




Verification and certification report form for CDM project activities

(Version 01.0)

VERIFICATION AND CERTIFICATION REPORT

Title of the project activity	Shenyang Laohuchong LFG Power Generation Project
Reference number of the project activity	1906
Version number of the verification and certification report	Version 01
Completion date of the verification and certification report	05/03/2018
Monitoring period number and duration of this monitoring period	Sixth monitoring period 01/01/2017-31/12/2017
Version number of monitoring report to which this report applies	Version 02
Crediting period of the project activity corresponding to this monitoring period	Start date: 25 December 2008 Length: fixed 10 years
Project participant(s)	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd. from China (Project owner) Asja Ambiente Italia S.p.A. from Italy (Buyer) ICF - International Clean Fund LLC from Switzerland (Buyer)
Host Party	People's Republic of China
Sectoral scope(s), selected methodology(ies), and where applicable, selected standardized baseline(s)	1-Energy industries (renewable/non-renewable sources); Sectoral scope 13: waste handling and disposal; ACM0001 (version 06) Consolidated baseline methodology for landfill gas project activity ACM0002 (Version 06) Consolidated baseline methodology for grid-connected electricity generation from renewable sources
Estimated GHG emission reductions or net anthropogenic GHG removals for this monitoring period in the registered PDD	167,687 tCO ₂ e
Certified GHG emission reductions or net anthropogenic GHG removals for this monitoring period	147,497 tCO ₂ e
Name of DOE	Shenzhen CTI International Certification Co., Ltd (CTI)
Name, position and signature of the approver of the verification and certification report	Zhou Lu, General Manager 

SECTION A. Executive summary

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Shenzhen CTI International Certification Co., Ltd (CTI) has performed the verification of the emission reductions reported for the “Shenyang Laohuchong LFG Power Generation Project” in China (UNFCCC Ref. No. 1906) for the period 01/01/2017-31/12/2017. The project involves the capture and utilization of landfill gas (LFG) from Laohuchong landfill in Shenyang for generating electric power, which is located in Su Jiatun District of Shenyang in China. The geographical coordinates of the project activity are 41°33' North Latitude and 123°34' East Longitude. The project activity was registered as a CDM project on 25/12/2008 and its fixed crediting period starts changed from 01/01/2009 in 25/12/2008. The selected monitoring period 01/01/2017-31/12/2017 is the 6th monitoring period of the project, which is within the fixed crediting period 25/12/2008 to 24/12/2018. The project designed to install 6 generation units with total capacity of 3MW (6×0.5MW LFG power generators) and two flares of 2,000Nm³/h. During this monitoring period, all sets of generation units have already been installed and one flare have been installed and put into operation, each of them has been installed in line with the registered PDD. As confirmed by interviewing with project owner, the last one flare will be installed as soon as the biogas flow will be high and stable enough to guarantee suitable working conditions, which is deemed reasonable based on the experience of verification team. The electricity generated by the project activity was supplied to the Northeast Electric Power Grid (hereafter referred to as “NEPG”), and as per the approved PDD, the project is estimated to deliver 147,497 tonnes CO₂ emission reduction in this monitoring period.

The scope of the verification is to verify that:

- The project activity has been implemented and operated in accordance with the registered PDD;
- The monitoring plan complies with the monitoring methodology and the actual monitoring activities complies with the monitoring plan, including compliance with any guidance provided by the Board regarding deviations from the provisions of a registered plan and/or methodology;
- The data and calculation of GHG emission reductions have been assessed to correctly support the emission reductions being claimed.

The verification team identified one CAR in this monitoring period, no CL and FAR was raised. The CAR was satisfactorily addressed by the project participants in the revised monitoring report (refer to Appendix 4 for further details). All changes made to the monitoring report (version 02 dated 03/03/2018) are as a result of the verification findings.

In CTI’s opinion, the GHG emission reductions reported for the project in the monitoring report (version 02, dated 03/03/2018) are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology ACM0001 (version 06) and ACM0002 (Version 06) , and the monitoring plan contained in the Project Design Document (version 03 dated 16/06/2008).

CTI confirmed that the GHG emission reductions are calculated without material misstatements. Based on the evidence and information that are considered necessary to guarantee that GHG emission reductions are appropriately calculated, CTI is able to certify that emission reductions from Shenyang Laohuchong LFG Power Generation Project during the period 01/01/2017-31/12/2017 amount to 147,497tCO₂e.

SECTION B. Verification team, technical reviewer and approver**B.1. Verification team member**

No.	Role	Type of resource	Last name	First name	Affiliation	Involvement in			
						Desk review	On-site inspection	Interview(s)	Verification findings
1.	Team Leader	IR	Zhang	Lei	N/A	√	√	√	√

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation
1.	Technical reviewer	IR	Lin	Wu	N/A
2.	Approver	IR	Zhou	Lu	N/A

SECTION C. Application of materiality**C.1. Consideration of materiality in planning the verification**

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Human error in the quantification of emissions (which may be more likely to occur if personnel are unfamiliar with, or not well trained regarding, emissions processes or data recording);	Low	The project owner has established the CDM monitoring and management manual and appointed the CDM technical staffs, CDM accountant staffs and CDM manager which were trained to responsible for meters reading and recording, auditing of these metered data. The installation and calibration of monitoring meters was also stipulated in the manual. The CDM monitoring and management manual has also established the QA/QC procedure to ensure the veracity and validity of the monitoring procedure and monitoring records. So the risk level is low.	Depending on the monitoring period being verified, conduct increased sampling during the months when there is a greater likelihood of errors and issues with data quality control due to project participants' leave schedules.
2.	Undue reliance on a poorly designed information system, which may have few effective quality controls; for example, the use of spreadsheets without adequate controls related to data changes/updates, version tracking, traceability, security, etc.	Low		Depending on the monitoring period being verified, conduct increased sampling during the months when there is a greater likelihood of errors and issues with data quality control due to project participants' leave schedules.
3.	Manual adjustment of otherwise automatically recorded activity levels; for example, manual input may be required if a flare meter becomes overloaded.	Low		Depending on how data is generated, processed, and reported, place greater emphasis on verifying data captured and processed manually and/or in spreadsheets versus those that are generated from an automated system.

C.2. Consideration of materiality in conducting the verification

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(1) As per the “Application of materiality in verifications (Version 02.0)” which enters into force on 01/04/2015, the project is a large-scale CDM project activity achieving total emission reductions of <300,000 tons of CO₂e per year; as such, a 2 per cent materiality threshold is applied.

(2) The parameters used for determining the project’s baseline emissions are:

- LFG_{total,y}: Total amount of LFG captured
- LFG_{flare,y} (FV_{RG,h}): Amount of LFG flared
- LFG_{electricity,y}: Amount of LFG gas combusted in power plant

The monitoring of the above parameters according to the approved PDD is recorded and the data was collected to every 5 minutes records.

(3) No errors are identified in the additional data set, and the DOE proceeds with the remaining elements of the verification as defined in its verification plan.

SECTION D. Means of verification**D.1. Desk review**

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The monitoring report was published on UNFCCC website on 05/02/2018. In addition to the monitoring report (version 01 dated 26/01/2018 and updated version 02 dated 03/03/2018) /1/, CTI reviewed:

- The PDD for the project activity/15/, including the monitoring plan and the corresponding validation report/16/;
- The 1st, 2nd, 3rd, 4th, and 5th verification report /17/ /18/ /19/;
- Baseline and monitoring methodology ACM0001 (version 06) and ACM0002 (version 06) applied by the project /38/;
- Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board/37//40//41//42/; and
- Other information and references relevant to the project activity /2/~32//34/.

