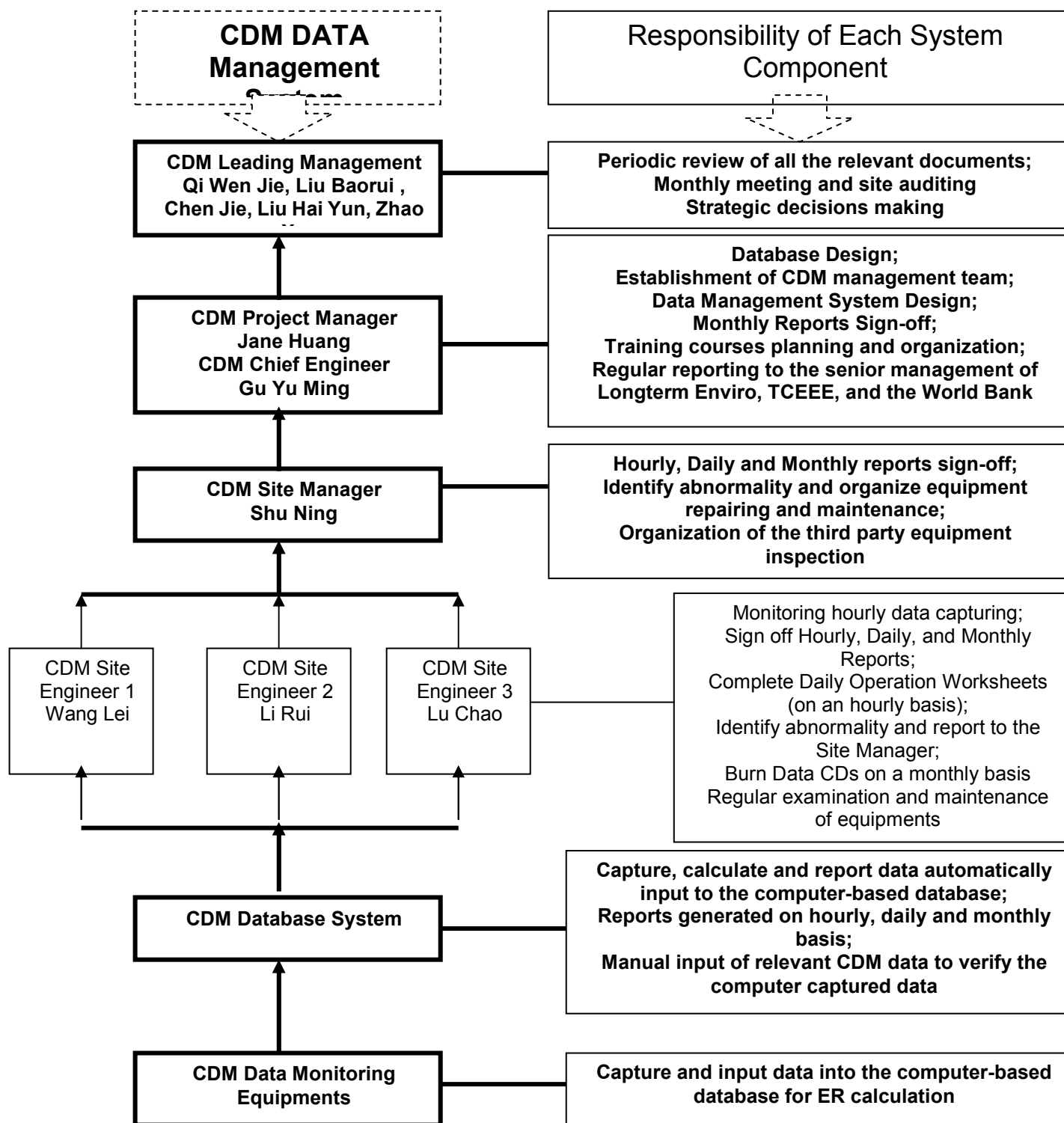
When corrupted data is identified, the data recorded in the last 7 days are retrieved to calculate the value converted from the average methane destroyed per 1 kWh everyday. The more conservative value among 7 values is chosen to replace the corrupted data.

