

Bangkok Kamphaeng Saen East Landfill Gas to Electricity Project

Document Prepared By TÜV NORD CERT GmbH

Project Title	Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project
Version	01
Project ID	MY – Pver 11/33 - 11/345

Report Title	1 st Verification report “Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project”
Client	Xentolar Holdings Limited
Pages	43
Date of Issue	02 February 2012
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Summary:

Xentolar Holdings Ltd. has commissioned TÜV NORD JI/CDM Certification Program to carry out the verification of the Project “Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project” in Tambol Sasimhum, Amphur Kamphaeng Saen, Nakhon Pathon, Thailand with regard to the requirements of VCS Version 3.1 Standard.

During this 1st monitoring period, the project activity has installed 4 units of 1.063 MW each biogas generator using landfill gas to generate power to supply to the national grid of Thailand.

The project begins operations and exports electricity with one unit operating on 08 April 2010 with 0.8MW capacity. Then, subsequently two additional biogas generators were installed and start supplying electricity on 03 June 2010 with capacity increase to 3 MW. On 06 October 2010, the fourth unit operating and total capacity increase to 4MW supply to the grid. Then permission to export 4MW was granted by the Provincial Electricity Authority (PEA). ^{/SD/COD/}

Reporting period: From 08 April 2010 to 20 January 2011 (both days inclusive)

The verification is based on the draft monitoring report, the monitoring plan as set out in the validated PD, the validation report, emission reduction calculation spreadsheet and supporting documents made available to the TÜV NORD JI/CDM CP by the project participant

In detail the conclusions can be summarized as follows:

- all operations of the project are implemented and installed as planned and described in the registered PDD version 0 and validated supplement project description version 2.

- the monitoring plan is in accordance with the applied approved methodology i.e, ACM0001 version 11, “Consolidated baseline methodology and monitoring for landfill gas project activities
- the installed equipment essential for measuring parameters required for calculating emission reductions are calibrated appropriately and according to the frequency as stated in the monitoring plan of the registered PDD version 9 and validated supplement PD version 2.
- the monitoring system is in place and functional. The project has generated GHG emission reductions.

In the course of the verification 10 Corrective Action Requests (CARs) and 4 Clarification Requests were raised and closed. CL.4.1-2 is converted to FAR.4.1-2 that will be cross checked during the next verification. The one FAR raise during the CDM validation has been checked and closed out.

As the result of this 1st periodic verification, the verifier confirms that the GHG emission reductions are calculated without material misstatements and in a conservative and appropriate manner. TÜV NORD JI/CDM CP herewith confirms that the project has achieved 136,381 tCO₂ emission reductions in the monitoring period from 08 April 2010 to 20 January 2011 (both days inclusive).

Abbreviations

BAU	Business as usual
CA	Corrective Action / Clarification Action
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CO₂	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
CP	Certification Program
CL	Clarification Request
DNA	Designated National Authority
EB	CDM Executive Board
EIA	Environmental Impact Assessment
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
QC/QA	Quality control/Quality assurance
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VCS	VCS - Project Description
VCU	Voluntary Carbon Unit
VVM	Validation and Verification Manual

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1 INTRODUCTION

Xentolar Holdings Ltd. has commissioned the TÜV NORD JI/CDM Certification Program to carry out the verification of the project:

“Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project”

with regard to the relevant requirements of the Voluntary Carbon Standard 2011^{VCS/}. The verifiers have reviewed the implementation of the monitoring plan (MP) in the registered VCS project for the monitoring period 08 April 2010 to 20 January 2011(both dates included).

The applied monitoring methodology is ACM0001 Version 11, “Consolidated baseline methodology and monitoring for landfill gas project activities”.

1.1 Objective

The purpose of the validation is conducted along with 1st verification to have an independent third party assessment of the project design, in particular, the project's baseline, the additionality, the monitoring plan (MP) and the project's compliance with regards to:

- The requirements of VCS version 3.1 program guidelines;
- approved methodology ACM0001 version 11, EB47;
- other relevant rules, including the host country, Thailand;
- legislation and sustainability criteria

The verification has been carried out along which purpose of independent checking of objective evidence, as follows:

- to verify that the project is implemented as described in the registered project design document and supplement PD documents;
- to assess the implementation of the monitoring plan (MP) content in the VCS-PD;
- to assess the project's compliance with other relevant rules, including the host country Thailand legislation;
- to confirm that the monitoring system is implemented and fully functional to generate voluntary emission reductions (VERs / VCUs) without any double counting; and
- to establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation to confirm that the monitoring system is implemented and fully functional to generate voluntary emission reductions (VERs / VCUs) without any double counting; and to establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation.

These are validated and verification objective to confirm that the project design as documented is sound reasonable and meets the stated requirements and identified criteria. Validation is seen as necessary to provide assurance to stakeholders on the quality of the project and its intended generation of Voluntary Carbon Units (VCUs). The verification is followed for check the implementation is compliance to the regulation and ensure of the amount of CER that correct.

1.2 Scope and Criteria

The scope of the validation covers the clauses of 1.2, 1.3, 1.5, 1.6, 1.7, 1.9, 1.10, 1.12.1, 1.12.2, 1.12.3, 1.12.4 and 1.13 of the VCS PD and verification of the Monitoring Report as required by the Policy Announcement from VCS Association. The validation and verification scope is given as an independent and objective review of the project design, the project's baseline study and monitoring plan based on ACM0001: “Consolidated baseline and monitoring methodology for landfill gas project activities” - Version 11, valid at the time of UNFCCC registration, which is included in the VCS PD, Monitoring report and other relevant supporting documents.

The items covered in the validation and verification are described below:

- VCS version 3.1 and Project Country Criteria
- Project Description

- Project Baseline
- Monitoring Plan
- Calculation of GHG Emissions
- Background investigation and follow up interviews
- Environmental Impacts
- Draft validation reporting with CARs, CLs & FARs, if any
- Final validation reporting and Project Design Document Version 8 at <http://cdm.unfccc.int/Projects/DB/SGS-UKL1267631662.24/view>.

The information included in the Project Design, Monitoring Report and supporting documents were reviewed against the requirements and criteria mentioned above. The TÜV NORD CERT GmbH JI/CDM CP has employed a risk-based approach in the validation and verification, focusing on the identification of significant risks for project implementation and the generation of VERs. The validation and verification is based on the information made available to TÜV NORD JI/CDM CP on the contract conditions and supporting documents made available to the DOE. This includes the information collected through performing interviews during the on-site assessment. Furthermore publicly available information was considered as far as available and required.

The assessment is not meant to provide any consulting to the project participant. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the project design. TÜV NORD JI/CDM CP has employed a risk-based approach in the validation and verification, focusing on the identification of significant risks and reliability of project monitoring and generation of emission reductions.

1.3 Appointment of team members and technical reviewer

On the basis of a competence analysis and individual availabilities a verification team was appointed. Furthermore also the personnel for the technical review and the final approval was determined. The list of involved personnel, the tasks assigned and the qualification status are summarized in the table 1-1 below.

Table 1-1: Involved Person

	Name	Company	Function ¹⁾	Qualification Status ²⁾	Scheme competence	Technical competence ⁴⁾	Host country Competence	Team Leading competence	Onsite visit
☒ Mr. ☐ Ms.	Cheong, Chun Yuen, (Robert)	TUV NORD Malaysia	TL	SA	☒	N	☐	☒	☒
☐ Mr. ☒ Ms.	Saowalak, Thongsong	TUV NORD Thailand	TM	A	☒	-	☒	☐	☒
☒ Mr. ☐ Ms.	Vasasmith, Nattapon	TUV NORD Thailand	TM	A	☒	-	☒	☐	☒
☒ Mr. ☐ Ms.	Samir, Beqqal	TUV NORD CERT GmbH	TR ³⁾	LA	☒	-	☐	☒	☐
☒ Mr. ☐ Ms.	Dr. Jochen, Schubert	TUV NORD CERT GmbH	TR/FA	SA	☒	N	☐	☒	☐

¹⁾ TL: Team Leader; TM: Team Member, TR: Technical review; FA: Final approval

²⁾ GHG Auditor Status: A: Assessor; E: Expert; SA: Senior Assessor; T: Trainee; TE: Technical Expert

³⁾ No team member

⁴⁾ As per S01-MU03 or S01-VA070 A2 (such as A, B, C.....)

Certificates of appointment for the above mentioned team members are enclosed with this report.

1.4 Level of assurance

The verification has been planned and organized to achieve a

- ☒ reasonable level of assurance
☐ limited level of assurance.

1.5 Summary Description of the Project

The project activity is owned and operated by Bangkok Green Power Co., Ltd, to extract, capture and utilize landfill gas to generate electricity to sell to the Provincial Electricity Authority of Thailand.

During this VCS validation stage, the team has reviewed the proof of ownership submitted by Bangkok Green Power Co., Ltd, ^{/RD/}

The additional documents reviewed to confirm the project participants issued by third parties such as host country approval and MoC provided by the project owner and information from relevant website was used for the assessment. ^{/unfccc/HCA/MoC/}

The installed capacity of the project will vary during the life of the project depending on the quantity of landfill gas availability. The volume of gas is expected to increase due to the landfill sites is not closed and continue to receive solid municipal waste. It is expected to install 15 generators with a maximum generation capacity of 16MW.

The project activity started to export power to the grid on 08 April 2010 with a capacity of 0.8MW and subsequently increased to 3MW on 03 June 2010. In 06 October 2010, there was a further increase to 4MW electricity exported to grid. The permission to export 4MW was granted by the Provincial Electricity Authority (PEA). ^{/SD/}

The project activity has a fully integrated LFG collection system installed and operating. When the yield of gas is insufficient for electricity generation or surplus LFG is available, due to engine maintenance or other site factors, the LFG is sent to an enclosed flare for flaring. Thus minimising methane emissions and maximising carbon abatement.

The emission reductions were from both flaring and electricity generation for this monitoring period. Electricity generating is exported to Thai national grid.