During the desk review, CTI has applied standard auditing techniques to assess the quality of information provided. The following activities were performed:

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of measuring equipment including calibration requirements, and the quality assurance and quality control procedures; and
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

D.2. On-site inspection

Duration of on-site inspection: 28/02/2018				
No.	Activity performed on-site	Site location	Date	Team member
1.	An assessment of the implementation and operation of the registered project activity is as per the PDD for the project activity	The project plant	28/02/2018	Zhang Lei
2.	A review of information flows for generating, aggregating and reporting the monitoring parameters	The office of the project.	28/02/2018	Zhang Lei
3.	Determine whether the operational and data collection procedures are implemented in accordance with the monitoring plan in the PDD	The office of the project.	28/02/2018	Zhang Lei
4.	A cross-check between information provided in the monitoring report and data from other sources such as plant logbooks and electricity sale receipts	The project plant and the office of the project.	28/02/2018	Zhang Lei
5.	A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology	The project plant and the office of the project.	28/02/2018	Zhang Lei
6.	A review of calculations and assumptions made in determining the GHG data and emission reductions	The office of the project.	28/02/2018	Zhang Lei
7.	An identification that quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters	The project plant and the office of the project.	28/02/2018	Zhang Lei

D.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Diao	Xianlan	Asja Ambiente Italia S.p.A.	28/02/2018	- Project design and implementation - Monitoring Plan - Monitoring data and Monitoring Report - GHG Calculations	Zhang Lei
2	Pan	Libo	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	28/02/2018	- Project design and implementation - Technical equipment, including calibration and operation - Monitoring Plan and management procedures - Monitoring data - Data uncertainty and residual risks (QA/QC)	Zhang Lei
3	Li	Wei				
4	Li	Gang				

D.4. Sampling approach

NA

D.5. Clarification requests, corrective action requests and forward action requests raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form	0	0	0
Compliance of the project implementation with the registered PDD	0	0	0
Post-registration changes	0	0	0
Compliance of the monitoring plan with the monitoring methodology including applicable tool and standardized baseline	0	0	0
Compliance of monitoring activities with the registered monitoring plan	0	0	0
Compliance with the calibration frequency requirements for measuring instruments	0	0	0
Assessment of data and calculation of emission reductions or net removals	0	1	0
Others (please specify)	0	0	0
Total	0	1	0

SECTION E. Verification findings**E.1. Compliance of the monitoring report with the monitoring report form**

Means of verification	Document review the monitoring report against the monitoring report form.
Findings	By checking the MR, CTI found that all the relevant data has been described in MR.
Conclusion	CTI confirms that the monitoring report is in accordance with the requirement of the monitoring report form.

E.2. Remaining forward action requests from validation and/or previous verification

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By checking the validation report /16/ and the 1st, 2nd, 3rd 4th and 5th verification report /17/ /18/ of the project listed in EB website, CTI confirmed that no remaining forward action requests were identified from the validation and previous verifications.

E.3. Compliance of the project implementation with the registered project design document

Means of verification	CTI conducted the document review and performed on-site assessment with project participants to: <ul style="list-style-type: none"> - An assessment of the implementation and operation of the registered project activity is as per the PDD for the project activity; - A check of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology.
Findings	The project was registered on 25/12/2008, with a fixed crediting period which is from 25/12/2008 to 24/12/2018. This is the 6 th monitoring period, which is from 01/01/2017-31/12/2017. The start date of the project has been identified on 01/07/2007 by signing the equipment contract/20/. The starting date of construction was on 01/07/2007 /11/. The project activity involves collection and utilization of landfill gas to generate electricity by installing power generators and flaring system. A landfill gas pre-treatment system with measurement equipment have been installed on-site before the first periodic verification.

The project designed to install 6 generation units with total capacity of 3MW. The LFG flaring system was put into operation since 18/10/2007. The 1#, 2# and 3# generator were put into operation on 04/03/2008, 4# and 5# generator were put into operation on 27/03/2012 and 6# generator was put into operation on 10/10/2015 which can be verified by checking the operation logs. The details of the generator units and flaring systems with respect to their installation and capacity have been verified to be consistent with description indicated in the approved PDD/15/. During this monitoring period, all sets of generation units have already been installed and one flare have been installed and put into operation, each of them has been installed in line with the registered PDD. As confirmed by interviewing with project owner, the last one flare will be installed as soon as the biogas flow will be high and stable enough to guarantee suitable working conditions, which is deemed reasonable based on the experience of verification team. The technical parameters of installed generators and flaring system are listed in the following table:

Table 1: Technical Parameters of Installed Generators/26/

Generator No.	1#~3#	4#~5#	6#
Installation time	2008	2012	2015
Manufacturer	JEDC	JEDC	JEDC
Model	500GF-N G12V190ZLDZ-2	500GF-N G12V190ZLDZ-2	500GF-N G12V190ZLDZ-2
Electric Voltage	500KW	500KW	500KW
Rated frequency	50 Hz	50 Hz	50 Hz
Rated voltage	400V	400V	400V
Rated current	902A	902A	902A

Table 2: Technical Parameters of flaring systems/25/

Flaring system No.	1
Manufacturer	Shunfeng -Pioneer
Flare type	Enclosed
Capacity	2,000m ³ /h
Combustion efficiency	≥ 98%

Thus, the verification team confirmed that the project implementation was in accordance with the approved PDD.

By means of on-site interviewing with Mr. Pan Libo (i.e. the project manager of the project) and checking the daily operation & maintenance logs, the verification team can confirm that the project activity operated well, and no event which may impact the applicability of the methodology occurred during the monitoring period from 01/01/2017-31/12/2017.

The electricity generated by this project is connected to the Northeast Power Grid (NEPG) through an on-site transformer station. The Power Purchase Agreement (PPA) was signed on 15/06/2017 /4/ between Liaoning Province Electric Power Company and Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.

The location of measurement equipment are shown in section C of the monitoring report (version 02 dated 03/03/2018). During this monitoring period, all the measuring equipment has been calibrated by the accredited third-party entity in accordance with relevant standards/12//13//14//28/~//33/. The detailed calibration information of the measuring equipment is described in E.6.2 of this verification report, which has been confirmed by the verification team during the on-site visit. All the monitoring system in operation period is

	consistent with the description in the approved PDD. By checking the daily operation logbooks/7/, CTI confirms that no serious malfunction happened and the project was under a normal operation as expected in this monitoring period.
Conclusion	CTI confirms that the project implementation is in accordance with the project description contained in approved PDD (version 03 dated 16/06/2008)/15/. Through on-site visit and document review, the verification team confirmed that all physical features of the proposed CDM project activity including data collection systems and storage systems have been implemented in accordance with the approved PDD.

E.4. Post-registration changes**E.4.1. Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline**

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NA

E.4.2. Corrections

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NA

E.4.3. Changes to the start date of the crediting period

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The start date of the crediting period has been changed from 01/01/2009 into 25/12/2008 and it has been accepted by the CDM EB.

E.4.4. Inclusion of a monitoring plan to a registered project activity

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N/A

E.4.5. Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline

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N/A

E.4.6. Changes to the project design of a registered project activity

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NA

E.4.7. Types of changes specific to afforestation and reforestation project activities

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N/A

E.5. Compliance of monitoring plan with the monitoring methodology including applicable tool and standardized baseline

Means of verification	CTI conducted the document review and performed on-site assessment with the compliance check of the monitoring plan with the applied methodology including applicable tools.
Findings	All parameters stated in the monitoring plan are in compliance with the applied methodology, i.e. ACM0001 (version 06) /38/ and ACM0002 (Version 06) /39/, and monitored and reported appropriately. The monitoring report lists each parameter required

	by the monitoring plan and the information flow (i.e. from data generation, aggregation, recording, calculation and reporting) for these parameters is provided. On-site training for the CDM related procedures including monitoring, recording and reporting was verified to be in place/5/ and their implementation was confirmed by interview with the key operators and observing the operation.
Conclusion	CTI confirmed that the monitoring plan is in accordance with the approved methodology applied by the project activity, i.e. ACM0001 (version 06) /38/ and ACM0002 (Version 06) /39/.

E.6. Compliance of monitoring activities with the registered monitoring plan

E.6.1. Data and parameters fixed ex ante

Means of verification	“Data and parameters fixed ex ante” in the MR are checked against the registration PDD /15/
Findings	<p>The parameters which are determined ex-ante at the validation stage and will not be updated during the fixed crediting period from 25/12/2008 to 24/12/2018 are:</p> <ul style="list-style-type: none"> • $\rho_{CH_4,n,h}$: Density of methane gas at normal conditions • Local and national regulatory framework: Law and regulations about waste management systems in China • $CEF_{elec,y}$: The emission factor of the NEPG <p>The parameter GWP_{CH_4} is determined ex-ante at the validation stage and updated accordingly. According to the methodology and the approved PDD, 21 is applied for the first commitment period and it shall be updated accordingly. 25 is adopted in this monitoring period according to IPCC Fourth Assessment Report: Climate Change 2007.</p>
Conclusion	CTI verified and confirmed that the above parameters used in the monitoring report is in compliance with the approved PDD.

