VALIDATION REPORT

Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia

REPORT NO. 9208-1026

REVISION NO. 04

DET NORSKE VERITAS

VALIDATION REPORT

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Date of first issue: 2008-07-17	Project No.: 92081026
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Client: KUB-Berjaya Enviro Sdn. Bhd.	Client ref.: How Lim Sek

Project Name: Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor
Country: Malaysia
Methodology: ACM0001, version 8
GHG reducing Measure/Technology: Consolidated baseline methodology for landfill gas utilization project activities
ER estimate: 219 625 tCO_2e per year over the first crediting period
Size
☒ Large Scale
☐ Small Scale
Validation Phases:
☒ Desk Review
☒ Follow up interviews
☒ Resolution of outstanding issues
Validation Status
☐ Corrective Actions Requested
☐ Clarifications Requested
☒ Full Approval and submission for registration
☐ Rejected

In summary, it is DNV's opinion that the Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia, as described in the PDD of 23 August 2009 meets all relevant UNFCCC requirements for the CDM and all relevant host Party criteria and correctly applies the baseline and monitoring methodology ACM0001 (version 8). DNV thus requests the registration of the project as a CDM project activity.

Report No.:	Date of this revision:	Rev. No.
9208-1026	2009-07-6	04

Report title:
Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor in Malaysia

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Key words:
Climate Change
Kyoto Protocol
Validation
Clean Development Mechanism

Abbreviations

BOE	Board of Engineers
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CH_4	Methane
CL	Clarification request
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
DANIDA	Danish International Development Agency
DNV	Det Norske Veritas
DNA	Designated National Authority
EPC	Engineering, Procurement and Construction
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
KBE	KUB-Berjaya Enviro Sdn. Bhd
LFG	Landfill Gas
JCF	Japan Carbon Finance
MP	Monitoring Plan
MSW	Municipal Solid Waste
NGO	Non-governmental Organisation
ODA	Official Development Assistance
OM	Operating Margin
PDD	Project Design Document
PTM	Pusat Tenaga Malaysia (Energy Commission of Malaysia)
TDL	Transportation and Distribution Loss
TNB	Tenaga Nasional Berhad
UNFCCC	United Nations Framework Convention on Climate Change

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1 EXECUTIVE SUMMARY – VALIDATION OPINION

Det Norske Veritas Certification AS (DNV) has performed a validation of the "Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor" in Malaysia. The validation was performed on the basis of UNFCCC criteria for the Clean Development Mechanism and host Party criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The review of the project design documentation and the subsequent follow-up interviews have provided DNV with sufficient evidence to determine the fulfilment of stated criteria.

The host Party is Malaysia. Malaysia fulfils the participation criteria and has approved the project and authorized the project participants. The DNA from Malaysia confirmed that the project assists in achieving sustainable development. The Annex I Party is Japan. Written approvals from the DNA of Malaysia and Japan have been provided.

The project correctly applies ACM0001 version 8, "Consolidated methodology for landfill gas project activities". By capturing, burning and generating electricity landfill gas instead of passively venting it, the project results in reductions of CH_4 and CO_2 that are real, measurable and give long-term benefits to the mitigation of climate change. It is demonstrated that the project is not a likely baseline scenario. Emission reductions attributable to the project are hence additional to any that would occur in the absence of the project activity.

The total emission reductions from the project are estimated to be on the average 219 625 t CO_2e per year over the selected 7 year crediting period. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

Adequate monitoring procedure has been established and it will be implemented when the plant will be in operation, as well as adequate training procedure and the personnel will be trained before the plant enters into operation and the crediting period starts.

In summary, it is DNV's opinion that the "Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor" in Malaysia, as described in the PDD version 5.3 of 23 August 2009, meets all relevant UNFCCC requirements for the CDM and all relevant host Party criteria and correctly applies the baseline and monitoring methodology ACM0001 version 08. DNV thus requests the registration of the project as a CDM project activity.

2 INTRODUCTION

KUB-Berjaya Enviro Sdn. Bhd. (KBE) has commissioned Det Norske Veritas Certification AS (DNV) to perform a validation of the Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor project in Malaysia (hereafter called "the project"). This report summarises the findings of the validation of the project, performed on the basis of UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and the subsequent decisions by the CDM Executive Board.

2.1 Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria are validated in order to confirm that the project design, as documented, is sound and reasonable and meets the identified criteria. Validation is a requirement for all CDM projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

2.2 Scope

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords, and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology ACM0001, version 8. The validation team has, based on the recommendations in the Validation and Verification Manual employed a risk-based approach, focusing on the identification of significant risks for project implementation and the generation of CERs.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

3 METHODOLOGY

The validation consisted of the following three phases:

I a desk review of the project design documents

II follow-up interviews with project stakeholders

III the resolution of outstanding issues and the issuance of the final validation report and opinion.

The following sections outline each step in more detail.