Based on the supplement PD the estimated annual emissions reduction is 201,116VERs

The on-site visit was conducted on 01 August 2011 to 02 August 2011 to confirm the project location. During the site visit the equipment installed and operation of the biogas power plant were checked. ^{/EHR/} The location coordinates are cross checked and confirmed with a hand held GPS unit.

The project location as confirmed in table 1-2.

Table 1-2: Project Location

Item	Project scope
Host country:	Thailand
Region:	Nakhon Pathom Province
Project address:	T. Sasimhum, A. Kamphaeng Saen
Latitude	14° 3'50.62" N
Longitude	99°56'50.96" E

The sources and green house gases (GHGs) of the project activity as illustrated in figure 3 of the registered PDD as below are confirmed during the onsite visit:

1. CH₄ emission from decomposition of waste at the landfill site;
2. CO₂ emission from grid electricity.

The project activity will contribute to the sustainable development as below:

- reduce the dependent fossil fuel for power generation,
- use of land fill gas as fuel to avoid methane emitted in an uncontrolled manner to the atmosphere,
- collection of the landfill gas for utilization shall improve the safety aspects of the landfill sites operation, reducing the dangers of combustion and explosion of methane pockets.
- improve air quality,
- provide employment for locals.

Essential data of the project is presented in the following Tables 1-3 and 1-4.

Table 1-3: Project Characteristics

Item	Data
Project title	Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project
Project owner	BANGKOK GREEN POWER CO., LTD.
Any specific project categories	☐ Mega projects ($> 10^6$ t CO _{2eq} / a) ☒ Projects (5,000 to 10^6 t CO _{2eq} / a) ☐ AFOLU project ☐ Grouped project ☐ No specific project category
VCS MR dated	Draft: 18 July 2011 Final: 02 February 2012
Applied Methodology	ACM0001: Version 11: Consolidated baseline methodology and monitoring for landfill gas project activities
Project starting date	08 April 2010
Crediting period	☒ Renewable Crediting Period (10 y) ☐ Fixed Crediting Period (10 y)
Start of crediting period	08 April 2010

Table 1-4: Technical data of the project ^{/ETI/}

Parameter / Item	Unit / Details	Value
Generator		
Type	Model	Jenbacher JGS320 engines
Electrical efficiency	%	40
Capacity	MW	1.063
Flare		
Type	-	Enclosed Flare
Capacity	Nm ³ /h	2,000
Flare temperature	°C	500-1200
Methane combustion efficiency	%	>98

2 VALIDATION PROCESS, FINDINGS AND CONCLUSION

2.1 Validation Process

- Method and Criteria:

The validation of the project was carried out as follows:

Preparations: 16 June 2011

On-site validation: 01 August 2011 to 02 August 2011

(Draft) Reporting: 10 September 2011

(Final) Reporting: 22 December 2011

The validation consisted of the following three phases:

- a desk review of the project design and the baseline and monitoring methodology
- follow-up interviews
- the resolution of outstanding issues and the issuance of the final validation report and opinion

- Review:

The PDD version 8 dated 13 August 2010 and the Validation Report version 3 dated 18 January 2011 was prepared by validating DOE, SGS and registered with UNFCCC on 21 January 2011. <http://cdm.unfccc.int/Projects/DB/SGS-UKL1267631662.24/view>.

There are a total of 20 findings raised by the validating DOE during the UNFCCC validation stage. There are 5 CARs, 15 CLs and 2 FARs. All CARs and CLs raised were closed by the validating DOE. ^{/VR/}

According to the validation report, CL#05 and CAR#15 are converted to FAR#5 and FAR#15.

FAR#5 refers to the delay in obtaining the license. The validation/verification team has reviewed the operating license during the onsite visit. ^{/SD/}

FAR#15 refers to monitoring system for the project activity. The validation/verification team confirmed a complete monitoring system had been established, implemented and managed by the operation team at the site. The monitoring and quality control manual and other relevant procedures are reviewed during the onsite visit. ^{/MWI/MWR/FC/}

The validation team has followed up on the two FARs raised by the validating DOE. The monitoring parameter, data and the document as presented by project proponent regarding the FARs during site visit. The team has verified and closed out these two FARs left from the validation.

However, CL.3.1-1 was raised and closed out by the team. Therefore, there is no other discrepancy found in the supplement PD.

This report shows the documents considered during the validation and verification process and listed as follows:

- Table 6-1: Documents provided by the project proponent
- Table 6-2: Background investigations and assessment documents
- Table 6-3: Websites consulted

- Interviews:

During the on-site visit on 01 August 2011 to 02 August 2011, the validation team of TÜV NORD CERT GmbH interviewed the project participants to confirm selected information and resolve any issues identified during the document review.

Bangkok Green Power Co., Ltd, the host country project participant who operate the LFG to energy project and Sindicatum Carbon Capital, the consultants. The main topics of the interviews and the participants' information are summarised in table 2-1 below.

Table 2-1: Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
Bangkok Green Power Co. Ltd. Mr. Teerasit Tantasuralk Miss Michelle O'hare Sindicatum Carbon Capital Ltd Mr. Jay Mariyappan Mr. Andy Cox Mr. Marcus Xia	• General aspects of the project • Technical equipment and operation • Changes since implementation • Monitoring and measurement equipment • Remaining issues from validation • Calibration procedures • Quality management system • Involved personnel and responsibilities • Training and practice of the operational personnel • Implementation of the monitoring plan • Monitoring data management • Data uncertainty and residual risks • GHG calculation • Procedural aspects of the verification • Maintenance • Environmental aspects • Editorial issues of the Monitoring Report

• **Site Inspections:**

The team has carried out site inspection and the interviews to cross check the compliance of the project activity along with the project description document. The related documents of the project activity had been assessed to confirm the actual situation during site visit.

• **Resolution of Any Material Discrepancy:**

Material discrepancies identified in the course of the validation are addressed either as CARs, CLs or FARs.

A **Corrective Action Request (CAR)** is established where:

- mistakes have been made in assumptions, application of the methodology or the project documentation which will have a direct influence the project results,
- the requirements deemed relevant for validation of the project with certain characteristics have not been met or
- there is a risk that the project would not be registered or that emission reductions would not be able to be verified and certified.

A **Clarification Request (CL)** will be issued where information is insufficient, unclear or not transparent enough to establish whether a requirement is met.

A **Forward Action Request (FAR)** will be issued when certain issues related to project implementation should be reviewed during the first verification.

A Corrective Action Request is established if:

- mistakes have been made in assumptions or the project documentation which directly will influence the project results,
- the requirements deemed relevant for validation of the project with certain characteristics have not been met or
- there is a risk that the project would not be registered by the UNFCCC or that emission reductions cannot be verified and certified.

The team assessed the Validation Report prepared by the validating DOE which was available on the UNFCCC website <http://cdm.unfccc.int/Projects/DB/SGS-UKL1267631662.24/view>. The findings raised by the validating DOE listed in the report were 5 CARs, 15 CLs and 2 FARs. All CARs and CLs were closed out by the validating DOE. The two FARs as follows:

1. Operating license for the power generation; ^{/SD/}
2. Monitoring system implemented; ^{/MM/}

The team has reviewed the evidences submitted to confirm the PP had obtained the necessary operating license and a monitoring system had been implemented. Therefore, two FARs are closed.

There was one CL raised during the VCS validation and closed out. The project document was revised to address the CL issued by TÜV NORD JI/CDM CP. Please refer to Section 2.2 of this report on the CL raised.

Table 2-2: Summarize of Validation Finding

No.	Topic / Chapter	CAR	CL	FAR
1	Project Detail	-	1	-
2	Application of Methodology	-	-	-
3	Quantification of GHG Emission Reductions and Removals	-	-	-
4	Monitoring	-	-	-
5	Environmental Impact	-	-	-
6	Comments by Stakeholders	-	-	-
	SUM	-	1	-

A detailed list of the CARs or CLs and FAR raised in the course of this validation is included in the section 2.2 of this report.

Table 2-3: Revision of PD

PD Version No.	Date	Remark
01	20 July 2011	Initial Version for On-site Assessment
02	05 August 2011	1st round of DOE assessment
03	11 November 2011	2nd round of DOE assessment
04	02 February 2012	Final version revised according to Technical Reviewer's Comment

2.2 Validation Findings

2.2.1 Gap Validation

The project activity was registered on 21 January 2011 with UNFCCC, reference No. 3462. <http://cdm.unfccc.int/Projects/DB/SGS-UKL1267631662.24/view>. The validation team has checked the registered PDD version 9 and validation report published at the UNFCCC website, <http://cdm.unfccc.int/Projects/DB/SGS-UKL1267631662.24/view>.

The project activity applies the approved methodology ACM0001 “*Consolidated methodology for landfill gas project activities*”, version 11 adopted at EB47 which was valid at the time of registration. The relevant tools applied are as follows:

- Tool for the demonstration and assessment of additionality, Version 05.2
- Tool to determine project emissions from flaring gases containing methane, Version 01
- Tool to calculate the emission factor for an electricity system, Version 02
- Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, Version 04

- Tool to calculate baseline, project and/or leakage emissions from electricity consumption, Version 1.

All CARs and CLs raised during the UNFCCC validation were closed out by the validating DOE.

The two FARs #05 and #15 raised will be addressed and closed out during this verification.

The pending document for confirmed proof of ownerships has been checked^{/SC/PPA/}. The power purchase agreement^{/PPA/}, local construction license, operating license, and generating license^{/SC/} have been validated. The documents are issued by the authorized party and confirms that the name of the project owner as listed in the project proponent.

For the other pending FAR#15 regarding the monitoring parameters, the team has checked all monitoring parameters as listed in the project description and monitoring report during site visit. That parameters for the emission reduction calculation has been monitored in accordance to the registered PDD and the respective methodology. Also, the following subscribed tools:

A detailed list of FAR regarding the monitoring parameter in course of the UNFCCC validation is included in the next section 3.4 of this report.