E.6.2. Data and parameters monitored

Means of verification	<p>CTI conducted document review and performed on-site assessment with project participants to:</p> <ul style="list-style-type: none"> - A review of information flows for generating, aggregating and reporting the monitoring parameters; - Determine whether the operational and data collection procedures are implemented in accordance with the monitoring plan in the PDD; - A cross-check between information provided in the monitoring report and data from other sources such as plant logbooks, electricity sale receipts, monthly balance bill and LFG original data/7//8//9//10//34/; - An identification that quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.
Findings	The monitoring has been carried out in accordance with the approved PDD. CTI confirms that all parameters stated in the monitoring plan are monitored and reported appropriately.

All parameters required to be monitored by the monitoring plan as per the applied monitoring methodologies and the management system were assessed during the site visit. The monitoring report lists each parameter required by the monitoring plan and the information flow (i.e. from data generation, aggregation, recording, calculation and reporting) for these parameters is provided. The information flow for each parameter is further verified in the following sections:

- **LFG_{total,y}: Total amount of landfill gas captured**

As per the approved PDD, this parameter is measured by a flow meter continuously. And data are aggregated monthly and yearly. During the on-site visit, the verification team found that:

This parameter is continuously measured by a flow meter. The reading of the flow meter F1 is converted to normal temperature and pressure condition (0°C and 101.325Pa) via the temperature and pressure transmitter. The normalized reading is recorded by PLC (Programmable Logic Controller) every 5 minutes. The data from the PLC will be sent to the Data Management System (DMS) so that the data can be checked and archived in a detailed CDM spreadsheet /9/. The flow data is checked daily and then aggregated monthly and yearly in a detailed CDM spreadsheet /9/. It was confirmed by the verification team that no breakdown was occurred during this monitoring period. Calibration of the flow meter was conducted by the accredited third-party organization /30/ /31/. The calibration information of the flow meter was listed in E.7 of this verification report.

The verification team confirms that LFG_{total,y} has been monitored as per the monitoring plan in the approved PDD.

- **LFG_{flared,y}: Amount of landfill gas flared**

As per the approved PDD, this parameter is measured by a flow meter continuously. And data are aggregated monthly and yearly. During the on-site visit, the verification team found that:

This parameter is continuously measured by a flow meter. The reading of the flow meter F2 is converted to normal temperature and pressure condition (0°C and 101.325Pa) via the temperature and pressure transmitter. The normalized reading is recorded by PLC (Programmable Logic Controller) every 5 minutes. The data from the PLC will be sent to the Data Management System (DMS) so that the data can be checked and archived in a detailed CDM spreadsheet/9/. The flow data is checked daily and then aggregated monthly and yearly in a detailed CDM spreadsheet/9/. It was confirmed by the verification team that no breakdown was occurred during this monitoring period. It was confirmed by the verification team that no breakdown was occurred during this monitoring period. Calibration of the flow meter was conducted by the accredited third-party organization/30/.The calibration information of the flow meter F2 was listed in E.7 of this verification report.

The verification team confirms that LFG_{flared,y} has been monitored as per the monitoring plan in the approved PDD.

- **LFG_{electricity,y} Amount of landfill gas combusted in power plant**

As per the approved PDD, this parameter shall be measured by flow meter on the inlet to generator units continuously and data are aggregated monthly and yearly. During the on-site visit, the verification team found that:

This parameter is continuously measured by a flow meter. The reading of the flow meter F3 is converted to normal temperature and pressure condition (0°C and 101.325MPa) via the temperature and pressure transmitter. The normalized reading is recorded by PLC (Programmable Logic Controller) every 5 minutes. The data from the PLC will be send to the Data Management System (DMS) so that the data can be checked and archived in a detailed CDM spreadsheet/9/. The flow data is checked daily and then aggregated monthly and yearly in a detailed CDM spreadsheet/9/. It was confirmed by the verification team that no breakdown was occurred during this monitoring period. Calibration of the flow meter was conducted by the accredited third-party organization/30/. The calibration information of the flow meter F3 was listed in E.7 of this verification report.

The verification team confirms that $LFG_{\text{electricity,y}}$ has been monitored as per the monitoring plan in the approved PDD.

- **T_{flare} : Temperature in the exhaust gas of the enclosed flare**

As per the Approved PDD, this parameter is continuously measured by an N-type thermocouple T1. A temperature above 500°C indicates that a significant amount of gases are still being burnt and that the flare is operating. As per the Tool to determine project emission from flaring emission from flaring gases containing methane/43/, this parameter is used to determine the hourly flare efficiency. According to the methodology and registered PDD, the parameters should be monitored as per the “Tool to determine project emissions from flaring gases containing methane”. The PP selected the default flare efficiency 90% in the registered PDD. During the on-site visit, the verification team found that:

There is one flaring system installed onsite. This parameter is continuously measured by an N-type thermocouple installed at the top of the flaring system. Reading of the N-type thermocouple is recorded by PLC every 5 minutes /9/. The data from the PLC will be send to the Data Management System (DMS) so that the data can be checked and archived in a detailed CDM spreadsheet/9/. It was confirmed by the verification team that no breakdown was occurred during this monitoring period. Calibration of the N-type thermocouple was conducted by the accredited third-party organization/28//29/. The calibration information of the N-type thermocouple was listed in E.7 of this verification report.

The verification team confirms that T_{flare} has been monitored as per the monitoring plan in the approved PDD.

- **$f_{VCH4,RG,h}$: Volumetric fraction of methane in the residual gas on dry basis in hour h**

As per the Approved PDD, this parameter is the same as W_{CH4} , but stands for the volumetric fraction of CH_4 in the residual gas to the flaring system. During the on-site visit, the verification team found that:

$f_{VCH4,RG,h}$ was monitored by a gas analyser installed on the main pipe. The parameter was measured continuously and recorded every 5 minutes in by PLC /9/. The data from the PLC

will be send to the Data Management System (DMS) so that the data can be checked and archived in a detailed CDM spreadsheet /9/. Calibration of the gas analyser was conducted by the accredited third-party organization /32/. The calibration information of the gas analyser was listed in E.7 of this verification report.

The verification team confirms that $fv_{CH_4,RG,h}$ has been monitored as per the monitoring plan in the approved PDD.

- **FV_{RG,h}: Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h**

As per Approved PDD, this parameter is the same as the parameter $LFG_{flare,y}$ and will be continuously measured by a flow meter. Measure on the dry basis that the measurement of volumetric fraction of methane in the residual gas ($fv_{CH_4,RG,h}$) when the residual gas temperature exceeds 60°C.

During the on-site visit, the verification team found that:

In the monitoring activities, the monitoring records of parameter $LFG_{flare,y}$ were used as the monitoring data of $FV_{RG,h}$. The normalized reading is recorded by PLC (Programmable Logic Controller) every 5 minutes /9/. The data from the PLC will be send to the Data Management System (DMS) so that the data can be checked and archived in a detailed CDM spreadsheet.

Calibration of the gas analyser was conducted by the accredited third-party organization /30/ /31/. The calibration information of the gas analyser was listed in E.7 of this verification report.

The verification team confirms that $FV_{RG,h}$ has been monitored as per the monitoring plan in the approved PDD.

- **W_{CH₄}: Methane fraction in the landfill gas**

As per the Approved PDD, this parameter is the same as $fv_{CH_4,RG,h}$. The parameter is measured continuously by gas analyser. During the on-site visit, the verification team found that:

The parameter was monitored by a gas analyser installed on the main pipe. The parameter was measured continuously and recorded every 5 minutes in by PLC /9/. The data from the PLC will be send to the Data Management System (DMS) so that the data can be checked and archived in a detailed CDM spreadsheet/9/. Calibration of the gas analyser was conducted by the accredited third-party organization /32/. The calibration information of the gas analyser was listed in E.7 of this verification report.