The error and corrective action will be recorded in the Daily Operation Recording Worksheet, and the reason for the error will be investigated and rectified as soon as possible.

Internal audit and training are undertaken at site. An audit of the Q/A system is performed on a 6-month basis. Internal training sessions are run among relevant operators to establish comprehensive understanding of the monitoring system and to ensure compliance with the tasks and procedures set out in the monitoring plan. Internal auditing reports and training records will be available to the DOE.

**Organizational structure, roles and responsibilities:**

A CDM data management structure is provided below showing the relevant personnel and associated responsibilities of each component in the management organization.





**SECTION D. Data and parameters****D.1. Data and parameters fixed ex ante or at renewal of crediting period**

(Copy this table for each piece of data and parameter.)

<b>Data / Parameter:</b>	<b>CEF<sub>electricity,y</sub></b>
Data unit:	<b>tCO<sub>2</sub>/MWh</b>
Description:	The emission factor of North China Power Grid
Source of data used:	PDD
Value(s) :	1.0303
Additional comment:	

<b>Data / Parameter:</b>	<b>GWP<sub>CH<sub>4</sub></sub></b>
Data unit:	<b>tCO<sub>2</sub>/CH<sub>4</sub></b>
Description:	Global warming potential value for methane
Source of data used:	IPCC default value
Value(s) :	21
Additional comment:	

<b>Data / Parameter:</b>	<b>D<sub>CH<sub>4</sub></sub></b>
Data unit:	<b>tCO<sub>2</sub>/m<sup>3</sup>CH<sub>4</sub></b>
Description:	Methane density
Source of data used:	ACM0001 ver.5
Value(s) :	0.0007168
Additional comment:	Density at normal conditions

**D.2. Data and parameters monitored**

(Copy this table for each piece of data and parameter.)

<b>Data / Parameter:</b>	<b>LFG<sub>total,y</sub></b>
Unit:	Nm3
Description:	Total amount of landfill gas captured
Measured/ Calculated / Default:	Measured
Source of data:	The flow meter located at the main pipe
Value(s) of monitored parameter:	7,729,873*
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information located at the end of this section.
Measuring/ Reading/ Recording frequency:	Continuously measured; recording and reading frequency every minute.
Calculation method (if applicable):	Calculation takes place every minute, converting the volume of LFG <sub>total,i</sub> to Nm3. Then the minute values are aggregated.  (Refer to Table 2 Formula (1))

QA/QC procedures:	<p>The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately.</p> <p>When corrupted data is identified, the data recorded in the last 7 days are retrieved to calculate the value converted from the average methane destroyed per 1 kWh everyday. The more conservative value among 7 values is chosen to replace the corrupted data.</p>
Purpose of data:	Used to calculate MD <sub>total</sub> (refer to Formula (1))
Additional comment:	
<p>*Less than estimated in PDD for this monitoring period because of lack of landfill gas supply caused by construction of the earth cofferdam of the tipping area</p>	
<b>Data / Parameter:</b>	LFG <sub>electricity,y</sub>
Unit:	Nm3
Description:	Total amount of landfill gas combusted in power plant
Measured/ Calculated / Default:	Measured
Source of data:	The flow meter located at the power plant
Value(s) of monitored parameter:	7,756,648
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information located at the end of this section.
Measuring/ Reading/ Recording frequency:	Continuously measured; recording and reading frequency every minute.
Calculation method (if applicable):	<p>Calculation takes place every minute, converting the volume of LFG<sub>electricity,y</sub> to Nm3. Then the minute values are aggregated.</p> <p>(Refer to Table 2 Formula (4))</p>
QA/QC procedures:	<p>The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately.</p> <p>When corrupted data is identified, the data recorded in the last 7 days are retrieved to calculate the value converted from the average methane destroyed per 1 kWh everyday. The more conservative value among 7 values is chosen to replace the corrupted data.</p>
Purpose of data:	Used to calculate MD <sub>electricity</sub> (refer to Table 2 Formula (4))