3.1 Desk Review of the Project Design Documentation

The following table lists the documentation that was reviewed during the validation:

/ 1/ Eco-Ideal Consulting Sdn. Bhd: "Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor project in Malaysia" version 01 dated 14 November 2007 and final PDD version 5.3 of 23 August 2009

/ 2/ Conservation and Environmental Management Division, Ministry of Natural Resources and Environment (DNA of Malaysia): *Letter of approval dated 22 January 2009 (final)*

/ 3/ The Liaison Committee for the Utilization of the Kyoto Mechanisms Ministry of Foreign Affairs, Climate Change Division, International Cooperation Bureau. (DNA of Japan): *Letter of approval dated 29 July 2008*

/ 4/ CDM Executive Board: *Validation and Verification Manual*. Version 01

/ 5/ CDM Executive Board: *Revision to the approved consolidated baseline methodology* ACM0001, version 8

/ 6/ CDM Executive Board: *Tool for the demonstration and assessment of additionality*. Version 4

/ 7/ CDM Executive Board: *Annex 13: Methodological "Tool to determine project emissions from flaring gases containing methane"*, EB 28, 15 December 2006

/ 8/ CDM Executive Board: *Annex 10: Methodological tool "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site"*, Version 02

/ 9/ CDM Executive Board: *Annex 12: Methodological tool "Tool to calculate the emission factor for an electricity system"*, Version 01

/ 10/ IPCC: "*Revised Guidelines for National Green House Gas Inventories*" 2006

/ 11/ Electricity Supply Department, Energy Commission : "*Statistics of Electricity Supply Industry in Malaysia*" Year 2005

/ 12/ Environmental Quality (Sewage and Industrial Effluents) Regulations, 1979;

/ 13/ Environmental Quality Act 1974
http://www.doe.gov.my/dmdocuments/legislation/a0127.pdf

/ 14/ Power market - TNB must move towards liberalisation
http://www.malaysiakini.com/letters/91889

/ 15/ Asia Clean Energy & Asia Clean Technology News
http://asiacleantech.wordpress.com/2007/08/08/tenaga-lifts-purchase-price-of-electricity-from-biomass-waste/

/ 16/ July 2008 TNB electricity bill for Bukit Tagar Landfill

/ 17/ *Financial models spreadsheet:*
KBE_Financial_1MW(on-site only)rev3nov.xls
KBE_Financial_3MW(031108).xls

/ 18/ *CER calculation spreadsheet:*
Bukit_Tagar_Revised_Calculations_06-08-2008_Version_4.0_(CEF_=_0.622).xls

/ 19/ *CEFgrid calculation spreadsheet using Revised 2006 IPCC valuest:*
Malaysia_power_baseline_PENINSULA_MALAYSIA_updated_05Aug08.xls

/ 20/ Historical on-site power consumption records via electricity bills invoiced to the landfill Bukit Tagar On-site Power Consumption records_2006to2008.xls

/ 21/ *Sensitivity Analysis spreadsheet:*
KBE_Financial_3MW-Capital outlay -10%.xls
KBE_Financial_3MW-Capital outlay +10%.xls
KBE_Financial_3MW-O&M -10%.xls
KBE_Financial_3MW-O&M +10%.xls
KBE_Financial_3MW_production hours decrease 10%.xls
KBE_Financial_3MW_production hours decrease 10%.xls
KBE_Financial_3MW-tariff-10%.xls
KBE_Financial_3MW-tariff+10%.xls
KBE_Financial_3MW(031108)+20% tariff_onsitepower.xls
KBE_Financial_3MW(031108)-20% tariff_onsitepower.xls
KBE_Financial_3MW(031108)+10% tariff_onsitepower.xls
KBE_Financial_3MW(031108)-10% tariff_onsitepower.xls
KBE_Financial_3MW(031108)_onsite-20%.xlsx
KBE_Financial_3MW(031108)_onsite+20%.xlsx
KBE_Financial_3MW(031108)_onsite-10%.xls
KBE_Financial_3MW(031108)_onsite+10%.xls

/ 22/ *Sensitivity Analysis spreadsheet:*
KBE_Financial_3MW-Capital outlay -31.8%.xls
KBE_Financial_3MW- production hours +25.6.xls
KBE_Financial_3MW-tariff +46.5%.xls
KBE_Financial_3MW-O&M -122.5%.xls
KBE_Financial_3MW(031108)+220% tariffonsitepower (benchmark).xls
KBE_Financial_3MW(031108)_onsite_120%toBenchmarkIRR.xls

/ 23/ EIA approval letter (Ref No: 50/013/911/059, dated 13 September 2004);

/ 24/ Special allowance for the COD level (Ref No: AS(PN) 50/013/911/059 J/d 13 (56), dated 16 February 2007);

/ 25/ Communication letter between the project host and National Electricity Company (TNB) dated 22 April 2008;

/ 26/ Submission of consultancy quotation for CDM between Eco-Ideal Consulting Sdn. Bhd. and KUB-Berjaya Enviro on 29 May 2007

/ 27/ Signing of term sheet with Japan Carbon Finance (CER buyer) on 24 November 2007

/ 28/ Appointment of Eco-Ideal Consulting Sdn. Bhd. as the CDM consultant on 3 December

2007

/ 29/ Emission Reduction Purchase Agreement signed between JCF and the project host on 21 April 2008

/ 30/ Letter of Acceptance of Tender for the landfill gas recovery works signed by Q2 Engineering Sdn. Bhd. dated 27 May 2008.