The verification team also checked the variations of methane percentage during this monitoring period and found that the methane concentrations are basically from 41% to 64%. According to local and sectoral knowledge about methane concentration (ranged from 40% to 70%) in the LFG, the verification team concludes that the data of methane concentrations is reasonable and acceptable. The verification team confirms that W_{CH_4} has been monitored as per the monitoring plan in the approved PDD.

- **EL_{LFG}: Net amount of electricity generated using LFG**

As per approved PDD, the parameters EL_{LFG} shall be measured continuously by electricity

meters. The data is measured continuously and aggregated monthly and yearly. During the on-site visit, the verification team found that:

One electricity meter was installed at the project site as per the approved PDD.

The electricity meter is maintained and calibrated according to relevant laws and regulations/14/. According to the logbooks, no failure of meters occurred during this monitoring period/7/. The meter was calibrated by a qualified third party once a year according to the industry standards and applicable regulations/12//13/.

The readings of electricity meter is used for calculation. Through review of the electricity receipts/10/ and interviews on-site, the information flow for parameters EL_{LFG} has been verified, which is described as follows:

- Monthly readings of the electricity meter is collected by the local grid company and project owner. The readings of the meter are recorded at 0:00AM daily and collected at 0:00AM on the first day of next month.
- The reading records of the electricity supplied to the grid by meter is cross-checked with electricity sales receipts supplied by local grid company/8//10/.
- The reading records of the electricity imported from the grid by meter is cross-checked with monthly balance bill/8//34/.

The verification team has verified the values provided in the monitoring report against the relevant documented evidences, i.e. the reading records of electricity meter, electricity sales receipts, daily operational log books, and monthly balance bill /7//10//34/and found it to be correct.

The verification team confirms that the $EL_{LFG,y}$ has been monitored as per the monitoring plan in the approved PDD/15/.

• **EL_{PR} : Total amount of electricity required to meet the project requirement**

As per approved PDD, the parameters EL_{PR} shall be measured continuously by electricity meters. The data is measured continuously and aggregated monthly and yearly. During the on-site visit, the verification team found that:

Two electricity meters were installed at the project site as per the approved PDD, which included meter A and meter B.

A - Electricity meter (accuracy: 0.5s) to measure the electricity imported from the grid;

B - Electricity meter (accuracy: 1) to measure the electricity imported from the grid

The electricity meters are maintained and calibrated according to relevant laws and regulations/14//33/. According to the logbooks, no failure of meters occurred during this monitoring period/7/. The meters were calibrated by a qualified third party once a year according to the industry standards and applicable regulations/12//13/.

The readings of electricity meter A and B are used for calculation. Through review of the electricity receipts/10/ and interviews on-site, the information flow for parameters EL_{PR} has been verified, which is described as follows:

- Monthly readings of the electricity meter are collected by the local grid company and project owner. The readings of the meter are recorded at 0:00AM daily and collected at 0:00AM on the first day of next month.

- The reading records of the electricity supplied to the grid by meter is cross-checked with electricity sales receipts supplied by local grid company/8//10/.
- The reading records of the electricity imported from the grid by meter is cross-checked with monthly balance bill/8//34/.

The verification team has verified the values provided in the monitoring report against the relevant documented evidences, i.e. the reading records of electricity meter, electricity sales receipts, daily operational log books, and monthly balance bill /7//10//34/ and found it to be correct.

The verification team confirms that the EL_{PR} has been monitored as per the monitoring plan in the approved PDD/15/.

- **$PE_{flare,y}$: Project emissions flaring of the residual gas stream in year y**

As per approved PDD, the parameter PE_{flare} shall be calculated as per the Tool to determine project emissions from flaring gases containing methane /44/. $PE_{flare,y}$ is calculated as follows:

$$PE_{flare,y} = \sum TM_{RG,h} * (1 - \eta_{flare,h}) * GWP_{CH_4} / 1000$$

$TM_{RG,h}$ = Mass flow rate of methane in the exhaust gas of the flare on dry basis at normal

$\eta_{flare,h}$ = Flare efficiency in hour

GWP_{CH_4} = Global Warming Potential of methane valid for the 2nd commitment period, 25 tCO₂e/tCH₄

$$TM_{RG,h} = FV_{RG,h} * fv_{CH_4,RG,h} * \rho_{CH_4,n}$$

Where:

$FV_{RG,h}$ = Volumetric flow rate of the residual gas on dry basis at normal conditions in the hour h, m³/h

$fv_{CH_4,RG,h}$ = Volumetric fraction of methane in the residual gas on dry basis in hour h

$\rho_{CH_4,n}$ = Density of methane at normal conditions (0.7168), kg/m³

The verification team confirm that the calculation of $PE_{flare,y}$ have been in accordance with the monitoring plan in the approved PDD.

- **EPH : Engine working hours of power plant (Hours)**

As per the approved PDD, this parameter is measured and archived electronically, and recorded every 5 minutes. During the verification, the verification team found that:

The parameter is automatically measured by the integrated device in the generator. The monitoring data are checked daily and reported monthly. The aggregated values of this parameter are listed in the MR. The verification team checked the operational logbooks/7/ and confirmed that the generators are maintained regularly according to manufacturer's specifications. The verification team has checked related operation records /8/ and confirms they are correct.

The verification team confirmed that the parameter has been monitored as per the monitoring plan in the approved PDD.

- **Flare working hours (Hours)**

As per the approved PDD, this parameter is measured and archived electronically, and recorded every 5 minutes. During the verification, the verification team found that:

	<p>The parameter is automatically measured. The monitoring data are recorded every 5 minutes. The aggregated values of this parameter are listed in the MR. The verification team checked the operational logbooks/7/ and confirmed that the generators are maintained regularly according to manufacturer's specifications. The verification team has checked related operation records/8/ and confirms they are correct.</p> <p>According to the methodology and registered PDD, the parameters should be monitored as per the "Tool to determine project emissions from flaring gases containing methane". The PP selected the default flare efficiency 90% in the registered PDD. All the required parameters $f_{vi,h}$, $F_{VRG,h}$, T_{flare} were monitored. No other flare operation parameters need to be monitored as per the specification of the flare system. The monitoring of these parameters is specified above in respective tables of this section.</p> <p>The verification team confirmed that the parameter has been monitored as per the monitoring plan in the approved PDD.</p> <p>The verification team confirmed that all monitoring data related to monitoring parameters is complete and accurate. A complete set of data for this monitoring period is available to be monitored and are in accordance with the monitoring plan in the approved PDD.</p> <p>The internal audits have been performed by pp, the verification team confirmed that all the records were available during the on-site visit.</p>
Conclusion	Monitoring of data and parameters related to the GHG emission reductions in the project activity has been carried out in accordance with the monitoring plan.

E.6.3. Implementation of sampling plan

Means of verification	N/A
Findings	N/A
Conclusion	N/A

E.7. Compliance with the calibration frequency requirements for measuring instruments

Means of verification	The documents review was carried out. Particular attention was paid to the frequency of measurements, the quality of the monitoring equipment including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology and corresponding tool(s), and the quality assurance and quality control procedures.																										
Findings	<p>The flow meters installed for the project activity have been calibrated periodically as per the relevant industrial standard by the accredited qualified third party to ensure accuracy of monitoring equipment and in good conditions. The relevant calibration information of flow meters/31/ is listed as below:</p> <table border="1"> <thead> <tr> <th>Metering equipment</th><th>Type</th><th>Serial No.</th><th>Accuracy class</th><th>Calibration frequency</th><th>Calibration date:</th><th>Validity of calibration</th></tr> </thead> <tbody> <tr> <td>Flow meter for LFG_{total,y}</td><td>Annubar 485</td><td>01726699</td><td>± 0.9%</td><td>Yearly</td><td>01/09/2016 01/09/2017</td><td>31/08/2017 31/08/2018</td></tr> <tr> <td>Flow meter for LFG_{flared,y}</td><td>Annubar 285</td><td>01746511</td><td>± 2%</td><td>Yearly</td><td>01/09/2016 01/09/2017</td><td>31/08/2017 31/08/2018</td></tr> </tbody> </table>						Metering equipment	Type	Serial No.	Accuracy class	Calibration frequency	Calibration date:	Validity of calibration	Flow meter for LFG _{total,y}	Annubar 485	01726699	± 0.9%	Yearly	01/09/2016 01/09/2017	31/08/2017 31/08/2018	Flow meter for LFG _{flared,y}	Annubar 285	01746511	± 2%	Yearly	01/09/2016 01/09/2017	31/08/2017 31/08/2018
Metering equipment	Type	Serial No.	Accuracy class	Calibration frequency	Calibration date:	Validity of calibration																					
Flow meter for LFG _{total,y}	Annubar 485	01726699	± 0.9%	Yearly	01/09/2016 01/09/2017	31/08/2017 31/08/2018																					
Flow meter for LFG _{flared,y}	Annubar 285	01746511	± 2%	Yearly	01/09/2016 01/09/2017	31/08/2017 31/08/2018																					

Flow meter for LFG _{electricity}	Annubar 285	01746510	± 2%	Yearly	01/09/2016 01/09/2017	31/08/2017 31/08/2018
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In the approved PDD, the accuracy of flow meter was not stated.