Additional comment:	
<b>Data / Parameter:</b>	$LFG_{\text{flare},y}$ (or $FV_{RG,h}$ )
Unit:	$Nm^3$ (or $Nm^3/h$ )
Description:	Total amount of landfill gas burned in flare
Measured/ Calculated / Default:	Measured
Source of data:	The flow meter located at the power plant
Value(s) of monitored parameter:	0
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information located at the end of this section.
Measuring/ Reading/ Recording frequency:	Continuously measured; recording and reading frequency every minute.
Calculation method (if applicable):	Calculation takes place every minute, converting the volume of $LFG_{\text{electricity},y}$ to $Nm^3$ . Then the minute values are aggregated.  (Refer to Table 2 Formula (4))
QA/QC procedures:	<p>The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately.</p> <p>When corrupted data is identified, the data recorded in the last 7 days are retrieved to calculate the value converted from the average methane destroyed per 1 kWh everyday. The more conservative value among 7 values is chosen to replace the corrupted data.</p>
Purpose of data:	Used to calculate $MD_{\text{flare}}$ (refer to Table 2 Formula (2) and (3))
Additional comment:	
<b>Data / Parameter:</b>	$W_{CH_4}$
Unit:	$M^3CH_4/m^3LFG$
Description:	Methane fraction in the landfill gas
Measured/ Calculated / Default:	Measured
Source of data:	CH4 fraction meter
Value(s) of monitored parameter:	<p>Data is measured and recorded every minute.</p> <p>Average value: 57.87</p>

Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measured; recording and reading frequency every minute.
Calculation method (if applicable):	N/A
QA/QC procedures:	<p>The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately.</p> <p>Methane fraction values are cross-checked with a portable methane analyzer.</p> <p>When corrupted data is identified, the data recorded in the last 7 days are retrieved to calculate the value converted from the average methane destroyed per 1 kWh everyday. The more conservative value among 7 values is chosen to replace the corrupted data.</p>
Purpose of data:	Used to calculate MD <sub>total</sub> , MD <sub>electricity</sub> and MD <sub>flare</sub> (refer to Table 2 Formula (1), (2) and (4))
Additional comment:	
<b>Data / Parameter:</b>	T
Unit:	°C
Description:	Temperature of the landfill gas
Measured/ Calculated / Default:	Measured
Source of data:	Temperature meter
Value(s) of monitored parameter:	<p>Data is measured and recorded every minute.</p> <p>Average value: 3.20</p>
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measuring; recording and reading frequency every minute.
Calculation method (if applicable):	N/A

QA/QC procedures:	<p>The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately.</p> <p>When corrupted data is identified, the data recorded in the last 7 days are retrieved to calculate the value converted from the average methane destroyed per 1 kWh everyday. The more conservative value among 7 values is chosen to replace the corrupted data.</p>
Purpose of data:	Used to calculate methane density (refer to Table 2 Formula (1), (2) and (4))
Additional comment:	

<b>Data / Parameter:</b>	$T_{\text{flare}}$
Unit:	$^{\circ}\text{C}$
Description:	Temperature in the exhaust gas of the enclosed flare
Measured/ Calculated / Default:	Measured
Source of data:	Continuous on site measurement
Value(s) of monitored parameter:	Data is measured and recorded every minute. The flare has been used for an insignificant amount of time, so no emission reduction for flare is claimed.
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measuring; recording and reading frequency every minute.
Calculation method (if applicable):	N/A
QA/QC procedures:	<p>The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately.</p>
Purpose of data:	<p>Used to calculate <math>PE_{\text{flare}}</math> (refer to Table 2 ID5)</p> <p>(1) <math>FE_{\text{flare},h}=90\%</math>, if <math>T&gt;500^{\circ}\text{C}</math> for more than 40 minutes within one hour, compliance with manufacturer's specifications of flare;</p> <p>(2) <math>FE_{\text{flare},h}=50\%</math>, if <math>T&gt;500^{\circ}\text{C}</math> for more than 40 minutes within one hour, anything out of specification of flare;</p> <p>(3) <math>FE_{\text{flare},h}=0</math>, if <math>T&lt;500^{\circ}\text{C}</math> for more than 20 minutes within one hour</p>
Additional comment:	