During the validation of the supplement PD, project detail has been assessed and cross checked with related document to confirm information described. There are no major inconsistency issues among the supplement PD and related documents and only one CL has been raised.

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

Project Design	3.1-1
Classification	☐ CAR ☒ CL ☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	According to the registered PDD and LoA issued by the host country, there 2 project proponents. The PD did not mention PS Natural Energy Co. Ltd.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The project proponent PS Natural Energy Co. Ltd. has been added to section 1.3 of the PD, see revised v2.0, dated 05 August 2011.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The revised PD version 2 has been submitted. Specific section 1.3 has been checked and the project proponent, PS Natural Energy Co. Ltd has been included and matches to the participants listed in the LoA issued by Thai DNA. Therefore, CL is closed. ^{/HCA/}
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

Final Assessment

The open issue was reviewed and confirmed that the project proponents listed in the supplement PD matches with the entities approved by the DNA of Thailand.

Since one CL raised and closed out by team during validation, hence the team confirms the application under VCS, the voluntary emission reductions is not double counting of the emission reductions. Therefore, it is a clear delineation between emissions reductions generated under the CDM and voluntarily. Hence project is compliance under the VCS rules.

2.2.2 Methodology Deviations

There is no deviation submitted during the UNFCCC validation.

2.2.3 New Project Activity Instances

Not applicable.

2.3 Validation Conclusion

Xentolar Holdings Limited, has commissioned the TÜV NORD JI/CDM Certification Program to carry out the supplementary validation of the project “Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project”, with regard to the relevant requirements of VCS version 3.1 Standard.

The project activity was developed by Bangkok Green Power Co., Ltd. The project activity is an electricity generation power plant by utilization landfill gas. The electricity generated is exported to the Thai national grid. The expected average emission reduction per annum is 197,673 VERs over a 10 years crediting period. The expected ERs has been cross checked with the First Order of Decaying calculations extended to 10 years instead of 7 years. In the registered PDD the expected ER calculation is based on 7 years crediting period as compared to VCS program of 10 years. The expected methane to be captured start to reduce due to the closure of the landfill with no fresh waste is available. Therefore, with reduce methane production the electricity generation will be affected thus reducing emission reductions.^{/FOD/}

The project activity has the potential to generate 16MW and planned to install 15 units of generator sets each with a capacity of 1.063MW. The installation of the generator sets will vary during the life time of the project. During the 1st year of operation, it is expected to install 11 generators provided the biogas generation is sufficient.

The methodology applied for this project is ACM0001 Version 11 – Consolidated baseline methodology and monitoring for landfill gas project activities.

This project which was earlier validated and registered as a CDM project activity where 5 CARs and 15 CLs were raised and closed by the validating DOE. A positive validation opinion was issued and the project was registered with UNFCCC (Ref. No. 3462) on 21 January 2011.

During this validation, one CL was raised and successfully closed out.

Thus, as per the VCS policy requirement, only supplementary validation is conducted since the project is registered with another scheme. A risk based approach has been followed to perform this limited validation covering the clauses 1.2, 1.3, 1.5, 1.6, 1.7, 1.9, 1.10, 1.12.1, 1.12.2, 1.12.3, 1.12.4 and 1.13 of the VCS template. As a result of the validation of the supplement PD, the validation team confirms that the project follows the VCS standard, version 3.1.

3. Verification Process

3.1 Method and Criteria

The verification of the project consisted of the following steps:

- Contract review;
- Appointment of team members and technical reviewers;
- Desk review of the Monitoring Report^{/MR/} submitted by the client and additional supporting documents.
- Verification planning;
- On-Site assessment;
- Background investigation and follow-up interviews with personnel of the project developer and its contractors;
- Draft verification reporting;
- Resolution of corrective actions; (if any)
- Final verification reporting;
- Technical review;
- Final approval of the verification

Table 3.1: Verification sequence

Topic	Time
Assignment of verification	16 June 2011
On-site visit	01 August 2011 to 02 August 2011
Draft reporting finalised	09 September 2011
Final reporting finalised	02 February 2012
Technical review on final reporting finalised	02 February 2012

The main verification steps are described below:

3.2 Document Review

The VCS PD^{/PD/} and supporting background documents related to the project design and baseline were reviewed. Furthermore, the verification team used additional documentation by third parties like host party legislation, technical reports referring to the project design or to the basic conditions and technical data. The references used in the course of this verification are summarized in section 6.

3.3 Interviews

The verification team has carried out interviews in order to assess the information included in the project documentation and to gain additional information regarding the compliance of the project with the relevant criteria applicable for the VCS. During verification the verification team has performed interviews to confirm selected information and to resolve issues identified in the document review. The main topics of the interviews were summarized in Table 3-2.

Table 3-2: Interviewed persons and interview topics

Interviewed Persons / Entities	Interview topics
Bangkok Green Power Co., Ltd. Mr. Teerasit Tantasuralerk Miss Michelle O'hare	• General aspects of the project • Technical equipment and operation • Changes since implementation • Monitoring and measurement equipment

Interviewed Persons / Entities	Interview topics
Sindicatum Carbon Capital Mr. Jay Mariyappan Mr. Andy Cox Mr. Marcus Xia	• Remaining issues from validation • Calibration procedures • Quality management system • Involved personnel and responsibilities • Training and practice of the operational personnel • Implementation of the monitoring plan • Monitoring data management • Data uncertainty and residual risks • GHG calculation • Procedural aspects of the verification • Maintenance • Environmental aspects • Editorial issues of the Monitoring Report

3.4 Site Inspections

3.4.1 Review of Performance Records

The verification team adopted suitable methodology to ensure that the project is implemented and operated as per the registered PD. In order to verify that the project is implemented and operated as per the applicable criteria, chief of them being the conditions and specifications described in the PD, site visits were performed by the team members to verify the equipment and instrument installed, check on the operation, accuracy of implemented monitoring methodology. The following items were verified in detail:

- Inspection of the landfill gas collection system, flares and electricity generation units whether they are consistent with peripherals equipment lists. The other equipments such as electrical switchgears, transformers, etc were installed and worked as planned and presented in the supplement PD;
- Members of operating staff were interviewed and were observed in order to verify allegiance to stated methods of operation and monitoring;
- Information processes for generating, aggregating and reporting the selected monitored parameters were reviewed;
- The calibration for all metering equipment was checked;
- The monitoring processes, routines and documentations were audited to check their proper application;
- The monitoring data were checked; recording of hourly generation, aggregating of data, and monthly reports were verified;
- Maintenance procedures were verified

The on-site visits were scheduled for 01 August 2011 to 02 August 2011 lead by the team leader with 2 team members with the requisite technical areas.

During the site visit, the team members were able to check and verify the following records:

- Daily electricity generation report which included details of running hours, total daily generation, auxiliary consumption and cumulative generation and consumption for each month;
- Landfill gas generation report which included total daily generation, daily amount sent for electricity generation and flaring. Cumulative landfill gas generation and consumption for electricity generation and flaring of each month;
- Outage register containing details of forced and planned outages, root cause analysis, and corrective actions implemented;
- Register containing hourly readings from the control room;

- Maintenance check list – mechanical and electrical – daily, weekly, monthly and annually;

The following equipment and instrument were checked:

- Landfill gas collection equipment nameplate;
- Generator name plate details;
- Flare name plate details;
- Check and Main meters, make, type and serial numbers;
- Main control room instrumentation;

Table 3-3: Parameters confirmed during verification

Parameter	Instrument Type	Manufacturer	Instrument Model	Accuracy
LFG _{total}	V-Cone Flow Meter	Kingways	KVS14IICD23FSN with Rosemount 3051 CD Differential Pressure Transmitter	±0.5%
LFG _{flare}	V-Cone Flow Meter	Kingways	KVS08IICD23FSN with Rosemount 3051 CD Differential Pressure Transmitter	±0.5%
LFG _{electricity}	V-Cone Flow Meter	Kingways	KVS06IICD23FSN with Rosemount 3051 CD Differential Pressure Transmitter	±0.5%
ω_{CH_4}	Infra Red Gas Analyser	Edinburgh Instruments Limited	Guardian Plus Infra-Red Gas Monitor	± 2.0% Full Scale Deflection
T	Temperature Transmitter	Honeywell	STT830-171	(0.3+0.005ltl) °C
P	Absolute Pressure Transmitter	Rosemount	Model 3051TA	± 0.065%
EL _{LFG}	Electric Meter	EDMI	EDMI-Mk6 (Genius)	Class 0.5S
EL _{import}	Electric Meter	EDMI	EDMI-Mk6 (Genius)	Class 0.5S
T _{flare}	Type N Thermocouple	Honeywell	STT830-173	Accuracy Class II (allowable deviation ±(0.0075ltl))

By means of site visit and documents review the team concluded that the accuracy class of the instruments are found to be in compliance with manufacturer's specifications as stated in the registered PDD and validated supplement PD.