/ 31/ Grid connection – computation of price from Ismail and Rakan Rakan Consultancy firm

/ 32/ 3 waste characterization test results from Satang Environmental Sdn. Bhd. dated July 2005;

/ 33/ Historical Waste Collection Data (2005-2007);

/ 34/ Electricity Company (TNB) 2007 annual report;

/ 35/ Bank Negara Dec07 bulletin - 4.1 Int - Banking Institution - December

/ 36/ Renewable Energy: The Failure of the Malaysian 5th Fuel Policy by Engineer Dr. Maulud Hj. Latif

/ 37/ The Development of a Business Framework and Techno-Financial Model for Biomass Power Plants, EngD Thesis, BATC, University Technology Malaysia, 2005.

/ 38/ Study on Clean Development Mechanism Potential in the Waste Sectors in Malaysia December 2004 by Malaysia Energy Centre and Danida

/ 39/ Stakeholder Consultation Attendance List and meeting minutes dated 22nd January 2008.

/ 40/ Bukit Tagar Landfill Onsite Electricity Bill for the Year 2007

/ 41/ Bukit Tagar Landfill Onsite Electricity Bill for the Year 2008

/ 42/ Bukit Tagar Landfill Onsite Electricity Bill for the Year 2006

Main changes between the version of the PDD published for the 30 days stakeholder commenting period and the final version of the PDD submitted for registration:

- Technological barrier has been removed from barrier analysis with a CAR

- Grid emission factor has been revised using IPCC 2006 values based on the historic data that was available at the time of submission of the PDD for validation

- Revised crediting period from 1 January 2009 to 1 July 2009

- Changes related to the responses of CARs and CLs

3.2 Follow-up Interviews with Project Stakeholders

On 5 May 2008, DNV performed on-site visit and interviews with project stakeholders to confirm selected information and to resolve issues identified in the document review. Representatives from the project participant, KUB-Berjaya Enviro Sdn. Bhd. and representatives of Eco-Ideal Consulting Sdn. Bhd. were interviewed / 43// 44/. The main topics of the interviews are summarised in the table below.

	Date	Name	Organization	Topic
/ 43/	2008-05-15	Mr. Soon Hun Yang	Eco-Ideal Consulting Sdn.	➢ Estimation of emission reductions and potential leakage.

		Mr. Francisco Cunha	Bh.	➢ Assumptions in baseline determination ➢ Stakeholder consultation process ➢ Provisions for training, operation and maintenance ➢ Technology applied and operational lifetime ➢ Project funding source ➢ Project's additionality as mandated in Article 12 of the Kyoto Protocol.
/ 44/	2008-05-15	Mr. How Lim Sek Mr. Fatimi Said Mr. Steven Wong	KUB-Berjaya Enviro Sdn. Bhd.	➢ Environmental compliance of existing landfill. ➢ Technological, institutional, legal/policy, investment, market, environmental and/or other barriers to investment in the projects. ➢ Project technology and provisions for technology. ➢ Environmental and social effect by implementation of the project. ➢ Monitoring plan.
/ 45/	2008-12-09	Puan Siti Khadijah Abdul Ghani	DNA of Malaysia	➢ Malaysia's DNA mechanism and criteria for sustainable development. ➢ Regulatory framework for solid waste management. ➢ Laws and regulations applying to landfills. ➢ Similar project activities.

3.3 Resolution of Outstanding Issues

The objective of this phase of the validation was to resolve any outstanding issues which needed to be clarified prior to DNV's positive conclusion on the project design. In order to ensure transparency a validation protocol was customised for the project. The protocol shows in a transparent manner the criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of three tables. The different columns in these tables are described in the figure below. The completed validation protocol for the Landfill Gas Recovery and Utilization at Bukit Tagar Sanitary Landfill, Hulu Selangor is enclosed in Appendix A to this report.

Findings established during the validation can either be seen as a non-fulfilment of CDM criteria or where a risk to the fulfilment of project objectives is identified. Corrective action requests (CAR) are issued, where:

i) mistakes have been made with a direct influence on project results;
ii) CDM and/or methodology specific requirements have not been met; or
iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

A request for clarification (CL) may be used where additional information is needed to fully clarify an issue.

VALIDATION REPORT

Validation Protocol Table 1: Mandatory Requirements for CDM Project Activities		
Requirement	***Reference***	***Conclusion***
The requirements the project must meet.	*Gives reference to the legislation or agreement where the requirement is found.*	*This is either acceptable based on evidence provided (**OK**), a **Corrective Action Request (CAR)** of risk or non-compliance with stated requirements or a request for **Clarification (CL)** where further clarifications are needed.*

Validation Protocol Table 2: Requirement checklist				
Checklist Question	***Reference***	***Means of verification (MoV)***	***Comment***	***Draft and/or Final Conclusion***
The various requirements in Table 2 are linked to checklist questions the project should meet. The checklist is organised in different sections, following the logic of the large-scale PDD template, version 03 - in effect as of: 28 July 2006. Each section is then further sub-divided.	*Gives reference to documents where the answer to the checklist question or item is found.*	*Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable.*	*The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.*	*This is either acceptable based on evidence provided (**OK**), or a c**orrective action request (CAR)** due to non-compliance with the checklist question (See below). A request for clarification (CL) is used when the validation team has identified a need for further clarification.*

Validation Protocol Table 3: Resolution of Corrective Action and Clarification Requests			
Draft report clarifications and corrective action requests	***Ref. to checklist question in table 2***	***Summary of project owner response***	***Validation conclusion***
If the conclusions from the draft Validation are either a CAR or a CL, these should be listed in this section.	*Reference to the checklist question number in Table 2 where the CAR or CL is explained.*	*The responses given by the project participants during the communications with the validation team should be summarised in this section.*	*This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion".*

Figure 1 Validation protocol tables

3.4 Internal Quality Control

The validation report underwent a technical review before requesting registration of the project activity. The technical review was performed by a technical reviewer qualified in accordance with DNV's qualification scheme for CDM validation and verification.