<b>Data / Parameter:</b>	$f_{vi,h}$
Unit:	M <sup>3</sup> CH <sub>4</sub> /m <sup>3</sup> LFG
Description:	Volumetric fraction of component is in the residual gas in the hour h where i = CH <sub>4</sub>
Measured/ Calculated / Default:	Measured
Source of data:	CH <sub>4</sub> fraction meter
Value(s) of monitored parameter:	Data is measured and recorded every minute. The flare has been used for an insignificant amount of time, so no emission reduction for flare is claimed.
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measured; recording and reading frequency every minute.
Calculation method (if applicable):	N/A
QA/QC procedures:	The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately. Methane fraction values are cross-checked with a portable methane analyzer.
Purpose of data:	Used to calculate MD <sub>flare</sub> (refer to Table 2 Formula (2))
Additional comment:	

<b>Data / Parameter:</b>	ELEX,LFG,y
Unit:	MWh
Description:	Total amount of electricity exported out of the project boundary.
Measured/ Calculated / Default:	Measured
Source of data:	Power meter
Value(s) of monitored parameter:	15,062.00
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measured; monthly record

Calculation method (if applicable):	N/A
QA/QC procedures:	The meter has been calibrated based on the national standard by a testing facility authorized by the North China Grid. Data measured by the meter are cross-checked against receipts from the grid company.
Purpose of data:	Used to calculate Ely (Net electricity output) (refer to Table 2 Formula (5))
Additional comment:	
<b>Data / Parameter:</b>	EL <sub>IMP</sub> ,
Unit:	MWh
Description:	Total amount of electricity imported to meet project requirement.
Measured/ Calculated / Default:	Measured
Source of data:	Power meter
Value(s) of monitored parameter:	452.19
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measured; monthly record
Calculation method (if applicable):	N/A
QA/QC procedures:	The meter has been calibrated based on the national standard by a testing facility authorized by the North China Grid. Data measured by the meter are cross-checked against receipts from the grid company.
Purpose of data:	Used to calculate EL <sub>y</sub> (Net electricity output) (refer to Table 2 Formula (5))
Additional comment:	
<b>Data / Parameter:</b>	Operating hours of Generator #1
Unit:	Hours
Description:	Operating hours of Generator #1
Measured/ Calculated / Default:	Calculated
Source of data:	Hour meter installed at Generator #1
Value(s) of monitored parameter:	8,365
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.

Measuring/ Reading/ Recording frequency:	Continuously measured; daily record
Calculation method (if applicable):	Sum up of the daily record
QA/QC procedures:	The meter has been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. If the daily operating hours are recorded as less than 24 hours, the reason will be identified and recorded.
Purpose of data:	N/A
Additional comment:	

<b>Data / Parameter:</b>	Operating hours of Generator #2
Unit:	Hours
Description:	Operating hours of Generator #2
Measured/ Calculated / Default:	Calculated
Source of data:	Hour meter installed at Generator #2
Value(s) of monitored parameter:	8409
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measured; daily record
Calculation method (if applicable):	Sum up of the daily record
QA/QC procedures:	The meter has been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. If the daily operating hours are recorded as less than 24 hours, the reason will be identified and recorded.
Purpose of data:	N/A
Additional comment:	

<b>Data / Parameter:</b>	Flare operation parameters
Unit:	
Description:	Manufacturer's specification of flare, such as temperature (less than 1300°C) , flow rate (0~600M3/H) of residual gas at the inlet of the flare (refer to the tables for $T_{\text{flare}}$ and for $LFG_{\text{flare},v}$ (or $FV_{RG,h}$ ))