Calibration records/31/ and accreditation certificates/30/ have been verified by the verification team. The accuracy of flow meters is ± 0.9% and ± 2%, and the calibration frequency of meters is once a year, which to be in compliance with the national standard of “Regulation on the installation and management of energy measurement devices for energy using entities (GB/17167-2006)”. The flow meter in use is within the validity period of calibration.

The verification team confirmed that the flow meters’ accuracy and calibration interval are in line with the requirement of the national standard, and the calibrations of flow meters are verified to be valid for this monitoring period.

The N-type thermocouple for the flare has been calibrated periodically as per the relevant industrial standard by the accredited qualified third party to ensure accuracy of the monitoring equipment and in good conditions. The relevant calibration information of temperature is listed as below:

Metering equipment	Type	Serial No.	Accuracy class	Calibration frequency	Validity period	period in use
N-type thermocouple	WRMK-331	/	± 2.5°C	Yearly replaced with same new one	26/12/2016 25/12/2017	25/12/2017 24/12/2018

For the monitoring of temperature in exhaust gas of enclosed flare, in order to ensure the measurement accuracy of N-type thermocouple, the project owner conservatively adopted the procedures to replace yearly with same new thermocouple, which is verified to be fully in compliance with the registered PDD. Calibration records and accreditation certificates have been verified by the verification team. The accuracy of N-type thermocouple is ±2.5°C.

The verification team confirmed that accuracy and calibration interval of t N-type thermocouple is in line with the requirement of the approved PDD, and the calibrations of N-type thermocouple is verified to be valid for this monitoring period.

The gas analyser installed for the project activity have been calibrated periodically as per the relevant industrial standard by the accredited qualified third party to ensure accuracy of the monitoring equipment and in good conditions. The relevant calibration information of gas analyser/32/ is listed as below:

Metering equipment	Type	Serial No.	Accuracy class	Calibration frequency	Validity period	Validity of calibration
Gas analyzer W _{CH4}	XGF-4043	0708404	≤2%	yearly	28/08/2016 28/08/2017	27/08/2017 27/08/2018

In the approved PDD, the accuracy of the gas analyser was not stated. Calibration records/32/ and accreditation certificates/33/ have been verified by the verification team.

	<p>The accuracy of gas analyser is $\leq 2\%$. The calibration frequency of gas analyser is once a year. The gas analyser in use is within the validity period of calibration.</p> <p>The verification team confirmed that accuracy and calibration interval of gas analyser is in line with the requirement of the approved PDD, and the calibrations of gas analyser is verified to be valid for this monitoring period.</p> <p>The electricity meters installed for the project activity have been calibrated periodically as per the relevant industrial standard by the accredited qualified third party to ensure accuracy of the monitoring equipment and in good conditions. The relevant calibration information of electricity meters/13/ is listed as below:</p>					
	Metering equipment	Type	Serial No.	Accuracy class	Calibration frequency	Validity period
	Electricity meter	DSSD331-3	8007472	0.5S	5 years	10/10/2013
	Electricity meter A	DTZ188	010112300001515158	0.5S	5 years	17/07/2013
	Electricity meter B	DTSS1	0103200019480	1	5 years	26/12/2013
	<p>In the approved PDD, the accuracy of the electricity meter was not stated. Calibration records/13/ and accreditation certificates/12/ have been verified by the verification team. The accuracy of electricity meters is no less than 1.0. The calibration frequency of electricity meters is 5 years. The electricity meters in use is within the validity period of calibration.</p> <p>The verification team confirmed that accuracy and calibration interval of electricity meters is in line with the requirement of Verification Regulation of Electrical Energy Meters with Electronics (JJG596-2012), and the calibrations of electricity meters is verified to be valid for this monitoring period.</p>					
Conclusion	<p>The measuring equipments have been installed and calibrated in accordance with approved PDD. The accuracy and calibration interval of measuring equipments are in line with the requirement of the monitoring plan, and the calibrations of measuring equipments are verified to be valid for this monitoring period.</p>					

E.8. Assessment of data and calculation of emission reductions or net removals

E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification	Cross-checking the baseline GHG emissions calculation in the MR against that in the ER spreadsheet and the registered PDD.
Findings	<p>The baseline emissions are calculated according to the ACM0001 (version 06), ACM0002 (version 06) and the registered PDD as below:</p> $BE_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_{LFG,y} * CEF_{elec,B,y} + ET_{LFG,y} * CEF_{ther,BL,y} \quad (1)$ <p>Where:</p> <ul style="list-style-type: none"> ➤ BR_y = The baseline emissions reduction, in tons of tCO₂ equivalent (tCO₂e) ➤ $MD_{project,y}$ = Amount of methane that would have been destroyed/combusted during

the year, in tons of methane (tCH₄)

- $MD_{reg,y}$ = Amount of methane that would have been destroyed/combusted during the year in the absence of the project, in tons of methane (tCH₄)
- GWP_{CH_4} = Global Warming Potential value for methane for this monitoring period is 25 tCO₂e/tCH₄
- $EL_{LFG,y}$ = Net quantity of electricity produced using LFG exported which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year y, in megawatt hours(MWh)
- $CEF_{elec,BL,y}$ = CO₂ emissions intensity of the baseline source of electricity displaced (tCO₂e/MWh)
- EL_{PR} = Amount of electricity generated in an on-site fossil fuel fired power plant or imported from the grid as a result of the project activity, measured using an electricity meter (MWh)
- $ET_{LFG,y}$ = Quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler, during the year y (TJ/y)
- $CEF_{ther,BL,y}$ = CO₂ emissions intensity of the fuel used by boiler to generate thermal energy which is displaced by LFG based thermal energy generation (tCO₂e/TJ)
- $ET_{PR,y}$ = fossil fuel consumption on site during project activity in year y (ton)
- $CEF_{ther,PR,y}$ = CO₂ emissions factor of the fossil fuel used by boiler to generate thermal energy in the project activity during year y.

Calculation of $MD_{project,y}$

Some LFG captured will be flared and most LFG will be used to generate electricity. Thus, the following equation is used to calculate the emission reductions.

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} \quad (2)$$

Where:

$MD_{flared,y}$: Quantity of methane destroyed by flaring (tCH₄)

$MD_{electricity,y}$: Quantity of methane destroyed by generation of electricity (tCH₄)

$$MD_{flared,y} = (LFG_{flare,y} * w_{CH_4,y} * D_{CH_4}) - (PE_{flare,y} / GWP_{CH_4}) \quad (3)$$

Where:

$LFG_{flare,y}$: Quantity of LFG fed to the flare(s) during year y measured in cubic meters (m³);

$w_{CH_4,y}$: Average methane fraction of the LFG as measured during year y and expressed as a fraction (in m³CH₄/m³LFG)

D_{CH_4} : Methane density expressed in tonnes of methane per cubic meter of methane (tCH₄/m³ CH₄)

$PE_{flare,y}$: Project emissions from flaring of the residual gas stream in year y (tCO₂e)

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH_4}}{1000} \quad (4)$$

Where:

$TM_{RG,h}$: Mass flow rate of methane in the residual gas in the hour h (kg/h)

$\eta_{flare,h}$: Flare efficiency in hour. Determined by the methodological tool Tool to determine project emissions from flaring gases containing methane/43/

$$TM_{RG,h} = FV_{RG,h} * fv_{CH_4,RG,h} * \rho_{CH_4,n} \quad (5)$$

Where:

$FV_{RG,h}$: Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h, m³/h;

$fv_{CH_4,RG,h}$: Volumetric fraction of methane in the residual gas on dry basis in hour h;

$\rho_{CH_4,n}$: Density of methane at normal conditions, kg/m³.