3.5 Validation Team

				Type of involvement					
Role/Qualification	***Last Name***	***First Name***	***Country***	Desk review	Site visit / Interviews	Reporting	Supervision of work	Technical review	Expert input
CDM validator / technical team leader	Lai	Chee Keong	China				√		
GHG auditor / Project Manager	Wong	Simon Yon-Sing	Malaysia	√	√	√			
Technical reviewer	Chaudhary	Anu	India					√	√

The qualification of each individual validation team member is detailed in Appendix B to this report.

4 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of verification and the results from validating the identified criteria are documented in more detail in the validation protocol in Appendix A.

The final validation findings relate to the project design as documented and described in the revised and resubmitted project design documentation of 23 August 2009/ 1/.

4.1 Participation Requirements

The project participants are KUB-Berjaya Enviro Sdn. Bhd. (KBE) of Malaysia and Japan Carbon Finance, Ltd. (JCF) of Japan. Malaysia as the host Party and Japan as the Annex-I Party meet the requirements to participate in the CDM. Written approvals of voluntary participation from the DNA of Malaysia and Japan have been provided / 2// 3/.

The project does not involve any public funding from an Annex 1 Party, and the validation did not reveal any information that indicates that the project can be seen as a diversion of official development assistance (ODA) funding towards the Malaysia. It has been confirmed with the Malaysian DNA and the project participant that the project has not received any ODA / 2/.

4.2 Project Design

The proposed project activity is located at Bukit Tagar Sanitary Landfill and it involves the installation of a landfill gas (LFG) collection system, a LFG flaring system and a LFG-fuelled electricity generation system. The landfill was first opened in 2005 and will be receiving wastes until 2045, and has to date developed two cells. The first cell (advance cell) was closed in November 2007, while the larger second cell (phase 1) is currently operating and is expected to receive wastes until 2011. Further cells will be developed after the closure of the second cell as the landfill has been the designated landfill for municipal solid waste (MSW) for the city of Kuala Lumpur and the Selayang district. It was verified on-site that there is currently no system in place to actively capture or flare the LFG generated. The treated effluent from the leachate treatment facility is used for irrigation within the site.

The objective of the proposed project activity is to reduce greenhouse gas emissions through the flaring and combustion of recovered LFG. The electricity generated by the project activity will be consumed internally and also be exported to the local grid planned in 2010. The project reflects good practice for the collection of LFG, flaring and utilization of LFG for electricity generation.

The starting date of the project activity is defined as 27 May 2008, which is the date on the appointment of Engineering, Procurement and Construction (EPC) Contractor (Q2 Engineering Sdn. Bhd.) to undertake the design, construction, completion and commissioning of landfill gas extraction and flaring system / 30/. DNV deems this as the earliest starting date of implementation, construction and real action. The letter of acceptance of tender has been provided to DNV for review and is found appropriate / 30/. The project has an operational lifespan of 21 years. A renewable crediting period starting from 1 July 2009 or the date of registration, whichever is later has been selected. The project activity is expected to reduce 219 625 tCO_2e emissions per year over the first crediting period. By improving LFG

management at the existing landfill, the project is likely to contribute to sustainable development in Malaysia. This has been confirmed with the local DNA / 2/.

4.3 Baseline Determination

The project correctly applies the approved baseline methodology ACM0001 "*Consolidated methodology for landfill gas project activities*", Version 8.

The applicability of this methodology is justified since:

- The baseline is total atmospheric release of landfill gas
- The project activity is the flaring of gas and generation of electricity from captured LFG.

"The tool for the demonstration and assessment of additionality", version 04 of EB 36 was used to identify all realistic and credible baseline alternatives for this project / 6/.

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

Step 1a: Define alternatives to the project activity

In the case of disposal of municipal solid waste (MSW), five alternatives have been identified:

LFG1 – atmospheric release of the landfill gas or partial capture of landfill gas and destruction to comply with regulation or contractual agreements;

LFG2 – landfill gas is recovered for flaring without CDM;

LFG3 – landfill gas is recovered for power generation on-site and flaring without CDM;

LFG4 – the project activity not implemented as a CDM project;

LFG5 – landfill gas is recovered for thermal energy generation and flaring without CDM.

In the case of power generation, six alternatives have been identified:

P1 – power generated from landfill gas undertaken without being registered as CDM project activity;

P2 – existing or construction of a new on-site or off-site fuel fired cogeneration plant;

P3 – existing or construction of a new on-site or off-site renewable based cogeneration plant;

P4 – existing or construction of a new on-site or off-site fossil fuel fired captive power plant;

P5 – existing or construction of a new on-site or off-site renewable based captive power plant;

P6 – existing and/or new grid-connected power plants.