Measured/ Calculated / Default:	Measured
Source of data:	On site measurement (refer to the tables for $T_{\text{flare}}$ and for $LFG_{\text{flare},y}$ (or $FV_{RG,h}$ ))
Value(s) of monitored parameter:	Data is measured and recorded every minute. The flare has not been used in this Monitoring Period, so no emission reduction from flaring is claimed.
Monitoring equipment:	Please refer to the detailed calibration information in Table 'Detailed calibration information.
Measuring/ Reading/ Recording frequency:	Continuously measured; recording and reading frequency every minute.
Calculation method (if applicable):	N/A
QA/QC procedures:	The meters have been subject to maintenance and calibration according to manufacturer's recommendations and monitoring plan requirements. Under the circumstance where any abnormality occurs on site, the on-site engineer is required to identify the reasons that have resulted the abnormalities and report to the supervisor. A solution is required to be proposed immediately.
Purpose of data:	It is assumed that all flare operation parameters meet the manufacturer's specifications; hence, the flare efficiency of the enclosed flared to be applied by the project is 90% for calculating the emission reductions. (refer to Table 2 ID5)
Additional comment:	

As per ACM0001 version 5, the parameter 'laws and regulations about waste management system' is required for any changes to the adjustment factor (AF), and is updated at renewal of the crediting period. Although solid waste landfill site requirements, infrastructure design and construction requirements of solid waste landfill disposal have been added or amended, this has no impact on this parameters monitored during this crediting period. Therefore, AF remains zero.

**Table 1 'Detailed calibration information' and Table 2 'Calculation design to get ER' are attached as Appendix 1 and Appendix 2.**

### D.3. Implementation of sampling plan

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N/A

## SECTION E. Calculation of emission reductions or GHG removals by sinks

### E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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Not applicable under ACM0001 (Ver. 05) and the registered PDD.

In the registered PDD, the methane destroyed in the baseline scenario due to regulatory requirements is recognized as 0 (PDD p.19)

### E.2. Calculation of project emissions or actual net GHG removals by sinks

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Not applicable under ACM0001 Ver. 05, and the registered PDD.

### E.3. Calculation of leakage

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According to ACM0001 Ver. 05, no leakage effects need to be accounted.

### E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO <sub>2</sub> e)
Total	N/A	N/A	N/A	83,478

### E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	157,639 t CO <sub>2</sub> e	83,478 t CO <sub>2</sub> e

### E.6. Remarks on difference from estimated value in registered PDD

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Less landfill gas than anticipated in PDD has been produced for capture and energy generation. This is due to poor anaerobic condition in the landfill, which was caused by low temperature during the cold winter in Tianjin and a large working area adopt, which caused an inadequate depth of garbage landfilled.

### E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	83,478 t CO <sub>2</sub> e	N/A

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## Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Class: Regulatory