3.4.2 Collection of Measurements

The verification team has carried out interviews and reviews of records to assess if the collection of measurements is in accordance with the monitoring plan of the validated PD and the relevant VCS criteria. The collection and measurement of GHG emission reduction have been implemented in accordance with the approved monitoring plan contained in the registered PDD. The monitoring is effective and reliable. The monitoring parameter are as bellowed described:

- **Amount of Landfill Gas**

1. LFG_{total} : Total amount of landfill gas captured at Normal Temperature and Pressure

2. $LFG_{\text{electricity}}$: Amount of landfill gas combusted in power plant at Normal Temperature and Pressure

3. LFG_{flare} : Amount of landfill gas flared at Normal Temperature and Pressure

The amount of landfill gas at normal temperature and pressure are measured by flow meter which continuously measure and recording every minute. Record of data is aggregated on monthly and yearly basis. During the site visit it was confirmed that the details of meters connected at the landfill site are listed as follows:

Table 3-3: Landfill gas flow meter

Details	Tag (Serial no.)	Type and Model	Installed period	Accuracy
LFG_{flare}	FT9391 (9061209)	Type: V cone flow meter Model: KVS14IHKD23FSN with Rosemount 3051 CD Differential Pressure Transmitter	08 April 2010 to 20 January 2011	+/- 0.5%
	FT9491 (9061210)		08 April 2010 to 20 January 2011	
	FT9591 (9061205)		08 April 2010 to 20 January 2011	
$LFG_{\text{electricity}}$	EFT9001 (9062901)	Type: V cone flow meter Model: KVS14IHKD23FSN with Rosemount 3051 CD Differential Pressure Transmitter	08 April 2010 to 20 January 2011	+/- 0.5%
	EFT9002 (9062903)		08 April 2010 to 20 January 2011	
	EFT9003 (9062907)		08 April 2010 to 20 January 2011	
	EFT9004 (9062913)		08 April 2010 to 20 January 2011	
LFG_{total}	FT9261A (9061213)	Type: V cone flow meter Model: KVS14IHKD23FSN with Rosemount 3051 CD Differential Pressure Transmitter	08 April 2010 to 20 January 2011	+/- 0.5%
	FT9261B (9061212)		08 April 2010 to 20 January 2011	

• **Temperature (T) and Pressure (P) :**

These two parameters are for reporting of landfill gas in the normalized condition.

Temperature : continuously measured and data recorded every minute by the DCS. This parameter is reported in °C. The temperature probe is installed at LFG pipe work between the gas treatment plant and generator sets / flares.

Table 3-4: Landfill gas Temperature measurement (T)

Equipment Details	TAG	Serial no.	Installed period	Accuracy
Manufacture: Honeywell Type: Temperature Transmitter Model : STT830-171 (Temperature at LFG _{flare})	TT9391	080625347	08 April 2010 to 22 August 2010	(0.3+0.005ltl)°C
		080625397	22 August 2010 to 20 January 2011	
	TT9491	080625432	08 April 2010 to 20 January 2011	
	TT9591	080625397	08 April 2010 To 22 August 2010	
		080625347	22 August 2010 to 20 January 2011	
Manufacture: Honeywell Thermocouple Type N Model : STT830-173 (Temperature at Flare)	TTC 9393A	090326010	08 April 2010 to 21 August 2010	±(0.0075ltl)°C
		080614323	21 August 2010 To 12 January 2011	
		090326010	12 January 2011 to 20 January 2011	
	TTC 9393B	080614292	08 April 2010 to 21 August 2010	
		080614320	21 August 2010 to 31 October 2010	
		090329544	31 October 2010 to 20 January 2011	
	TTC 9393C	080614371	08 April 2010 to 21 August 2010	
		080614290	21 August 2010 to	

			20 January 2011	
	TTC 9493A	080614306	08 April 2010 to 21 August 2010	
		090326006	21 August 2010 to 12 January 2011	
		080614306	12 January 2011 to 20 January 2011	
	TTC 9493B	080614298	08 April 2010 to 21 August 2010	
		080614379	21 August 2010 to 28 December 2010	
		080614289	28 December 2010 to 20 January 2011	
	TTC 9493C	080614289	08 April 2010 to 21 August 2010	
		080614373	21 August 2010 to 20 January 2011	
	TTC 9593A	080614305	08 April 2010 to 21 August 2010	
		090326013	21 August 2010 to 20 January 2011	
	TTC 9593B	090326008	08 April 2010 to 21 August 2010	
		090326012	21 August 2010 to 20 January 2011	
	TTC 9593C	090326007	08 April 2010 to 21 August 2010	

		090326009	21 August 2010 to 20 January 2011	
Manufacture: Honeywell Type: Temperature Transmitter Model : STT830-171 (Temperature at LFG _{total})	TT9261A	080625360	08 April 2010 to 20 January 2011	(0.3+0.005Itl)° C
	TT9261B	080625355	08 April 2010 to 20 January 2011	

Pressure : continuously measured and data recorded every minute by the DCS. This parameter is measured is reported in *Pa*. The pressure transmitter is mounted at the LFG pipe work between the gas treatment plant and the generator sets / flares.

Table 3-5: Landfill gas Pressure measurement

DETAILS	TAG	Serial no.	Installed period	Accuracy
Measure: Pressure at LFG _{flare} Type: Absolute Pressure Transmitter Manufacture: Rosemount Model : 3051TA	PT9391	5466010	08 April 2010 to 06 July 2010	± 0.065%
		5466004	06 July 2010 to 20 January 2011	
	PT9491	5466007	08 April 2010 to 06 July 2010	
		5466006	06 July 2010 to 20 January 2011	
	PT9591	5466015	08 April 2010 to 06 July 2010	
		5466083	06 July 2010 to 20 January 2011	
Measure: Pressure at LFG _{electricity} Type: Absolute Pressure Transmitter Manufacture: Rosemount Model : 3051TA	EPT9001	02150753	08 April 2010 to 16 November 2010	± 0.065%
		02166915	16 November 2010 to 20 January 2011	
	EPT9002	02150751	08 April 2010 to	

			16 November 2010	
		02300672	16 November 2010 to 20 January 2011	
	EPT9003	02166916	08 April 2010 to 16 November 2010	
		02300673	16 November 2010 to 20 January 2011	
	EPT9004	02150750	08 April 2010 to 16 November 2010	
		02300674	16 November 2010 to 20 January 2011	
Measure: Pressure at LFG _{total} Type: Absolute Pressure Transmitter Manufacture: Rosemount Model : 3051TA	PT9261A	5466080	08 April 2010 to 06 July 2010	± 0.065%
		5466002	06 July 2010 to 20 January 2011	
	PT9261B	5466089	08 April 2010 to 06 July 2010	
		5466003	06 July 2010 to 20 January 2011	

• **Methane fraction in landfill gas (ω_{CH_4}) and volumetric of CH₄ in the residual gas (fv_{CH_4})**

Both parameters are for the fraction of methane in landfill gas and volumetric of CH₄ in the residual gas. This is measured by an on-line gas analyzer which continuously measured and record every minute. Record of data is aggregated on monthly and yearly basis. A portable gas analyzer is used to cross check the methane concentration at least once a day. The portable Gas Analyzer is also regularly verified with the standard gas every month. During the site visit it was confirmed that the parameter is monitored in accordance the registered PDD. The details of meters connected for monitoring of methane gas concentration at the landfill site are listed in the following table 3-6:

Table 3-6: Methane Analyzer

DETAILS	TAG	Serial No.	Installed period	Accuracy
Type: Infra Red Gas Analyser	CH4 9261A	29692	08 April 2010	± 2.0% Full Scale

Model : Guardian Plus Infra-Red Gas Monitor			to 24 June 2010	Deflection
		29693	24 June 2010 to 06 October 2010	
		29790	06 October 2010 to 08 October 2010	
		31421	08 October 2010 to 20 January 2011	

- Quantity of Electricity**

1. The total electricity imported from the grid by the project activity
2. The total electricity exported to the grid by the project activity
3. Net Electricity supplied by the project activity to the grid

Parameters mentioned under 1 & 2 above are measured by main meter and backup meter located at the transmitting point. The generated electricity is exported to the Thai grid and this is in accordance with the registered VCS PD. During the site visit it was confirmed that the details of meters connected at the generating facilities are listed in the following table 3-7:

Table 3-7: Electricity Meters

DETAILS	Instruments Tag	Model & No	Installed period	Accuracy
Main Meter (Export)	EPMP	EDMI-Mk6(Genius) serial no. 201005194– PEA 15850695	08 April 2010 to 19 July 2010	0.5S
		EDMI-Mk6(Genius) serial no. 201005194– PEA 15850695	19 July 2010 to 20 January 2011	
Main Meter (Import)	IPMP	EDMI-Mk6(Genius) serial no. 203327797– PEA 18323739	08 April 2010 to 19 July 2010	0.5S
		EDMI-Mk6(Genius) serial no. 203327797– PEA 18323739	19 July 2010 to 24 November 2010	
		EDMI-Mk6(Genius) serial no. 201006718– PEA 15852219	24 November 2010 to 20 January 2011	0.5S
Backup Meter (Export)	EPMS	EDMI-Mk6(Genius) serial no. 201007272– PEA 15852773	08 April 2010 to	0.5S

			19 July 2010	
		EDMI-Mk6(Genius) serial no. 201007272– PEA 15852773	19 July 2010 to 20 January 2011	
Backup Meter (Import)	IPMS	EDMI-Mk6(Genius) serial no. 201005191– PEA 15850692	08 April 2010 to 19 July 2010	0.5S
		EDMI-Mk6(Genius) serial no. 201005191– PEA 15850692	19 July 2010 to 20 January 2011	

3.4.3 Observation of established practices and testing of the accuracy of monitoring equipment

During the on-site visit, the verification team has checked the test methods and practices established for the monitoring instruments. They are in accordance to local and international requirements and as in the validated supplement PD.

3.5 Resolution of Any Material Discrepancy

Material discrepancies identified in the course of the verification are addressed either as CARs, CLs or FARs.

A **Corrective Action Request (CAR)** is established where:

- mistakes have been made in assumptions, application of the methodology or the project documentation which will have a direct influence the project results,
- the requirements deemed relevant for verification of the project with certain characteristics have not been met or
- there is a risk that the project would not be registered or that emission reductions would not be able to be verified and certified.

A **Clarification Request (CL)** will be issued where information is insufficient, unclear or not transparent enough to establish whether a requirement is met.

A **Forward Action Request (FAR)** will be issued when certain issues related to project implementation should be reviewed during the first verification.

A detailed list of the CARs CLs and FAR raised and discussed in the course of this verification is included in the next section 4 of this report.

Table 3-8: Overview of CARs, CLs and FARs issued

No.	Topic / Chapter	CAR	CL	FAR
2.2.1	Gap Validation	-	-	-
2.2.2	Methodology Deviation	-	1	-
4.1	Project Implementation	3	1	1
4.2	Emission Reductions Calculations	5	-	-
4.3	Quality of Evidence	2	2	-
4.4	Management and Operational System	-	-	-
	SUM	10	4	1

A detailed list of the CARs CLs and FAR raised and discussed in the course of the verification is included in the next section 4 of this report.