During this monitoring period, as the data were recorded hourly, the flare information per minute is unavailable, the flare efficiency cannot be defined according to the Tool to determine project emission from flaring emission from flaring gases containing methane/43/. Therefore, 0 is adopted for the flare efficiency for conservative, which means $MD_{flare,y}=0$.

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH_4,y} * D_{CH_4} \quad (6)$$

Where:

$LFG_{electricity,y}$: Quantity of LFG fed into electricity generator (m³)

The amount of the landfill gas fed to the generators is compared with the total landfill gas minus landfill gas fed to the flare of methane monitored for the same period.

The value $LFG_{electricity,y}$ adopted for the calculation of baseline is determined as follows, for conservativeness:

$$LFG_{electricity,y} = \min(LFG_{total,y} - LFG_{flare,y}, LFG_{electricity,y}) \quad (7)$$

The value of D_{CH_4} equals to that of $\rho_{CH_4,n}$ under normal condition, which is 0.0007168 tCH₄/m³CH₄.

Calculation of BE_y

Baseline emissions from LFG combustion

Verification team is able to confirm that the formulas and emission factors used are consistent with the registered PDD and the applied methodologies. In the above formulas, to be conservative, the minimum of $LFG_{total,y}$ and sum of ($LFG_{flare,y} + LFG_{electricity,y}$) was used for emission reductions from CH₄ destruction. $LFG_{total,y}$, $LFG_{flare,y}$, $LFG_{electricity,y}$ and $w_{CH_4,y}$ have been aggregated and reported. The value of D_{CH_4} ($\rho_{CH_4,n}$) is at normal conditions is 0.0007168 tCH₄/m³CH₄ according to tool to determine project emissions form flaring gases containing methane .

Period	LFG _{total} (Nm ³)	LFG _{flare} (Nm ³)	LFG _{electricity} (Nm ³)	MD _{project} (tCO ₂)
	A	B	C	
01/01/2017-31/12/2017	13,831,456	61,783	13,368,237	125,288

Baseline emissions from electricity generation

Period	Meter readings records (kWh)	Electricity sales receipts (kWh)	$EL_{LFG,y}$ (kWh)
	D	E	F=MIN(D,E)
01/01/2017-31/01/2017	1,805,360	1,810,000	1,805,360
01/02/2017-28/02/2017	1,635,880	1,640,000	1,635,880
01/03/2017-31/03/2017	1,654,120	1,650,000	1,650,000
01/04/2017-30/04/2017	1,557,200	1,560,000	1,557,200
01/05/2017-31/05/2017	1,688,440	1,690,000	1,688,440
01/06/2017-30/06/2017	1,877,200	1,880,000	1,877,200
01/07/2017-31/07/2017	2,107,360	2,110,000	2,107,360
01/08/2017-31/08/2017	2,133,040	2,130,000	2,130,000
01/09/2017-30/09/2017	1,997,960	2,000,000	1,997,960
01/10/2017-31/10/2017	1,908,840	1,910,000	1,908,840
01/11/2017-30/11/2017	1,677,240	1,680,000	1,677,240

	01/12/2017-31/12/2017	1,619,360	1,620,000	1,619,360
	Total	-	-	21,654,840
The baseline emissions are calculated according to formula (1): $BE_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_{LFG,y} * CEF_{elec,BL,y}$ $= 125,288 + 22,775$ $= \mathbf{148,063 tCO_2e}$				
Conclusion	The verification team has confirmed that the calculation of the baseline emissions is correct.			

E.8.2. Calculation of project GHG emissions or actual net GHG removals by sinks

Means of verification	Cross-checking the project GHG emissions calculation in the MR against that in the ER spreadsheet and the registered PDD.																																																															
Findings	<p>The project emissions are calculated according to the ACM0001 (version 06) and the approved PDD as below:</p> $PE_y = EL_{PR,y} * CEF_{elec,PR,y} + ET_{PR,y} * CEF_{ther,PR,y} \tag{8}$ <p>Where:</p> <p>$EL_{PR,y}$ = Amount of electricity generated in an on-site fossil fuel fired power plant or imported from the grid as a result of the project activity, measured using an electricity meter (MWh)</p> <p>$CEF_{elec,PR,y}$= CO₂ emissions intensity of the baseline source of electricity displaced (tCO₂eq/MWh)</p> <p>$ET_{PR,y}$ = fossil fuel consumption on site during project activity in year y (ton)</p> <p>$CEF_{ther,PR,y}$= CO₂ emissions factor of the fossil fuel used by boiler to generate thermal energy in the project activity during year y.</p> <p>Calculation of PE_y</p> <table><tr><th rowspan="2">Period</th><th>Meter readings records (kWh)</th><th>Monthly balance bill (kWh)</th><th>$EL_{PR,y}$ (kWh)</th></tr><tr><th>G</th><th>H</th><th>I=MAX(G,H)</th></tr><tr><td>18/12/2016-10/01/2017</td><td>26,061</td><td>10,611</td><td>26,061</td></tr><tr><td>11/01/2017-16/02/2017</td><td>29,158</td><td>23,929</td><td>29,158</td></tr><tr><td>17/02/2016-15/03/2017</td><td>20,141</td><td>23,414</td><td>23,414</td></tr><tr><td>16/03/2017-15/04/2017</td><td>29,895</td><td>31,076</td><td>31,076</td></tr><tr><td>16/04/2017-17/05/2017</td><td>28,446</td><td>29,351</td><td>29,351</td></tr><tr><td>18/05/2017-18/06/2017</td><td>55,315</td><td>38,462</td><td>55,315</td></tr><tr><td>19/06/2017-17/07/2017</td><td>62,269</td><td>36,242</td><td>62,269</td></tr><tr><td>18/07/2017-19/08/2017</td><td>69,064</td><td>35,938</td><td>69,064</td></tr><tr><td>20/08/2017-18/09/2017</td><td>49,815</td><td>32,785</td><td>49,815</td></tr><tr><td>19/09/2017-18/10/2017</td><td>25,250</td><td>53,882</td><td>53,882</td></tr><tr><td>19/10/2017-21/11/2017</td><td>35,813</td><td>20,269</td><td>35,813</td></tr><tr><td>22/11/2017-23/12/2017</td><td>26,291</td><td>26,553</td><td>26,553</td></tr><tr><td>24/12/2017-22/02/2018</td><td>44,928</td><td>45,522</td><td>45,522</td></tr><tr><td>Total</td><td></td><td></td><td>537,293</td></tr></table> <p>For the conservative, the value from 18 December 2016 to 22 February 2018 was taken into account to calculate the PE_y.</p> <p>The project emissions are calculated according to formula (8):</p> $PE_y = PE_{EC,y} = EL_{PR,y} * CEF_{elec,PR,y} = 537.293 * 1.05176 = 566tCO_2e$	Period	Meter readings records (kWh)	Monthly balance bill (kWh)	$EL_{PR,y}$ (kWh)	G	H	I=MAX(G,H)	18/12/2016-10/01/2017	26,061	10,611	26,061	11/01/2017-16/02/2017	29,158	23,929	29,158	17/02/2016-15/03/2017	20,141	23,414	23,414	16/03/2017-15/04/2017	29,895	31,076	31,076	16/04/2017-17/05/2017	28,446	29,351	29,351	18/05/2017-18/06/2017	55,315	38,462	55,315	19/06/2017-17/07/2017	62,269	36,242	62,269	18/07/2017-19/08/2017	69,064	35,938	69,064	20/08/2017-18/09/2017	49,815	32,785	49,815	19/09/2017-18/10/2017	25,250	53,882	53,882	19/10/2017-21/11/2017	35,813	20,269	35,813	22/11/2017-23/12/2017	26,291	26,553	26,553	24/12/2017-22/02/2018	44,928	45,522	45,522	Total			537,293
	Period		Meter readings records (kWh)	Monthly balance bill (kWh)	$EL_{PR,y}$ (kWh)																																																											
		G	H	I=MAX(G,H)																																																												
	18/12/2016-10/01/2017	26,061	10,611	26,061																																																												
	11/01/2017-16/02/2017	29,158	23,929	29,158																																																												
	17/02/2016-15/03/2017	20,141	23,414	23,414																																																												
	16/03/2017-15/04/2017	29,895	31,076	31,076																																																												
	16/04/2017-17/05/2017	28,446	29,351	29,351																																																												
	18/05/2017-18/06/2017	55,315	38,462	55,315																																																												
	19/06/2017-17/07/2017	62,269	36,242	62,269																																																												
18/07/2017-19/08/2017	69,064	35,938	69,064																																																													
20/08/2017-18/09/2017	49,815	32,785	49,815																																																													
19/09/2017-18/10/2017	25,250	53,882	53,882																																																													
19/10/2017-21/11/2017	35,813	20,269	35,813																																																													
22/11/2017-23/12/2017	26,291	26,553	26,553																																																													
24/12/2017-22/02/2018	44,928	45,522	45,522																																																													
Total			537,293																																																													
Conclusion	The verification team has confirmed that the calculation of the project emissions is correct.																																																															