Document Type: Form

Business Function: issuance

Keywords: monitoring report, performance monitoring

Table1: Detailed calibration information

ID number	Name of the instrument	Manufacturer	Model	Monitoring Equipment No.	Location (Figure 1)	Accuracy	Calibration Required by Manufacture	Calibration Validity Period		Working Period during the Monitoring Period	Remarks
								2011-2012	2012-2013	2011-2012	
0 MSW <sub>total,y</sub>	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		
1 LFG <sub>total,y</sub>	Vortex Flowmeter	Wu Xi Qiu Xin Flowmeter Co., Ltd.	LU150	10150G179	Main Pipe	1.50%	Annually calibrated		23 Feb 2012-22 Feb 2013	5 Mar 2012- 31 Dec 2012 (at the main pipe)	JJG1029-2007
		Wu Xi Qiu Xin Flowmeter Co., Ltd.	LU150	08150C04	Main Pipe	1.50%	Annually calibrated	17 Mar 2011-16 Mar 2012		1 Jan 2012-5 Mar 2012 (at the main pipe)	JJG1029-2007
2 LFG <sub>flare,y</sub>	Vortex Flowmeter	Wu Xi Qiu Xin Flowmeter Co., Ltd.	LU100	08100C13	Flare Pipe	1.50%	Annually calibrated	22 Jul 2011 - 21 Jul 2012		1 Jan 2012-11 Jul 2012 (at the flare pipe)	JJG1029-2007
		Wu Xi Qiu Xin Flowmeter Co., Ltd.	LU100	10100G178					23 Feb 2012-22 Feb 2013	5 Mar 2012-5 Jul 2012(at the generator pipe) 11 Jul 2012-31 Dec 2012(at the flare pipe)	JJG1029-2007
3 LFG <sub>electricity,y</sub>	Vortex Flowmeter	Beijing Kunlun Seaside Sensor Technology Center	LUGB	V15025015	Main Pipe	1.50%	Annually calibrated		30 May 2012-29 May 2013	5 Jul 2012-31 Dec 2012(at the generator pipe)	JJG1029-2007
		Wu Xi Qiu Xin Flowmeter Co., Ltd.	LU100	08100C12	Pipe leading to the Generator	1.50%	Annually calibrated	17 Mar 2011 - 16 Mar 2012		1 Jan 2012-5 Mar 2012(at the generator pipe)	JJG1029-2007
5-1 T <sub>flare, y</sub>	Temperatue meter to measure exhaust gas (3 meters installed)	Nanjing Wanda Meter Manufacture	WRNB-430	1	Inside the Chimney	Class II	Annually calibrated	18 Aug 2011-17 Aug 2012		1 Jan 2012 –1 Aug 2012 (at the flare)	JJG351-96
5-2 T <sub>flare, y</sub>	Temperatue meter to measure exhaust gas (3 meters installed)	Nanjing Wanda Meter Manufacture	WRNB-430	2	Inside the Chimney	Class II	Annually calibrated	18 Aug 2011-17 Aug 2012		1 Jan 2012 –1 Aug 2012 (at the flare)	JJG351-96

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5-3 $T_{\text{flare}, y}$	Temperatue meter to measure exhaust gas (3 meters installed)	Nanjing Wanda Meter Manufacture	WRNB-430	3	Inside the Chimney	Class II	Annually calibrated	18 Aug 2011-17 Aug 2012		1 Jan 2012 – 1 Aug 2012 (at the flare)	JJG351-96
5-4 $T_{\text{flare}, y}$	Temperatue meter to measure exhaust gas (3 meters installed)	Nanjing Wanda Meter Manufacture	WRNB-430	12061646	Inside the Chimney	Class II	Temperature meters calibrated twice a year		25 Jul 2012-24 Jan 2013	1 Aug 2012 – 31 Dec 2012 (at the flare)	JJG351-96 In Use
5-5 $T_{\text{flare}, y}$	Temperatue meter to measure exhaust gas (3 meters installed)	Nanjing Wanda Meter Manufacture	WRNB-430	12061647	Inside the Chimney	Class II	Temperature meters calibrated twice a year		25 Jul 2012-24 Jan 2013	1 Aug 2012 – 31 Dec 2012 (at the flare)	JJG351-96
5-6 $T_{\text{flare}, y}$	Temperatue meter to measure exhaust gas (3 meters installed)	Nanjing Wanda Meter Manufacture	WRNB-430	12061648	Inside the Chimney	Class II	Temperature meters calibrated twice a year		25 Jul 2012-24 Jan 2013	1 Aug 2012 – 31 Dec 2012 (at the flare)	JJG351-96 In Use
6 $FV_{CH_4, h}$ or $W_{CH_4, y}$	CH4 fraction meter	Wu Han Si Fang Photoelectricity Technology Co.	3200	08031214/10803210106100000051	Main Pipe or Flaring pipe	±2%	Annually calibrated	10 Feb 2011—9 Feb 2012	8 Nov2012-7 Nov2013	1 Jan 2012 – 8 Feb 2012 (at the flare pipe) 13 Dec 2012 – 31 Dec 2012 (at the main pipe)	JJG693-2011 QTD CC06-2007
16 $w_{CH_4, y}$ or $FV_{CH_4, h}$	CH4 fraction meter	Wu Han Si Fang Photoelectricity Technology Co.	3200	0901809	Flaring pipe or Main Pipe	±2%	Annually calibrated	19 Dec 2011-18 Dec 2012		1 Jan 2012 – 13 Dec 2012 (at the main pipe)	JJG693-2011 QTD CC06-2007
16 $w_{CH_4, y}$ or $FV_{CH_4, h}$	CH4 fraction meter	Wu Han Si Fang Photoelectricity Technology Co.	3200	11201060106100000019	Flaring pipe or Main Pipe	±2%	Annually calibrated		31 Jan 2012-30 Jan 2013	8 Feb 2012 – 31 Dec 2012 (at the flare pipe)	JJG693-2011