Table 3-9: Revision of MR

MR Version No.	Date	Remark
01	20 July 2011	Initial Version for On-site Validation
02	05 August 2011	1st round of DOE assessment
03	11 November 2011	2nd round of DOE assessment
04	14 December 2011	3 rd round for Technical Review
05	02 February 2012	4 th round response to comment from Technical Review

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

Description:

The Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project commenced construction of the landfill gas extraction pipe system in August 2009. The construction was completed on February 2010 and the landfill gas has been extracted and combusted by the flare since February 2010. By the end of March 2010, the construction for the grid connection and the first four engines was completed. In April 2010, the project activity commenced exporting electricity to the Thai Grid.

This monitoring report provides an overview of the (voluntary) emission reductions generated by the project activity for the purpose of verification against the Voluntary Carbon Standard (VCS version 3.0), covering the monitoring period of 08 April 2010 – 20 Jan 2011 (inclusive of both days).

During the site visit, it was confirmed that the project has been implemented as per design and registered PDD. Four gas engines for the the electricity generation was first commissioned and operating to deliver electricity to the grid.

A total 4 biogas engines were installed and operating in this 1st monitoring period. The table below indicates the commissioning date for the generators as listed in the below table:

Engine (no.)	Commissioning Handover Date	Model	Capacity (MW)
1	18 May 2010	Jenbacher JGS320 engines	1.063
2	17 June 2010	Jenbacher JGS320 engines	1.063
3	18 May 2010	Jenbacher JGS320 engines	1.063
4	18 May 2010	Jenbacher JGS320 engines	1.063

There are no changes to the key equipment since the validation of the project. During the onsite visit, it was confirmed that the name plate for biogas engines, flares and such other generating and peripheral equipment were in accordance with the description provided in the registered PDD.

The monitoring methodology was in accordance with the chosen methodology. The equipment and instruments installed for monitoring of the project activity were sufficient.

The verification site visits were conducted on 01 August 2011 to 02 August 2011. During the site visit it was confirmed that there was no alteration or changes for the generating equipment and / or monitoring instruments and continued to be in line with the description as narrated in the registered PDD and supplement PD.

During this monitoring period 08 April 2010 to 20 Jan 2011 the project exported 17,779.55 MWh of net electricity to the Thai national grid. A main and backup meters were installed which is located at the grid connection point. As per grid connection agreement, main meter was defined as the invoice meter. A backup meter is installed to cross check the reading is similar as main meter. A joint for the exported electricity was conducted on the 1st day of every the month. Main meter is taken as the final for electricity exported to the grid to calculate the ER.

The verification team found the following findings:

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

Project Implementation	4.1-1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Cover page of report: The following corrections are requested: 1. The CDM registration reference ID is not stated 2. The monitoring period did not indicate whether both the dates are inclusive		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The Monitoring Report has been corrected to include the CDM reference number of the project as the project ID and to clarify that the monitoring period dates are inclusive, see MR v2.0, dated 05 August 2011.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The cover page of Monitoring report version 2 was checked. The ID no 3462 and the period "08 April 2010 to 20 January 2011 inclusive" are stated. The ID no. and period is checked to confirm is it correct. Therefore, CAR is closed.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Project Implementation	4.1-2		
Classification	☐ CAR	☐ CL	☒ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 1.3: According to the registered PDD and LoA issued by the host country, there are 2 project proponents. The PD did not mention PS Natural Energy. However, it is consider as other entities and include in section 1.4.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	For the CDM project there are two host country project participants, Bangkok Green Power and PS Natural Energy. However, as the project is currently, and for the monitoring period, under 10MW, it is owned and being operated solely by Bangkok Green Power which is therefore the only project proponent at this time. In the future expansion of the project above 10MW, then PS Natural Energy as will also become a project proponent. MR v2.0, dated 05 August 2011 has been updated accordingly.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	MR v.2.0 dated 05 August 2011 section 1.4 has been updated to include PS Natural Energy as one of the other entity involved project. PS Natural Energy is not considered as the project proponent during this verification period. Cross checking the PPA it was signed between Bangkok Green Power and the Provincial Electricity Authority of Thailand. The approved capacity is specified 8MW. Since there is an opportunity to generate power above 10MW in the near future. Therefore, this finding would be converted as FAR to be verified during future verification. /PPA/HCAI		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Project Implementation	4.1-3		
Classification	☐ CAR	☒ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 2.1: During the on-site interview, it was indicated the project flare system start operating earlier than the electricity generation. It was not clear why the start date of the flaring system was consider as the project start date in accordance to VCS rules.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Section 2.1 of the MR has been clarified to explain that whilst the project was operational earlier than the date provided in the MR, it was still in installation and testing phase and not all monitoring equipment was operational. See MR v2.0, dated 05 August 2011.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The MR version 2 has been checked and the explanation has been included. The project activity was undergoing testing and commissioning prior to exporting power on 08 April 2010. The team has cross checked the explanation in the MR with related documents for the meters installation record and the date was 19 March 2010. This confirms the start date is the date when the electricity was exported to the grid. Therefore, CL is closed.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Project Implementation	4.1-4		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 1.7: The host country name was not indicated in the project location.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Section 1.7 of the MR has been updated to include Thailand, see MR v2.0, dated 05 August 2011.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Section 1.7 of Monitoring Report version 2, has been updated to state the host country "Thailand". Therefore, CAR is closed.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Project Implementation	4.1-5		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 2.1: The monitoring period is from 08 April 2010 to 20 January 2011 with 4 gas engines are in operation. In the MR it mention 6 engines are operating where 2 units are installed later than the monitored period. The PP is requested to correct the table.		

Project Implementation	4.1-5
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Section 2.1 of the MR has been clarified to cover only the engines installed during the monitoring period, see MR v2.0, dated 05 August 2011.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The Monitoring Report version 2, section 2.1 was corrected. The gas engine no. 5 and 6 were removed. There are total of 4 units listed and match with the actual situation for this monitoring period. Therefore, CAR is closed.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

Final Assessment

An on-site verification visit was carried out. On the basis of this site visit and the reviewed project documentation it can be confirmed that w.r.t. the project activity is implemented in accordance to technology, the project equipments, as well as the monitoring and metering equipment and operated as described in the registered PDD and validated supplement PD.

All necessary monitoring instruments are in operating conditions and found to be in good condition and found to be accurate, and reliable. Operating procedures have been implemented as described in the registered PDD and validated supplement PD. The exported electricity to grid and import to the project activity were read jointly and recorded at the beginning of every month. In case of any error or meter malfunction, the reading from the back up meter will be used. So far for there is no error reading for this monitoring period.

Calibration procedures and test reports of all meters covering the reported monitoring period were verified. The calibration frequencies are traceable to industry standards. Calibration records of all installed meters were checked and found satisfactory.

The submitted monitoring report which forms the basis of the verification was prepared by summarizing consolidated monthly data over the whole monitoring period in accordance with the monitoring plan of the registered PDD

The verification team had reviewed the data recorded, calculation sheets and supporting documents. All data were cross checked with the records to confirm the correctness of the recording.

The verification team had further verified the archiving of the data and external documents applied in the emissions reduction calculations.

The verification team confirms the project is operating in accordance to the registered PDD. The monitoring plan implemented as described in the registered PDD. There are 3 CARs and 1 CL were raised and closed out. One CL is converted to a FAR that will be checked in future verifications.

4.2 Accuracy of GHG Emission Reduction or Removal Calculations

The formulae applied in the calculations of emission reductions are in accordance to the ACM0001. Version 11 – Consolidated baseline methodology and monitoring for landfill gas project activities. All aspects related to the direct and indirect GHG emissions relevant to the project have been addressed and calculations are presented in a transparent manner.

The baseline and project emissions were calculated appropriately and no leakage is involved. The calculations for the emission reduction of this 1st verification period are transparently computed and presented in the spread sheet with the proper reference for the sources of data.

Assumptions are correct and appropriate; default values; correction factors are in accordance with ACM0001. Version 11 – Consolidated baseline methodology and monitoring for landfill gas project activities.

The sources of project specific original data were cross-checked and found to be correct based on the evidences provided by the project proponent. The same is listed in table 6-1 of reference section of this report. The verification team has checked the underlying input values as well as the computation in the spreadsheet. The estimation of the baseline emissions, project emissions was in a transparent and conservative manner.

The VER sheet contains the actual emissions reduction for this 1st verification (carried out in combination with validation). The project has achieved emissions reduction for this reporting period from 08 April 2010 to 20 January 2011 as follows:

Emissions reduction = **136,381 t CO₂e**

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

ER Calculations	4.2-1		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 3.2: Refer parameter $\omega_{CH_4,y}$, the methodology is not correctly represented.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The methodology reference in Section 3.2, Parameter $\omega_{CH_4,y}$, has been corrected to ACM0001, see MR v3.0, dated 11 November 2011.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The Monitoring Report version 2, section 3.2 has been corrected the parameter $\omega_{CH_4,y}$ which is represented to the applied methodology ACM0001 version 11. Therefore, CAR is closed.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the next periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

ER Calculations	4.2-2		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 3.2: Refer parameters EL_{LFG} and EL_{import} , there are internal back-up meters to monitor the export and import of electricity on a daily basis. However, there is no information in the MR regarding the period from 08 April 2010 to 30 April 2010 where the date for the backup meter data applied for the export and import electricity. Therefore, PP is requested to update in the MR.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Tables EL_{LFG} and EL_{import} in Section 3.2 have been revised to include a clarification comment regarding the use of the back-up meters for electricity data for the period 7 th April-1 st May 2010, see MR v2.0, dated 05 August 2011.		