E.8.3. Calculation of leakage GHG emissions

Means of verification	According to the ACM0001 (version 06) and the approved PDD, the leakage of the project is not considered.
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Findings	According to the ACM0001 (version 06) and the approved PDD, the leakage of the project is not considered
Conclusion	According to the ACM0001 (version 06) and the approved PDD, the leakage of the project is not considered

E.8.4. Summary of calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

Means of verification	Cross-checking the data applied for ER calculation with all the relevant documents as listed in Appendix 3, and the ER calculation in the MR against that in the ER spreadsheet and the approved PDD.
Findings	<p>According to the ACM0001 (version 06) /38/ and the approved PDD/15/, the emission reductions are determined as the difference between the baseline emissions, project emissions and leakage:</p> $ER_y = BE_y - PE_y - L_y = 148,063\text{tCO}_2\text{e} - 566\text{tCO}_2\text{e} = 147,497\text{tCO}_2\text{e}$ <p>During the verification, CAR1 was raised as the data of EL_{PR} in CER spreadsheet is inconsistent with data from meter readings and electricity transaction notes in December of 2017. After review the monthly record provide by PP and the electricity transaction notes from Liaoning Province Power Grid Company, the verification team confirmed the correct data of EL_{PR} in December 2017 was used to calculate the ER. The MR has been also updated. Thus, the CAR 1 is closed.</p>
Conclusion	The verification team has confirmed that the calculation of the emission reductions is correct.

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Means of verification	The section E.5 of MR (Version 02) /2/ is cross-checked against the registered PDD.
Findings	<p>The emission reductions claimed are 147,497 tCO₂e in this monitoring period (i.e. 365 days) and the yearly expected emission reductions of 2017 is 167,687tCO₂e in the registered PDD.</p> <p>The actual emission reductions reported are 12.04% lower than the expected value.</p>
Conclusion	CTI verified the input data for calculating emission reductions and the calculating process, and confirmed the result were complete and transparent.

E.8.6. Remarks on difference from estimated value in registered PDD

Means of verification	The section E.6 of MR (Version 02) is cross-checked against the registered PDD.
Findings	The reported emission reductions in this monitoring period are 12.04% lower than that expected.
Conclusion	CTI verified the input data for calculating emission reductions and the calculating process, and confirmed the result were complete and transparent; and the actual emission reductions reported in this monitoring period are reasonable and appropriate.

E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Means of verification	The section E.4 of MR (Version 02) is cross-checked against the registered PDD.
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Findings	The emission reductions achieved during the first commitment period and the period from 01/01/2013 onwards are verified by the verification team as		
	Item	Actual values achieved up to 31/12/2012	Actual values achieved from 01/01/2013 onwards
	ER _y (tCO ₂)	0	147,497
	The calculated emission reductions in this monitoring period (from 01/01/2017-31/12/2017) is 147,497 tCO ₂ e.		
Conclusion	CTI verified the input data for calculating emission reductions and the calculating process, and confirmed the result were complete and transparent.		

SECTION F. Internal quality control

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This final verification report including the initial findings underwent a technical review before being submitted to PP and requesting issuance of CERs of the project activity according to CTI internal procedure. The technical reviewers were not part of the verification team, and the technical review was independently of the verification team.

SECTION G. Verification opinion

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In CTI's opinion, the GHG emission reductions reported for the project in the monitoring report (version 02 dated 03/03/2018) are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology ACM0001 (version 06) and the monitoring plan contained in the Project Design Document (version 03 dated 16/06/2008).

CTI confirmed that the GHG emission reductions are calculated without material misstatements. Based on the evidence and information that are considered necessary to guarantee that GHG emission reductions are appropriately calculated, CTI is able to certify that the amount of emission reductions from Shenyang Laohuchong LFG Power Generation Project during the period 01/01/2017-31/12/2017 as follows:

Baseline emissions: 148,063tCO₂e

Project emissions: 566tCO₂e

Leakage: 0 tCO₂e

Emission reductions: 147,497 tCO₂e

SECTION H. Certification statement

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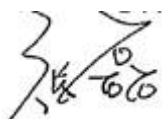
Shenzhen CTI International Certification Co., Ltd (CTI) has performed the verification of the emission reductions that have been reported for the CDM project activity 1906 “Shenyang Laohuchong LFG Power Generation Project” in China for the period 01/01/2017-31/12/2017.

The verification is based on the baseline and monitoring methodology ACM0001 (version 06), the validated and approved PDD (version 03 dated 16/06/2008) and the monitoring report (version 02 dated 03/03/2018). The verification consisted of the following three phases: i) desk review of the project design and the baseline and monitoring plan; ii) follow-up interviews with project participants; iii) resolution of outstanding issues and the issuance of the final verification and certification report.

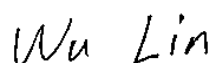
The project participants are responsible for the collection, calculation and determination of the GHG data in accordance with the monitoring plan and the reporting of GHG emission reductions on the basis set out within the project monitoring report.

It is CTI’s responsibility to provide an independent verification statement on the reported GHG emission reductions for the project. Based on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these, CTI planned and performed our work to obtain the information and explanations that we considered necessary to provide reasonable assurance that reported GHG emission reductions are fairly stated.

CTI confirmed that the GHG emission reductions are calculated without material misstatements. Based on the evidence and information that are considered necessary to guarantee that GHG emission reductions are appropriately calculated, CTI confirms that the emission reductions from the “Shenyang Laohuchong LFG Power Generation Project” in China during the period 01/01/2017-31/12/2017 amount to 147,497tCO₂e.



Mr. Zhang Lei
Team Leader
05/03/2018



Mr. Lin Wu
Technical Reviewer
05/03/2018

Appendix 1. Abbreviations

Abbreviations	Full texts
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CL	Clarification request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
CTI	Shenzhen CTI International Certification Co., Ltd
DOE	Designated Operational Entity
EF	Emission Factor
ER	Emission Reduction
ETN	Electricity Transaction Note
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
MR	Monitoring Report
NEPG	Northeast Power Grid
PDD	Project Design Document
PPA	Power Purchase Agreement
PS	Project Standard
tCO ₂ e	Tonnes of CO ₂ equivalents
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Clean Development Mechanism Validation and Verification Standard

Appendix 2. Competence of team members and technical reviewers

Mr. Zhang Lei

Satisfies the requirements of the Certification Body of CTI and is hereby appointed as:

Qualification as						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	01/01/2015	01/01/2015	01/01/2015	01/01/2015	01/01/2015	01/01/2015

Qualification in the scope and technical area		
Scope	Technical area	Date
SS 1: Energy industries (renewable/nonrenewable sources)	TA 1.2: Energy generation from renewable energy sources	01/01/2015
SS 4: Manufacturing industries	TA 4.1: Cement	01/01/2015
SS 13: Waste handling and disposal	TA 13.1: Waste handling and disposal	01/01/2015
	TA 13.2: Animal waste management	01/01/2015

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:

Lin Wu

Wu Lin

Technical competent manager
Shenzhen, 01/01/2015

Mr. Lin Wu

Satisfies the requirements of the Certification Body of CTI and is hereby appointed as:

Qualification as						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	01/01/2015	01/01/2015	01/01/2015	01/01/2015	01/01/2015	01/01/2015

Qualification in the scope and technical area		
Scope	Technical area	Date
SS 1: Energy industries (renewable/nonrenewable sources)	TA 1.1: Thermal energy generation	01/01/2015
	TA 1.2: Renewables	01/01/2015
SS 2: Energy distribution	TA 2.1: Energy distribution	01/01/2015
SS 3: Energy demand	TA 3.1: Energy demand	01/01/2015
SS 4: Manufacturing industries	TA 4.1: Cement and lime production	01/01/2015
SS 13: Waste handling and disposal	TA 13.1: Waste handling and disposal	01/01/2015
	TA 13.2: Animal waste management	01/01/2015

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:

Zhou Lu



Director

Shenzhen, 01/01/2015

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
/1/	Asja Ambiente Italia S.p.A.	Monitoring Report for Shenyang Laohuchong LFG Power Generation Project	version 01 dated 26/01/2018 and version 02 dated 03/03/2018	Project participant
/2/	Asja Ambiente Italia S.p.A.	Emission reduction calculation spreadsheet for Shenyang Laohuchong LFG Power Generation Project	version 01 dated 26/01/2018 and version 02 dated 03/03/2018	Project participant
/3/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Business licence for Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	-	Project participant
/4/	Liaoning Province Electric Power Company and Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Power Purchase Agreement of Shenyang Laohuchong LFG Power Generation Project	15/06/2017	Project participant
/5/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	CDM Monitoring Manual	-	Project participant
/6/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Planning and records of training for on-site staff	-	Project participant
/7/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Operation logbooks	01/01/2017-31/12/2017	Project participant
/8/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Monthly reading records	01/01/2017-31/12/2017	Project participant
/9/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Monitoring raw data	01/01/2017-31/12/2017	Project participant
/10/	Liaoning Province Power Grid Company	Monthly electricity sales receipts	01/01/2017-31/12/2017	Project participant
/11/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Contract agreement of construction	01/07/2007	Project participant
/12/	General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China	Qualification Certificates of Metrological Authorization to Northeast Electric Power Research Institute Co., Ltd.	01/12/2012-30/11/2017	Project participant
/13/	Metrological Authorization to Northeast Electric Power Research Institute Co., Ltd.	Calibration certificate of electricity meters	10/10/2013 17/07/2013 26/12/2013	Project participant
/14/	State Economic and Trade Commission	Technical administrative code of electric energy metering (DL/T 448-2000)	-	Others
/15/	Asja Ambiente Italia S.p.A.	CDM-PDD for project activity	Version 03 dated 16/06/2008	Project participant

/16/	DNV	Validation report for project activity	Version 01 dated 30/06/2008	Others
/17/	TUV Rheinland (China) Ltd.	1 st , 2 nd and 3 rd verification reports	-	Others
/18/	Perry Johnson Registrars Carbon Emissions Services, Inc	4 th verification report	-	Others
/19/	CTI	5 th verification report	-	Others
/20/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Equipment contract of Shenyang Laohuchong LFG Power Generation Project	2007	Project participant
/21/	Shenyang Sujiatun Power Supply Branch of Liaoning Electric Power Co., Ltd.	Statement on the operation start date of #1, #2 and #3 power generating sets for Shenyang Laohuchong LFG Power Generation Project	25/06/2010	Project participant
/22/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Flare installation acceptance report	20/10/2007	Project participant
/23/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Operation log indicating the operation of #4 and #5 power generating sets	27/03/2012	Project participant
/24/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Operation log indicating the operation of #6 power generating sets	10/10/2015	Project participant
/25/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	User manual (flaring)	03/2010	Project participant
/26/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Nameplate (generator sets 1#~6#)	-	
/27/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Annual Waste Quantity Summary	01/01/2017-31/12/2017	
/28/	China National Accreditation Service for Conformity Assessment (CNAS)	Qualification Certificates of Liaoning Provincial Institute of Measurement	06/06/2012	Project participant
/29/	Liaoning Provincial Institute of Measurement	Calibration certificate of flow meter for LFG _{total,y}	01/09/2016 01/09/2017	Project participant
/30/	Liaoning Provincial Institute of Measurement	Calibration certificate of flow meter for LFG _{flared,y}	01/09/2016 01/09/2017	Project participant
/31/	Liaoning Provincial Institute of Measurement	Calibration certificate of flow meter for LFG _{electricity,y}	01/09/2016 01/09/2017	Project participant
/32/	Liaoning Provincial Institute of Measurement	Calibration certificate of Gas analyzer W _{CH4}	28/08/2016 28/08/2017	Project participant
/33/	General Administration of Quality Supervision, Inspection and Quarantine of the P.R.C.	JJG1037-2008 - Verification regulation of turbine flow meters JJF1183-2007 - Verification Regulation of the temperature transmitter JJG351-1996- Verification Regulation of Working Base Metal Thermocouple JJG882-2004 - Verification regulation of the pressure transmitter JJG677-2006 -	-	Others

		Verification regulation of the methane analyzer JJG596-2012 – Verification regulation of electrical energy meters with electronics		
/34/	Shenyang Laohuchong Municipal Solid Waste Management Co. Ltd.	Monthly balance bill	01/01/2017-31/12/2017	Project participant
/35/	EB	Clean Development Mechanism Validation and Verification Standard	Version 9.0	EB
/36/	EB	Clean Development Mechanism Project Standard	Version 9.0	EB
/37/	EB	Clean Development Mechanism Project Cycle Procedure	Version 9.0	EB
/38/	EB	Consolidated baseline and monitoring methodology for landfill gas project activities (ACM0001)	Version 06	EB
/39/	EB	Consolidated baseline methodology for grid-connected electricity generation from renewable sources	Version 06	EB
/40/	EB	Standard for application of the global warming potential to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol, Annex 3 of EB69	13/09/2012	EB
/41/	EB	Guideline-Completing the monitoring report form	Version 06.0	EB
/42/	EB	Guideline- Completing the verification and certification report form for CDM project activities	Version 01.0	EB
/43/	EB	Tool to determine project emission from flaring emission from flaring gases containing methane	Version 01.0.0	EB
/44/	EB	Tool to calculate baseline, project and/or leakage emissions from electricity consumption	Version 01	EB

Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. Remaining FAR from validation and/or previous verification

FAR ID	NA	Section no.	NA	Date: NA
Description of FAR				
NA				
Project participant response				Date: NA
NA				
Documentation provided by project participant				
NA				
DOE assessment				Date: NA
NA				

Table 2. CL from this verification

CL ID	NA	Section no.	NA	Date: NA
Description of CL				
NA				
Project participant response				Date: NA
NA				
Documentation provided by project participant				
NA				
DOE assessment				Date: NA
NA				

Table 3. CAR from this verification

CAR ID	1	Section no.	E.8	Date: 28/02/2018
Description of CAR				
The EL _{LFG} and EL _{PR} was measured by electricity meters and the receipts based on the reading of meters from grid company was used to cross check. The data of EL _{PR} in CER spreadsheet is inconsistent with data from meter readings and electricity transaction notes in December of 2017.				
Project participant response				Date: 28/02/2018
EL _{PR} data has been updated as per the electricity transaction in the ER spreadsheet, and the MR has also been updated correspondingly.				
Documentation provided by project participant				
Electricity transaction notes.				
DOE assessment				Date: 28/02/2018
EL _{PR} is measured continuously by the two electricity meters installed at the low-voltage side of the project activity. Data is stored electronically in a database. The meter readings of parameter EL _{PR} is cross-checked against the invoices. After review the monthly record provide by pp and the electricity transaction notes from Liaoning Province Power Grid Company, the verification team confirmed the correct data of EL _{PR} in December 2017 was used to calculate the ER. The MR has been also updated. The CAR is closed.				

Table 4. FAR from this verification

FAR ID	NA	Section No.	NA	Date: NA
Description of FAR				
NA				
Project participant response				Date: NA
NA				
Documentation provided by project participant				
NA				

DOE assessment	Date: NA
NA	

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
01.0	23 March 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: project activities, verifying and certifying		