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7-1 T	Temperature Meter	Beijing Kunlun Seaside Sensor Technology Center	ExiallCT5	CE072030	Main Pipe	±0.5%	Annually calibrated		5 Jun 2012-4 Jun 2013	5 Jul 2012 -31 Dec 2012(at the main pipe)	JJF 1183-2007
7-2 T	Temperature Meter	Beijing Kunlun Seaside Sensor Technology Center	JWB/Pt100	K1111232	Main Pipe	±0.5%	Annually calibrated	18 Jul 2011—17 Jul 2012		1 Jan 2012 – 31 Dec 2012(at the main pipe)	JJF 1183-2007
8-1 P	Pressure meter	Beijing Kunlun Seaside Sensor Technology Center	JYB-KB-PAG	08030358	Main Pipe	±0.5%	Annually calibrated		1 Jun 2012-31 May 2013	5 Jul 2012 -31 Dec 2012(at the main pipe)	JJG882-2004
8-2 P	Pressure meter	Beijing Kunlun Seaside Sensor Technology Center	JYB-KB-PAG	08030359	Main Pipe	±0.5%	Annually calibrated	7 Jul 2011—6 Jul 2012		1 Jan 2012 – 31 Dec 2012(at the main pipe)	JJG882-2004
9 EL <sub>EX,LFG,y</sub>	Power Generation Meter (major )	Yan Tai Oriental Electricity	DSSD178	L4J07600476621708	Control Room	0.5S	Calibration is undertaken by the State Grid, as per State Grid Connection Requirements. The validity period is 5 years.	18 Oct 2007- 17 Oct 2012	5 Jul 2012-4 Jul 2017	Meter remains unchanged	GB/T17883/ JJG596-1999
	Power Generation Meter (backup)	Yan Tai Oriental Electricity	DSSD178	L4J07600378821708	Control Room	0.5S	Calibration is undertaken by the State Grid, as per State Grid Connection Requirements. The validity period is 5 years.	17 Aug 2007- 16 Aug 2012	5 Jul 2012-4 Jul 2017	Meter remains unchanged	GB/T17883/ JJG596-1999
10-1 EL <sub>IMP</sub>	Self Consumption Electricity Meter	Yan Tai Oriental Electricity	DTSD178	N5Z08600564341708		0.5S	Calibration is undertaken by the State Grid, as per State Grid Connection Requirements. The validity period is 5 years.	13-May 2008- 12 May 2013		27 Aug 2008-5 Jul 2012	GB/T17883
10-2 EL <sub>IMP</sub>	Self Consumption Electricity Meter	Yan Tai Oriental Electricity	DTSD178	070764286942		0.5S	Calibration is undertaken by the State Grid, as per State Grid Connection Requirements. The validity period is 5 years.		5 Jul 2012-4 Jul 2017	5 Jul 2012-31 Dec 2012	JJG596-1999

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14-1 Operating hours	Hour Meter	Tianjin Kunlun Tianchen Meter Co.	JS/A-H8T1 VIN	E0907030201	Generator Container	0.10%	Annually calibrated		4 May 2012-3 May 2013	4 May 2012 – 31 Dec 2012 (at Generator No.1)	JJG238-95
14-2 Operating hours	Hour Meter	Tianjin Kunlun Tianchen Meter Co.	JS/A-H8T1 V1	F20110211010 1	Generator Container	0.10%	Annually calibrated	5 May 2011—4 May 2012	4 Jun 2012-3 Jun 2013	1 Jan 2012 – 4 May 2012 (at Generator No.1) 11 Jul 2012 – 31 Dec 2012 (at Generator No.2)	JJG238-95/JJG237-2010
14-3 Operating hours	Hour Meter	Tianjin Kunlun Tianchen Meter Co.	JS/A-H8T1 V1	E20100506020 1	Generator Container	0.10%	Annually calibrated	13 Jul 2011—12 Jul 2012		1 Jan 2012 – 11 Jul 2011 (at Generator No.2)	JJG238-95