Alternative LFG2 involves the flaring of captured gas and do not generate any revenue, this is not a viable option for the project host. Alternatives LFG4 and P1 were deemed to be not financially attractive to investors in lieu of cost and revenues. Further demonstration of the financial unattractiveness related to Alternatives LFG4 and P1 will be discussed in Section 4.4. Alternatives LFG5, P2, P3, and P4 generates both electricity and heat, however there is no heat requirement for the project, hence these alternatives were not considered realistic since they are not in line with the Project Developer's core business, therefore they cannot be considered as a likely baseline scenario. P5 is also not in the business expertise of the technology supplier and is not within the scope of the Project Developer's core business which involves the treatment of solid waste in landfills.

Landfill gas scenarios: This leaves alternatives LFG1 and LFG3. Both scenarios are in compliance with the applicable local laws and regulation, but as demonstrated with the investment analysis (refer to Section 4.4), the only realistic baseline scenario is LFG1.

Power generation scenarios: In Section 4.4 below, it is confirmed that P1 is not a realistic scenario since revenue from electricity sale does not cover the investment and operating costs of power generation. Only scenario P6 (existing and/or new grid-connected power plants) results in a realistic baseline.

DNV considers the list of realistic and credible alternatives to be complete.

Step 1b: Consistency with mandatory laws and regulations

Malaysia has existing Federal Laws and State policies in place, the Solid Waste and Public Cleansing Management Act 2007 and the Local Government Act 1976. It was verified that both legislations only address the requirement for final solid waste disposal in landfill, but no requirements for LFG collection or flaring. Hence, an adjustment factor (AF) has not been taken into account for this project activity. This is deemed acceptable based on the current ongoing practice in Malaysia which is open dumpsite and landfill with no gas capture. In addition, as a sanitary landfill, the landfill was only designed with air vents for the purpose of releasing the gas generated to the atmosphere for safety reasons. These vents are for the purpose of effective atmospheric release of gas and not designed for collection and utilisation. In comparison to the project activity, vertical gas extraction wells are designed with proper heads, controls, piping system for gas and leachate management systems to optimize the capturing and utilization of the landfill gas.

It was also confirmed with the DNA of Malaysia that the common practice in existing landfills in the country is still open dumpsites with no LFG collection.

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

DNV was able to verify that although the Malaysian government is taking steps to secure environmentally sustainable supplies of energy, there is no regulation or policy to regulate the contribution of fossil fuel powered plants in the national grid. Hence, all 6 power generation alternatives identified in Step 1a is in compliance with all applicable legal and regulatory requirements in Malaysia.

In conclusion, it is DNV's opinion that the baseline scenario is correctly selected as the atmospheric release of the landfill gas (LFG1) and this complies with the regulations, the power generation is produced by the existing grid connected power plants (P6). The application of the baseline methodology is transparent and conservative.

The project boundary is the site of the project activity where the gas is captured and subsequently flared or utilized for electricity generation and the connected grid where the generated electricity will be sold.

The estimated quantity of LFG flared and utilized was selected as the baseline emissions indicator for this project. The system boundary is presented as the following and the selected sources and gases are justified for the project activity:

	GHGs involved	***Description***
Baseline emissions	*CO_2 and CH_4 (included).* *N_2O not included.*	*CO_2 and CH_4 included, which is consistent with ACM0001 version 8. Electricity generated by the biogas generator will be exported to grid based on fossil fuel power plant. CH_4 emissions from landfill will be captured for flaring and combustion.*
Project emissions	*CH_4 and CO_2 (included)*	*CH_4 from the incomplete combustion of landfill gas and biogas in flares and in generator engines.* *CO_2 from grid electricity consumption.*
Leakage	*CH_4, CO_2 and N_2O are not included.*	*No leakage effects need to be considered under methodology ACM0001 version 8.*

4.4 Additionality

According to the approved methodology ACM0001, the project additionality was assessed applying the approved methodology tool "The tool for the demonstration and assessment of additionality", version 04 / 6/.

4.4.1 CDM consideration and continued action to secure CDM status

It has been demonstrated by the following chronological events that the CDM revenues were considered for the project activity prior to starting date of the project:

Date	Event
29 May 2007 (CDM has been considered)	Submission of consultancy quotation for CDM consultancy from Eco-Ideal Consulting Sdn. Bhd. to the project host, KUB-Berjaya Enviro / 26/
24 November 2007 (Decision making date)	Signing of term sheet with Japan Carbon Finance (CER buyer) / 27/
3 December 2007	Appointment of Eco-Ideal Consulting Sdn. Bhd. as the CDM consultant / 28/
27 May 2008 (starting date of the project activity)	Appointment of EPC Contractor (Q2 Engineering Sdn. Bhd.) to undertake the design, construction, completion and commissioning of landfill as extraction and flaring system / 30/. On the basis of EB 41 guidance's, it is DNV's opinion that this is the correct date to represent the earliest of the dates on which the implementation, construction or real action of the project activity began. It has been demonstrated that the CDM benefits were seriously taken into account before the decision to go

	ahead with the project.