ER Calculations	4.2-2
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The Monitoring Report version 2, section 3.2 has been reviewed. The main power meter for those two monitoring parameter EL_{LFG} and EL_{import} were included the explanation. The Primary PEA electric meter which read monthly by the PEA are used for ER calculations when available. For periods outside of these monthly readings during 08 April 2010 to 30 April 2010 and 01 January -20 January 2011, the internal daily readings from the PEA Back-up meters and used for the ER calculation. Therefore, CAR is closed.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

ER Calculations	4.2-3
Classification	☒ CAR ☐ CL ☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 3.2 The backup import electricity meter data was applied for import electricity to the project activity. However, the date taken for the reading was incorrect which should be 07 April 2010 and 21 January 2011.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Tables EL_{LFG} and EL_{import} in Section 3.2 have been revised to include a clarification comment regarding the use of the back-up meters for electricity data for the period 08 April 2010 and 21 January 2010, see MR v2.0, dated 05 August 2011.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Section 3.2 of the Monitoring Report version 2, EL_{LFG} and EL_{import} have been corrected to 07 April - 30 April 2011 and 01 January - 21 January 2011. Therefore, CAR is closed.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

ER Calculations	4.2-4
Classification	☒ CAR ☐ CL ☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 4.1: The representation for baseline formula is requested to be corrected for clarity.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The presentation of the baseline formula (equation 1) in section 4.1 has been corrected, see MR v2.0, dated 05 August 2011.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The Monitoring Report version 2 has been checked. The baseline formula in section 4.1 was corrected and consistence to the formula listed in the methodology. Therefore, CAR is closed.

ER Calculations	4.2-4
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

ER Calculations	4.2-5
Classification	☒ CAR ☐ CL ☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 5.2: Parameter LFG _{flare} . The range of the flow meter stated in the MR is inconsistent with the actual.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The specification table in section 5.2 has been corrected to show the actual range of the flow meter installed, (250-2500m ³ /hr), see MR v2.0, dated 05 August 2011.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The Monitoring Report version 2 has been reviewed. There are two range for the flow meter to measure LFG _{flare} . The range 250-2500m ³ /hr has been included and matches to actual. Therefore, CAR is closed.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

Final Assessment

The excel sheets were thoroughly cross checked with the archived data. All CARs raised as above described mistakes identified during the verification and closed out.

The data applied in the calculations are consistent with the relevant raw data records.

4.3 Quality of Evidence to Determine GHG Emission Reductions or Removals (change necessary)

During the on-site visit, the verification team has reviewed and verified the respective documents that were used to determine the emission reductions. The records were traceable to reference data or a parameter. The verification team had reviewed the data to check on the evidence in support of the emission reductions. All documents reviewed were signed by the responsible person of the project activity. The documents are archived and stored in the server at the power plant and externally at the Plant Manager office. All data for the monitoring period are stored for the whole crediting period and additional 2 years after expiry. Details of the documents are listed in Table 6-1n the ER calculations were appropriately and satisfactorily corrected by the PP. All the formulae have been found to be correctly applied in the emission reduction calculations. No factual error including manual or electronic mistakes has been found. Thus it is confirmed that the ER calculations are overall correct.

The parameters for the emissions calculation have been assessed. There are discrepancy been raised as below.

Related Findings

- ☐ No CARs, CLs or FARs have been identified in this context
- ☒ The following finding(s) have been addressed:

Quality of Evidence	4.3-1		
Classification	☐ CAR	☒ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	During the on-site review of the raw data spreadsheet for gas generation and utilisation, the time shown refers to GMT and not local host country time. There is no explanation in the MR in handling the reading the time from these data sheets.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The clarification notes within Section 4 of the MR have been updated to clarify that all data stored on the Formac system and used in the ER spreadsheets is presented in UTC time, 7 hours behind Bangkok time, see MR v2.0, dated 05 August 2011.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	Monitoring Report version 2, section 4.4 has include “the ER calculations recorded in UTC time, therefore for comparison to Bangkok time 7 hours should be added. The verification team has checked to confirm the time and date of the data and match with the archived hard copy. Therefore, CL is closed.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Quality of Evidence	4.3-2		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 5.3: Parameter ω_{CH_4} . There are 2 calibrations being conducted for the gas analyser serial number 29693. However, it is reported only 1 calibration in the MR.		
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The details of the 2 nd calibration i.e. certificate number and calibration period have been corrected in the MR v2.0, dated 05 August 2011. The calibration certificate (RC2009-1255441) has also been provided as evidence.		
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The Monitoring Report version 2 in section 5.3 has been reviewed. Parameter ω_{CH_4} , methane analyzer serial number 29693 was included into the calibration period 24 June 2010 to 06 October 2010. The certificate of calibration no. RC2009-1255441 has been checked with the instrument which matches and valid during the period installed. Therefore, CAR is closed.		
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements		

Quality of Evidence	4.3-3		
Classification	☒ CAR	☐ CL	☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	Section 5.3: Parameter P for landfill gas. The calibration certificate number for PT9261a serial number 5466080 stated in the MR is inconsistent with the certificate document.		

Quality of Evidence	4.3-3
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	The correct calibration certificate number for PT9261a is 075466080, this has been corrected in the MR v2.0, dated 05 August 2011.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The Monitoring Report version 2 in specific section 5.3 has been reviewed. The calibration certificate number for tag no. PT9261A, instrument serial number 5466080 has been corrected. The new calibration report number 75466080 has been included and the report number is the actual report matches with the equipment which valid during the period of installation. Therefore, CAR is closed.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☐ Appropriate action was taken ☒ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

Quality of Evidence	4.3-4
Classification	☐ CAR ☒ CL ☐ FAR
Description of finding <i>Describe the finding in unambiguous style; address the context (e.g. section)</i>	The PP is requested to demonstrate the calibration for the following electricity meter calibration is valid for the crediting period as indicated in section 5.3 of MR. 1) EPMS no. PEA-15852773, the calibration was conducted on 15 November 2004. 2) IPMP no. PEA-18323739, the calibration as conducted on 15 November 2004. 3) IPMS no. PEA-15850692, the calibration was conducted on 15 November 2004.
Corrective Action #1 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	Confirmation has been provided by the PEA in their letter dated 20 September 2010 as attached to this response.
DOE Assessment #1 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The letter from PEA date 20 September 2010 was substantiated. The PEA document has been shown and confirmed that meter PEA-15852773 and PEA-15850692 were calibrated prior to and after installation which is valid at the time of meter installation period. However, the letter is not referred to the IPMP no. PEA-18323739. Therefore, the evidence should be further substantiated.
Corrective Action #2 <i>This section shall be filled by the PP. It shall address the corrective action taken in details.</i>	A letter from Transec Power Services Co. Ltd. who is the Authorised Contractor for the PEA for the electric meter installation has been provided which includes the details of all electric meters.

Quality of Evidence	4.3-4
DOE Assessment #2 <i>The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.</i>	The team has assessed to the letter provided by PP which is originate issued by Transec Power Services Co. Ltd. The letter reference no. TS-FSD-0303/210 and date 25 September 2010^{TPS/}, has been stated regard the work that Transec Power Services Co. Ltd. had contracted to PEA in order to provide, install and calibrate of the electricity meter for the project activity. The letter has been stated and confirmed that meter no PEA-18323739 was calibrated by PEA and following to PEA standard. The accuracy of meter calibration result is within standard and guaranteed by PEA that the instrument is ready of usage at site. By means of assessment, hence the team concluded electricity meters no. : - EPMS no. PEA-15852773 - IPMP no. PEA-18323739 - IPMS no. PEA-15850692 were calibrated by PEA standard and valid during the monitoring period. Therefore, CL is closed.
Conclusion <i>Tick the appropriate checkbox</i>	☐ To be checked during the first periodic verification ☒ Appropriate action was taken ☐ Project documentation was corrected correspondingly ☐ Additional action should be taken ☒ The project complies with the requirements

Final Assessment

There are some CARs raised as described above due to mistakes identified during the verification. The PP has taken appropriate corrective actions. The data for the monitored parameters have been found to be correctly applied in the emissions reduction calculation.

The verification team had reviewed the data collected and archived for the determination of the baseline emissions and any project emissions for the crediting period. A sampling method has been applied to cross checked on the data applied in the calculations to conclude that the emission reductions are calculated correctly. The PP has demonstrated to the verification team during the onsite visit to confirm the raw data can be monitored externally. The data are linked to a server which is updated in real time. The documents developed to monitor and determine the emission reductions were easily traceable and reference. The archiving and storage of data and hard copies are in secured locations. Thus it is confirmed that the Quality of Evidence to Determine GHG Emission Reductions is reliable

4.4 Management and Operational System

The allocation of responsibilities is documented in a written form and followed as described in the MR. This has been verified during the onsite visit. Routines for the archiving of data are defined and documented. Formulae applied in the calculations are in line with methodology and registered PDD.

The monitoring personnel at site are well trained and follow the daily routines established. This was evident during the site visit. Members of monitoring team were interviewed. Procedure for training and maintenance of critical equipments were discussed during site visit. Day to day operation is supervised by the technically qualified site engineers to ensure round the clock operation and maintain the project activity.

Training is provided to the respective personnel as and when required. The plant operators are trained by technology provider on the operation of the generators and maintain the landfill gas extract and treatment system.

All necessary recorded raw data were checked and confirmed during on-site visit. The personnel in charge of each shift are responsible for recording the total electricity generation, electricity export, electricity import, plant shut down times, down time, etc.

The daily data is aggregated and monthly reports are generated. These reports are submitted to the Monitoring Manager for review and signed off. The raw data was reviewed for correctness and any corrective measures initiated in case of minor errors in the monitored data.

Related Findings

- ☒ No CARs, CLs or FARs have been identified in this context
- ☐ The following finding(s) have been addressed

Final Assessment

No discrepancy was identified for the management and operation system as described in the monitoring report.

5.0 Verification conclusion

Xentolar Holdings Ltd. has commissioned TÜV NORD JI/CDM Certification Program to carry out the verification of the Project “Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project” in Tambol Sasimhum, Amphur Kamphaeng Saen, Nakhon Pathon, Thailand with regard to the requirements of VCS Version 3.1 Standard.