Table2: Calculation design to get ER

ID number	Data variable	Data unit	Frequency of Capturing Data for calculation	Calculation to get MD
0 $MSW_{total,y}$	Total Quantity of Waste Landfilled in year y	metric tones	Daily	N/A
1 $LFG_{total,y}$	Total amount of landfill gas captured	m <sup>3</sup>	Every Minute	$MD_{total,y} = DCH4 * \sum_{h=1}^{8760} (\sum_{i=1}^{60} WCH4_{i,h} * LFG_{total,i,h} * Pi * 273.15 \div (Ti * 101.325)))h \quad (1)$
2 $LFG_{flare,y}$	Amount of landfill gas flared	m <sup>3</sup>	Every Minute	$MD_{flare,h} = DCH4 * \sum_{i=1}^{60} WCH4_{i,h} * LFG_{flare,i,h} * Pi * 273.15 \div (Ti * 101.325) - (1 - FE_{flare,h}) * 0.000716 * \sum_{i=1}^{60} FVCH4_{i,h} * LFG_{flare,i,h} * Pi * 273.15 \div (Ti * 101.325) \quad (2)$ $MD_{flare,y} = \sum_{h=1}^{8760} MD_{flare,h} \quad (3)$
3 $LFG_{electricity,y}$	Amount of landfill gas combusted in power plant	m <sup>3</sup>	Every Minute	$MD_{electricity,y} = DCH4 * \sum_{h=1}^{8760} (\sum_{i=1}^{60} WCH4_{i,h} * LFG_{electricity,i,h} * Pi * 273.15 \div (Ti * 101.325)))h \quad (4)$
5 $PE_{flare,y}$	Project emissions from flaring of the residual gas stream in year y	tCO <sub>2</sub> e	Every Hour	(4) $FE_{flare,h} = 90\%$ , if $T > 500^{\circ}C$ for more than 40 minutes, compliance with manufacturer's specifications of flare; (5) $FE_{flare,h} = 50\%$ , if $T > 500^{\circ}C$ for more than 40 minutes, anything out of specification of flare; (6) $FE_{flare,h} = 0$ , if $T < 500^{\circ}C$ for more than 20 minutes
6 $w_{CH4,y}$	Methane fraction in the landfill gas	m <sup>3</sup> CH <sub>4</sub> / m <sup>3</sup> LFG	Every Minute	Measured to get $MD_{total,y}$ , $MD_{electricity,y}$ ,
7 T	Temperature of the landfill gas	°C	Every Minute	Measured to get $MD_{total,y}$ , $MD_{electricity,y}$ , and $MD_{flare,y}$



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8 P	Pressure of the landfill gas	Pa	Every Minute	Measured to get $MD_{total,y}$ , $MD_{electricity,y}$ , and $MD_{flare,y}$
9 $EL_{EX,LFG}$	Total amount of electricity exported out of the project boundary.	MWh	Monthly Total	Measured to get ER $E_{ly} = E_{EX,LFG} - E_{IMP}$ (5)
10 $EL_{IMP}$	Total amount of electricity imported to meet project requirement.	MWh	Monthly Total	Measured to get ER $E_{ly} = E_{EX,LFG} - E_{IMP}$ (5)
11	CO <sub>2</sub> emission intensity of the electricity and/or other energy carriers in ID 9.	tCO <sub>2</sub> e / MWh	N/A – calculated	$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH_4} + E_{ly} * CE_{Electricity,y} - E_{Ty} * CE_{Thermal,y}$ (6) 1.0303
13	Regulatory requirements relating to landfill gas projects	Test	At the renewal of crediting period.	N/A
14 Operating hours	Operating hours of the energy plant	Hours	Annually	N/A
16 $FV_{CH_4,h}$	Volumetric fraction of methane in residual gas in hour $h$	%	Continuously	Measured to get $MD_{flare,y}$