Real action to secure CDM status was evidenced through:

The agreement on the purchase of CER was signed between JCF and the project host on 21 April 2008 / 29/. The project participant appointed DNV to perform a validation on 2 April 2008.

The following steps, according to the methodological tool for demonstration and assessment of additionality have been applied:

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

Step 1 has already been demonstrated in Section 4.3, where it was demonstrated that the most plausible baseline scenario is the continuation of current practice if it is demonstrated that the savings of electricity will not be sufficient enough to overcome the investment involved in Alternative LFG3.

4.4.2 Investment analysis: Choice of approach

Since the project scenario without CDM (LFG3 and P1) generates revenues through the sales of electricity, a benchmark analysis is applicable.

4.4.3 Investment analysis: Benchmark selection

The proposed project activity is a relatively new type of investment and it is not a common practice in Malaysia as demonstrated in Step 4. Therefore, more operational, technological and market risks than a conventional power plant can be expected. Several benchmarks were considered:

- *Base lending rate (BLR):* At time of decision making, in 2007, DNV was able to verify through the monthly statistical bulletin released by the Central Bank of Malaysia, evidenced through an attachment, that confirms the base lending rate in Malaysia was 6.72% / 35/. The BLR is not suitable to be the benchmark for such renewable energy project as it does not carry the project and technology risk. Nevertheless, the project IRR analysis indicates an IRR of 4.9% for the project without CDM revenues which is still lower than the BLR rate of 6.72%.
- *Malaysian Board of Engineer:* A research survey was conducted in 2004 by an academic institution / 37/ to gather response from industrial players as to how they view the existing policies and financial incentives. DNV was able to verify through the survey conducted by Board of Engineer (BoE) that the Renewable Energy Developers will be comfortable with a project IRR of not less than 12% while a survey within the banks and financial institutions requires a higher benchmark of between 15% to 18% / 36/. References to the survey results have been cited in the Article Renewable Energy: The Failure of the Malaysian 5th Fuel Policy, Ingeniur Magazine, published by Board of Engineer Malaysia (2005) / 36/. The selected project IRR benchmark 12% presents the lower bound of the range indicated by the BoE and is deemed conservative.
- *Stakeholders*: A joint study conducted by the Ministry of Energy, Water and Communications, Malaysia Energy Centre and Danish International Development Assistance (DANIDA) states that for the investment in landfill gas utilization projects, the project IRR should be more than 15% / 38/.

IRR benchmark	IRR from surveys (potential project developer)	IRR from surveys (bankers/financial institutions)	IRR from "Study on CDM Potential in Waste Management Sector"
12%	12%-15%	15%-18%	15%

In conclusion, through results from the survey carried out among the stakeholders involved, it is not likely the benchmark will be less than 6.72% as it is the base lending rate without encompassing risks such as country or technology risk. There being no fixed requirement in Malaysia on the model adoption for choosing a benchmark to arrive at the financial viability of such projects, the selection of the 12% as the project IRR benchmark for the project investment is in our opinion reasonable. The benchmark selected is the lowest and most conservative value from survey results and thus deemed conservative.

4.4.4 Investment analysis: Input parameters

The assumptions made in incremental operational and maintenance cost have been reviewed and deemed to be reliable and do not deviate from the range of accepted industry values. The project owner has provided a summary of costs related to equipment, machinery and civil work for the project and quotations from the equipment supplier / 30/. The project involves a capital investment of RM 41 million, the breakdown of major investment such as the installation of wells and piping (RM 12 million), installation of grid connection (RM 6.4 million) / 31/, 1 MW LFG genset (RM 3 million) and skid mounted LFG blower & flare (RM 5.3 million). The negotiations are still on-going to secure a Power Purchase Agreement (PPA) with the grid operator Tenaga Nasional Berhad (TNB) and hence a PPA has not been signed yet / 25/. Therefore, the revenue from the sale of electricity to TNB grid was established in accordance to price structure (19 cents/kWh), under the Renewable Energy Power Purchase Agreement (REPPA) / 15/. The savings on own consumption is based on the price of electricity which was calculated on an average based on actual charge rate (25 cents/kWh), evidenced from Bukit Tagar Landfill electricity bill dated July 2008 / 16/. Considering that the decision to go ahead with the CDM project was made in November 2007 / 27/, DNV further verified the correctness of the tariff by comparing the historical on-site electricity bills / 20/ for (6 months period between May 2007 and October 2007) and (12 months period between October 2006 and October 2007) and the average value was found to be 26 cents/kWh and 25 cents/kWh respectively. Nevertheless, neither value would result in significant changes in the IRR analysis as presented in the sensitivity analysis / 21// 22/. DNV was able to compare the input parameters for the financial analysis included in the PDD with the parameters stated in the various contracts, agreements, as well as other relevant document, and was able to confirm the values applied are consistent with the values stated in the mentioned before.