During this 1st monitoring period, the project activity has installed 4 units of 1.063 MW each biogas generator using landfill gas to generate power to supply to the national grid of Thailand.

The project begins operations and exports electricity with one unit operating on 08 April 2010 with 0.8MW capacity. Then, subsequently two additional biogas generators were installed and start supplying electricity on 03 June 2010 with capacity increase to 3 MW. On 06 October 2010, the fourth unit operating and total capacity increase to 4MW supply to the grid. Then permission to export 4MW was granted by the Provincial Electricity Authority (PEA). ^{/SD/COD/}

Reporting period: From 08 April 2010 to 20 January 2011 (both days inclusive)

The verification is based on the draft monitoring report, the monitoring plan as set out in the validated PD, the validation report, emission reduction calculation spreadsheet and supporting documents made available to the TÜV NORD JI/CDM CP by the project participant

In detail the conclusions can be summarized as follows:

- all operations of the project are implemented and installed as planned and described in the registered PDD version 0 and validated supplement project description version 2.
- the monitoring plan is in accordance with the applied approved methodology i.e, ACM0001 version 11, “Consolidated baseline methodology and monitoring for landfill gas project activities
- the installed equipment essential for measuring parameters required for calculating emission reductions are calibrated appropriately and according to the frequency as stated in the monitoring plan of the registered PDD version 9 and validated supplement PD version 2.
- the monitoring system is in place and functional. The project has generated GHG emission reductions.

In the course of the verification 10 Corrective Action Requests (CARs) and 4 Clarification Requests were raised and closed. CL.4.1-2 is converted to FAR.4.1-2 that will be cross checked during the next verification. The one FAR raise during the CDM validation has been checked and closed out.

As the result of this 1st periodic verification, the verifier confirms that the GHG emission reductions are calculated without material misstatements and in a conservative and appropriate manner. TÜV NORD JI/CDM CP herewith confirms that the project has achieved emission reductions in the above mentioned reporting period as follows:

Reporting period: From 08 April 2010 to 20 January 2011

Verified GHG emission reductions or removals:

GHG Emission Reductions or Removals	tCO ₂ e
Baseline Emissions	136,420
Project Emissions	39
Leakage	0
Net GHG emission reductions or removals	136,381

Subang Jaya. 2012-02-02



Cheong, Chun Yuen, (Robert)

TÜV NORD JI/CDM Certification Program

Verification Team Leader

Essen, 2012-02-02



Dr. Schubert, Jochen

TÜV NORD JI/CDM Certification Program

Final Approval

6. References

Table 6-1: Documents provided by the project participant

Reference	Document
/ACI/	ISO 17025 Certificate for Calibration Institute : 1) Calibration Laboratory Co.Ltd. Calibration no CALIBRATION 0059, valid until 04 July 2013 (refer as CLC) 2) Jiangsu Institute of Measurement & Testing Technology no. CNAS L0841 valid until 26 February 2012 (refer as JIM) 3) Miracle International Technology Company Limited no. CALIBRATION 0052, valid until 03 March 2013 (refer as MIT) 4) Marske Machine(Thailand) Company Limited no. CALIBRATION 0035, valid until 29 April 2012 (refer as MMC) 5) Shanghai Instrument and Testing Institute of Instruments and Automatics System no. CINAS L0130, valid until 07 February 2013 (refer as SIT) 6) Thermology Company Limited no. CALIBRATION 0109, valid until 06 June 2013 (refer as TCL)
/COD/	PEA meter reading at increase capacity : - Capacity 3 MW, date 03 June 2010 - Capacity 4 MW, date 06 October 2010
/CR1/	1. Certificate of Calibration for Methane Analyzer, instruments were calibrated by Jiangsu Institute of Measurement & Testing Technology (JIM) Tag no. CH4 9261A: 1) Serial no. 29692 date 27 July 2009 cert. no. RC2009-1255443 2) Serial no. 29693 conducted two times: - date 27 July 2009 Cert. no. RC2009-1255441 - date 13 June 2010 Cert.no. C2010-0002565 3) Serial no. 29790 date 01 July 2010 Cert. no. C2010-0006501 4) Serial no. 31421 date 23 August 2010 Cert.no. C2010-0018051 2. Certificate of Calibration for Pressure Transmitter : <u>At LFG_{total}:</u> Tag no. PT 9261A: 1) Serial no. 5466080 date 14 July 2009 ref. no. 075466080(Emerson) 2) Serial no. 5466002 date 30 June 2010 Cert. no. L1007-092 (MIT) Tag no. PT 9261B: 1) Serial no. 5466089 date 14 July 2009 ref. no. 075466089(Emerson) 2) Serial no. 5466003 date 30 June 2010 Cert. no. L1007-093 (MIT) <u>At LFG_{flare}:</u> Tag no. PT 9391: 1) Serial no. 5466010 date 11 July 2009 ref. no. 075466010 (Emerson) 2) Serial no. 5466004 date 30 June 2010 Cert. no. L1007-094 (MIT) Tag no. PT 9491: 1) Serial no. 5466007 date 11 July 2009 ref. no. 075466007 (Emerson) 2) Serial no. 5466006 date 30 June 2010 Cert. no. L1007-095 (MIT) Tag no. PT 9591: 1) Serial no. 5466015 date 11 July 2009 ref. no. 075466015 (Emerson) 2) Serial no. 5466083 date 30 June 2010 Cert. no. L1007-096 (MIT) <u>At LFG_{electricity}:</u> Tag no. EPT 9001: 1) Serial no. 02150753 date 17 November 2009 ref. no. 0702150753 (Emerson)

Reference	Document
	2) Serial no. 02166915 date 16 November 2010 Cert. no. C1011-354 (MIT) Tag no. EPT 9002: 1) Serial no. 02150751 date 17 November 2009 ref. no. 0702150751 (Emerson) 2) Serial no. 02300672 date 16 November 2010 Cert. no. C1011-355 (MIT) Tag no. EPT 9003: 1) Serial no. 02166916 date 17 December 2009 ref. no. 0702166916 (Emerson) 2) Serial no. 02300673 date 16 November 2010 Cert. no. C1011-356 (MIT) Tag no. EPT 9004: 1) Serial no. 02150750 date 17 November 2009 ref. no. 0702150750 (Emerson) 2) Serial no. 02300674 date 16 November 2010 Cert. no. C1011-357 (MIT)
	3. Certificate of Calibration for Temperature Transmitter <u>At LFG_{total}:</u> Tag no. TT 9261A: 1) Serial no. 080625360 date 03 September 2009 Cert. no. H2009-1261898 (JIM) and date 22 August 2010 Cert. no. C1008-615 (MIT) Tag no. TT 9261B: 1) Serial no. 080625355 date 03 September 2009 Cert. no. H2009-1261893 (JIM) and date 22 August 2010 Cert. no. C1008-619 (MIT) <u>At LFG_{flare}:</u> Tag no. TT 9391: 1) Serial no. 080625347 date 03 September 2009 Cert. no. H2009-1261864 (JIM) 2) Serial no. 080625397 date 22 August 2010 Cert. no. C1008-618 (MIT) Tag no. TT 9491: 1) Serial no. 080625432 date 03 September 2009 Cert. no. H2009-1261899 (JIM) and date 22 August 2010 Cert. no. C1008-617 (MIT) Tag no. TT 9591: 1) Serial no. 080625397 date 03 September 2009 Cert. no. H2009-1261866 (JIM) 2) Serial no. 080625347 date 22 August 2010 Cert. no. C1008-616 (MIT)

Reference	Document
	4. Certificate of Calibration for Thermocouple Tag no. TTC 9393A: 1) Serial no. 090326010 date 03 September 2009 Cert. no. H2009-1261829 (JIM) 2) Serial no. 080614323 date 16 August 2010 Cert. no. 10/1814 (TCL) 3) Serial no. 090326010 date 25 August 2010 Cert. no. 10/2051 (TCL) Tag no. TTC 9393B: 1) Serial no. 080614292 date 03 September 2009 Cert. no. H2009-1261850 (JIM) 2) Serial no. 080614320 date 16 August 2010 Cert. no. 10/1813 (TCL) 3) Serial no. 090329544 date 06 September 2009 Cert. no. H2010-0018860 (JIM) Tag no. TTC 9393C: 1) Serial no. 080614371 date 03 September 2009 Cert. no. H2009-1261830 (JIM) 2) Serial no. 080614290 date 16 August 2010 Cert. no. 10/1812 (TCL) Tag no. TTC 9493A: 1) Serial no. 080614306 date 03 September 2009 Cert. no. H2009-1261835 (JIM) 2) Serial no. 090326006 date 16 August 2010 Cert. no. 10/1817 (TCL) 3) Serial no. 080614306 date 25 August 2010 Cert. no. 10/2054 (TCL) Tag no. TTC 9493B: 1) Serial no. 080614298 date 03 September 2009 Cert. no. H2009-1261853 (JIM) 2) Serial no. 080614379 date 16 August 2010 Cert. no. 10/1816 (TCL) 3) Serial no. 080614289 date 25 August 2010 Cert. no. 10/2055 (TCL) Tag no. TTC 9493C: 1) Serial no. 080614289 date 03 September 2009 Cert. no. H2009-1261827 (JIM) 2) Serial no. 080614373 date 16 August 2010 Cert. no. 10/1815 (TCL) Tag no. TTC 9593A: 1) Serial no. 080614305 date 03 September 2009 Cert. no. H2009-1261832 (JIM) 2) Serial no. 090326013 date 16 August 2010 Cert. no. 10/1820 (TCL) Tag no. TTC 9593B: 1) Serial no. 090326008 date 03 September 2009 Cert. no. H2009-1261847 (JIM) 2) Serial no. 090326012 date 16 August 2010 Cert. no. 10/1819 (TCL) Tag no. TTC 9593C: 1) Serial no. 090326007 date 03 September 2009 Cert. no. H2009-1261837 (JIM) 2) Serial no. 090326009 date 16 August 2010 Cert. no. 10/1818 (TCL)
	5. Certificate of Calibration for Flow Meter Calibration LFG_{total} 1) Serial no. 9061213 date 03 August 2009 Cert no. D09-770-JG-14 (SIT) 2) Serial no. 9061212 date 03 August 2009 Cert no. D09-770-JG-13 (SIT) LFG_{flare} 1) Serial no. 9061209 date 03 August 2009 Cert no. D09-770-JG-10 (SIT) 2) Serial no. 9061210 date 03 August 2009 Cert no. D09-770-JG-11 (SIT) 3) Serial no. 9061205 date 03 August 2009 Cert no. D09-770-JG-06 (SIT) LFG_{ELE} 1) Serial no. 9062901 date 14 August 2009 Cert no. D09-800-JG-02 (SIT)