4.4.5 Investment analysis: Calculation and conclusion

The IRR calculations were provided in a spreadsheet. The calculations were verified and found to be correct by DNV. The assumptions used in the calculations were also deemed to be correct by DNV. The power capacity of 0.5 MW for the landfill on-site production used in the spreadsheet is based on the actual consumption of power at the landfill, which was derived from the average value of actual electricity bills for the landfill operations. DNV was able to

verify from the electricity bills between May 2007 and October 2007 that the average loading on the landfill was 385kW (0.385 MW), hence the assumption of 0.5 MW was reasonable and conservative / 20/. In addition, DNV's further investigation shows that by taking a longer period between October 2006 and October 2007, the average peak load was found to be 382 kW as compared to 385 kW (May 2007 and October 2007), a mere 3kW or less than 1% difference / 20/. Since the PP has chosen a conservative value of 500kW (much higher than the 385kW (May 2007 and October 2007) or the 382 kW (October 2006 and October 2007) for the investment analysis, the value assumed for the on-site power consumption is acceptable and conservative to our opinion / 40// 41// 42/.

Between May 2007 and October 2007	Between October 2006 and October 2007
Average kWh consumption: 188 993 Average loading (peak) (kW): 385 Average cost per kWh : 26 cents	Average kWh consumption: 193 712 Average loading (peak) (kW): 382.3 Average cost per kWh : 26 cents

Based on the pricing analysis of the different gas engine sizes provided by the technology supplier / 30/, the project has decided to invest in 1 MW gas engine instead as the price difference between a unit of 1 MW (USD$ 864 000) and 720 kW (USD$ 677 000) gas engine is small and thus more economical to invest in an 1 MW gas engine instead. In addition, extra electricity generated from the genset can cater any future increase in electricity demand for on-site consumption or to be exported to the grid. The 2.2 MW used for grid connected power generation was based on the assumption that part of the power generated (assumed 200 kW) from the 1 MW gas engine for on-site utilisation can be sold to the grid on average.
As all the gas engines are anticipated to be connected to the same power system, it is possible to alternate the usage of the power generation for on-site use as well as export to grid. The actual amount of grid export will be dependent on the actual demand of the local grid. The amount will also be subjected to further negotiation between the PP and the power company. The measurement of electricity on-site utilisation and electricity export to grid has been included in the monitoring plan.

Phase1 (tentatively 2010)	Phase 2 (tentatively 2011)
1 MW genset for on-site consumption where 0.5 MW to be used onsite and any extra electricity will be exported to the grid (in PDD, assumed 0.2 MW from this gen-set will be sold to grid on average)	Additional 2 MW genset dedicated for grid export (negotiations are on-going and subjected to approval from TNB and Energy Commission of Malaysia)

The project activity without CER income was demonstrated to have a project IRR of 4.9%, as compared to the benchmark of 12% project IRR. This shows that the revenues generated by the project activity alone are too low to justify implementing the proposed project activity.

The inclusion of revenues from the sale of certified emissions reduction (CER) increases the IRR (after-tax) to 24.2%, thus making the project financially viable.

4.4.6 Investment analysis: Sensitivity analysis

The sensitivity analysis was conducted considering critical parameters like electricity tariff, power plant production hours, investment costs, on-site power consumption, feed-in tariff for on-site power and operating and maintenance costs (O&M) with variations of -10% to +10%. These parameters were considered the most critical because the electricity sale is the only revenue of the project activity, and increasing the revenue consequently increase the internal rate of return. The operational and maintenance (O&M) costs represent the main expenses of the project activity, reducing these costs consequently increases the internal rate of return. It was demonstrated from the analysis in all scenarios presented that the value of the IRR is always lower than the benchmark.

In addition, a sensitivity analysis considering at which value each parameter corresponds with the benchmark was carried out, and the results were: (i) +46.5% in electricity tariff, (ii) +25.6% in production hours, (iii) -31.8% in total investment cost and (iv) -122.5% in O&M cost. Considering that (i) it is unlikely the assumed tariff (19 cents/kWh) will exceed TNB's overall cost per unit of electricity sold which has remained at 21.2 cents/kWh in the financial year ending August 2007, (ii) the financial calculation assumes 90% capacity factor, an increase of 37% in production hours is not possible, (iii) unreasonable reduction in investment costs when global commodity prices are increasing, and (iv)) it is unreasonable to assume that the project activity can operate with zero O&M.

In response to EB's further clarification on minor corrections on 29 July 2009, the project proponent has included two more parameters for variation in the sensitivity analysis / 22/, which includes on-site consumption and feed-in tariff for on-site consumption and the results were:

i) an increase of 120% in on-site consumption will result in the project IRR reaching the benchmark, which is not possible considering that maximum fluctuations of the electricity consumption on-site, based on monthly records from Jun 2006 – May 2008 (TNB utility bills) has not exceeded a maximum of 23% of the yearly average consumption and it will not be likely that the on-site demand will be increase up to 120%. Furthermore it has been verified through the electricity bills that the assumed on-site consumption of 500kW applied in the IRR analysis is still above the maximum peak load recorded latest at the point of submission for registration / 40// 41// 42/, which was recorded only once in December 2007 (peak demand of 460 kW) or the maximum peak demand recorded in May 2007 and August 2007 (both months have peak demand of 400 kW), between the period of October 2006 and October 2007 / 40// 42/. The assumed peak load is also much higher than the average on-site consumption (peak demand of 385 kW) for different periods as discussed in Section 4.4.5; and
ii) an increase of 220% in the feed-in tariff for on-site consumption will result in the project IRR reaching the benchmark, which is unlikely due to the tariff (cost per kWh), based on monthly TNB utility bills, has been in the range of 24-26 cents/kWh for the period from Jan 07-May 08 / 40// 41/, which is similar to the assumed price 0.25 cents/kWh applied in the IRR calculations. DNV could confirm that the

probability for any of the parameters to reach those values is very low and this confirms that the project is not financially attractive for private investors.