Reference	Document
	2) Serial no. 9062903 date 14 August 2009 Cert no. D09-800-JG-04 (SIT) 3) Serial no. 9062907 date 13 August 2009 Cert no. D09-800-JG-08 (SIT) 4) Serial no. 9062913 date 11 August 2009 Cert no. D09-800-JG-14 (SIT)
/CR2/	Certificate of Span Gas (Methane Gas): 1) Cylinder no. 10/4623UT, Ref no. 29573 Certificate of Composition no. 29573-2-1 valid until February 2013 2) Cylinder no. 9727594, Ref no. 29574 Certificate of Composition no. 29574-2-1, valid until February 2013
/CR3/	Record of of Methane Analyzer Verification Monthly with Span Gas during monitoring period 08 April 2010 to 20 January 2011
/DR/	Hourly and Monthly Data Reading Extracted from Server during monitoring period 08 April 2010 to 20 January 2011 1) Hourly Power Generation 2) Biogas Engines Daily Reading Record 3) Hourly Data Record of Project Activity
/DT/	Down Time Record during monitoring period 08 April 2010 to 20 January 2011 1) Biogas Plant during 08 April 2010 to 20 January 2011 2) Biogas Engine 4 units, during 08 April 2010 to 20 January 2011 3) Flare 3 units, during 08 April 2010 to 20 January 2011
/EH/	GE Jenbacher Biogas Engine Hand Over Report: 1) Generator no. X09C100255 date 18 May 2010 (Unit no.1) 2) Generator no. X09C100328 date 16 June 2010 (Unit no.2) 3) Generator no. X09B080254 date 18 May 2010 (Unit no.3) 4) Generator no. X09C100327 date 18 May 2010 (Unit no.4)
/ER/	Environmental Monitoring Report year 2010 1) Report issued date 21-24 June 2010 2) Report issued date 21-23 December 2010
/EEE/	Monthly Reading Electricity Export and Import to PEA (confirm reading by PP and PEA) from April 2010 to January 2011 1. April 2010, reading date May 2010 (undated) 2. May 2010, reading date 01 June 2010 3. June 2010, reading date July 2010 (undated) 4. July 2010, reading date 01 August 2010 5. August 2010, reading date 01 September 2010 6. September 2010, reading date 01 October 2010 7. October 2010, reading date 01 November 2010 8. November 2010, reading date 01 December 2010 9. December 2010, reading date 01 January 2011 10. January 2011, reading date 01 February 2011
/EMCC/	Electricity Meters Calibration Certificates from PEA : 1) Export Primary Meter : - Serial no. 201005194-PEA15850695 calibrated twice on date 01 April 2010, and date 19 July 2010 2) Export Secondary Meter : - Serial no. 201007272-PEA15852773 calibrated twice on date 15 November 2004 and date 19 July 2010 3) Import Primary Meter : - Serial no. 203327797-PEA18323739 calibrated twice on date 15 November

Reference	Document
	2004 and date 19 July 2010 - Serial no. 201006718-PEA15852219 date 15 November 2010 4) Import Secondary Meter : - Serial no. 201005191-PEA15850692 calibrated twice on date 15 November 2004 and date 19 July 2010
/EPT/	Electricity Transmission Loss Calculation
/FC/	Pre-treatment and Flare Commissioning Procedure
/FOD/	First Order of Decaying model for methane potential dated
/HCA/	Host Country Approval, TGO no. 02/332, issued 07 August 2009
/IAR/	Internal Audit Report _ version 10 August 2010
/IEE/	Initial Environmental Examination, November 2009
/MWI/	CDM Monitoring & Quality Control Manual no. LFTH/518/MQCM01
/MWR/	Preventive Maintenance Procedure and Recording during April 2010 to January 2011
/MR/	- Draft Monitoring Report Version 1 dated 18 July 2011 - Monitoring Report Version 2 dated 05 August 2011 - Monitoring Report Version 3 dated 11 November 2011 - Monitoring Report Version 4 dated 02 February 2012
/PD/	- Draft Project Description Version 1 dated 18 July 2011 - Project Description Version 2 dated 05 August 2011 - Project Description Version 3 dated 11 November 2011 - Project Description Version 4 dated 02 February 2012
/PPA/	Power Purchase Agreement no. VSPP-PEA-252/2552 - date 14 July 2009, - capacity 8 MW
/PEAC/	PEA's Letter of Meter Confirmation of Calibration and Accuracy date 20 September 2010 (20 Sept. BE.2553)
/RD/	Registration Deed of Representation by Bangkok Green Power Co.,Ltd. date 03 August 2011
/SCI/	Statutory Document Concern: 1) Construction License no. 41/2552 issued by Local Authority date 23 November 2009 2) Notification Letter submitted to Local Industrial Department regarding to Start Up the Landfill Gas Power Plant, Receiving no. 4152 date 19 October 2011 3) Operating License issued by Department of Industrial Work (DIW) no. 3-88-9/53 Nor-Tor date 02 March 2010 4) Receipt of annual fee payment for the operating license by Local Industry Department, no. 8576 (04) 5) License for Production of Electricity no. 01-1(1)/53-081 issued by Energy

Reference	Document
	Regulatory Commission - Validity 28 April 2011 to 03 March 2020 - Less than 10 MW with 8212.5 KVA 6) Permission issuance by Energy Regulatory Commission no. Sor-Kor-Por 5501/074 date 04 March 2010 for specific biogas engines:
/SDI/	PEA meter reading on the date start export of electricity to grid on 08 April 2010
/SLDI/	Project Activity Drawing and Equipment Layout: 1) Project Layout 2) Pipe Layout 3) Electricity Layout 4) Monitoring Instrument List
/TMI/	Technical Manual for Equipments and Instrument: 1. Power Meter: EDM I Electricity meter Manual 2. Honeywell Temperature Transmitter Manual 3. Emerson Pressure Transmitter Manual from Rosemount 4. Honey Well Thermocouple Manual 5. Guardian Plus Methane Gas Analyzer Manual from Edinburgh Instruments Limited 6. Kingsway-Keyon Tech (V-cone) Manual 7. Technical Manual for Machine and Equipment in stalled in Project Activity
/TPS/	Confirmation letter from Transec Power Services Co. Ltd. no. TS-FSD 0303/2010 date 25 September 2010 “The letter stated and confirmed that the electricity meters are calibrated by PEA”
/TR/	- Training Matrix and Plan for each work position - Training Record concerned for the operation, calibration, safety , environmental and CDM
/XER/	ER Calculation sheets for monitoring period from 08 April 2010 to 20 January 2011

Table 6-2: Background investigation and assessment documents

Reference	Document
/ACM0001/	“Consolidated baseline methodology and monitoring for landfill gas project activities”, version 11
/CPM/	TÜV NORD JI / CDM CP Manual (incl. CP procedures and forms)
/IPCC/	2006 IPCC Guidelines for National Greenhouse Gas Inventories: General Guidance and Reporting
/ISO 14064/	Greenhouse gases -- Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements Greenhouse gases -- Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions

Reference	Document
/ISO14065/	Greenhouse gases -- Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition
/RPDD/	Registered PDD version 9 dated 27 December 2010 title “Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project”
/TEF/	Tool to calculate the emission factor for an electricity system (version 2)
/VCS/	Voluntary Carbon Standard, Version 3.1
/VCS-PD-T/	VCS PD Template version 3
/VPA/	VCS Policy Announcement “Further Guidance for Projects that are Registered in Two GHG Programs”
/VR/	UNFCCC Validation Report issued by SGS dated 10 January 2011 title “Bangkok Kamphaeng Saen East: Landfill Gas to Electricity Project”
/VRT/	VCS Verification Report Template
/VVM/	Validation and Verification Manual (Version as per EB 55)

Table 6-3: Websites used

Reference	Link	Organisation
/cd4cdm/	www.cd4cdm.org	UNEP Riso Centre
/ipcc/	www.ipcc-nggip.iges.or.jp	IPCC publications
/vcs/	www.v-c-s.org	VCSA
/unfccc/	http://cdm.unfccc.int	UNFCCC
/eppo/	http://www.eppo.go.th/info/stat/T03_02_03.xls	Energy Planning and Policy Office, Thailand

Table 6-4: List of interviewed persons

Reference	Mol ¹		Name	Organisation / Function
/IM01/	V	☒ Mr. ☐ Ms.	Jay Mariyappan	Sindicatum Carbon Capital / Managing Director
	V	☒ Mr. ☐ Ms.	Andy Cox	Sindicatum Carbon Capital / Sr VP LFG Operations
	V	☒ Mr.	Marcus Xia	Sindicatum Carbon Capital /

Reference	Mol ¹		Name	Organisation / Function
		☐ Ms		
/IM02/	V	☒ Mr. ☐ Ms	Teerasit Tantasuralerk	Bangkok Green Power Co.,Ltd./ CDM Manager
	V	☐ Mr. ☒ Ms	Michelle O'Hare	Bangkok Green Power Co.,Ltd./ Operation Manager

¹⁾ Means of Interview: (Telephone, E-Mail, Visit)