In conclusion, DNV has checked the IRR calculation and the sources referred above and can confirm that the investment analysis and the sensitivity assessment have been correctly performed and show that the project activity is unlikely to be the most financially attractive option.

4.4.7 Barrier analysis

Step 3: Barrier Analysis:

Sub-step 3a: Identifying barriers that would prevent the implementation of type of the proposed activity

Investment barrier **–**During follow-up interviews, it was reported by the project participant that the project activity involves high capital investments and low electricity tariffs. In addition to it, the process to set-up selling of electricity to the national grid is commonly subjected to a lengthy application process and licensing conditions. DNV was able to verify that this is especially true as the lengthy process is related to difficulty in obtaining permits and approvals from relevant local authorities, and a more thorough technical and economic evaluation has been established by the Energy Commission.

Technological barrier **–** Although it has been argued that the technology is new and risk could arise from the implementation of the landfill gas recovery due to the lack of skilled manpower and management experience within the country, these are common for all such initiatives and not a decisive barrier. It still remains unclear why these technological barriers are prohibitive for the implementation of the project without the recognition as a CDM project and how these barriers are overcome by the CDM. Hence, DNV does not consider this barrier unique to the project type in question, and does not accept a technological barrier on this ground. The technological barrier has been removed in the additionality argument.

Lack of prevailing practice **–** The prevalent practice of waste management is open dumping and unmanaged landfill as it represents lowest cost option. DNV was able to verify that data as received from the National Solid Waste Management confirms that almost 90% of the dump sites in Malaysia are open dumps with no pollution control whatsoever. Thus the current waste management method and proposed project activity is already considered above industry standard. This was further confirmed following an interview with the representatives from the DNA of Malaysia / 45/.

Sub-step 3b- Eliminate alternative scenarios which are prevented by the identified barriers:

The identified barriers do not prevent scenarios (c) and (d) in Step 1, which is the continuation of the current practices of not collecting or utilizing LFG from the landfill and consumption of fossil fuel based grid electricity. Based on the results shown in investment analysis, the project participants have sufficiently justified that the savings and revenues of electricity will not be sufficient enough to overcome the investment involved.

4.4.8 Common practice analysis

Step 4 – Common Practice Analysis

Sub-step 4a – Analyze other activities similar to the proposed project activity

It was argued that open dumping remains the common practice in Malaysia. DNV was able to verify through the DANIDA Solid Waste Management Component, at the end of 2007, the state of Selangor had 11 dumpsites, where 5 remains open and only 1 has an operating landfill

gas system. Due to the unavailability of official data, the project participant has conducted a survey on the common practices in landfill management on national level. DNV was able to verify through data collected that the common practice in Malaysia is to not capture and destruct landfill gas.

Sub-step 4b – Discuss any similar options that are occurring

Similar project activities are found in Malaysia, but their implementation is a direct result of CDM. In addition, 2 landfill gas utilization projects have been registered as CDM projects at the point of validation. However the CERs have not materialized yet. Taking note of the guidance provided in EB 38 paragraph 60 on the common practice analysis, these landfill gas recovery projects undergoing CDM would not be considered in the common practice analysis. From the above arguments, it is DNV's opinion that passive venting are common practices in landfills in Malaysia.

In conclusion, the investment barrier and prevalent practice prevent the projects and emission reduction of the project activity is deemed additional to the situation without the CDM incentive.

4.5 Monitoring

The selected monitoring methodology is in accordance with the approved consolidated monitoring methodology ACM0001 "Consolidated methodology for landfill gas project activities" (Version 8) / 5/.

4.5.1 Parameters determined ex-ante

The monitoring plan is in accordance with the monitoring methodology. The monitoring plan will give opportunity for real measurements of achieved emission reductions. The following values were determined before the start of the project activity to determine the *ex-ante* estimation of projected landfill gas generation from the landfill:

1. Carbon emission factor for grid electricity in Peninsular Malaysia- (0.622, tCO_2/MWh):
   - Operating Margin (OM) factor for grid electricity, EF_{OM} – (0.598 tCO_2/MWh), and
   - Build Margin emission (BM) factor for grid electricity, EF_{BM} – (0.645 tCO_2/MWh)
2. Transportation and Distribution Loss (TDL_y) – 0.1 (10%);
3. Total waste in closed cell (advance cell) – (1 429 279.34 metric tonnes) / 33/;
4. Total waste in place (phase 1) – (219 863 metric tonnes until Feb 2008) / 33/;
5. Regulatory requirements relating to landfill gas projects, AF - (0); and
6. Global warming potential of methane, GWP_{CH4} - (21).

The total quantity of waste deposited at the landfill is the actual amount recorded by weighbridge, records were verified on-site / 33/. The grid electricity emission factor is determined using the '*tool to calculate the emission factor for an electricity system*". Details such as the OM & BM and the procedure to arrive at the CEF are elaborated in Section 4.6.

The following 2006 IPCC default values for waste generation were used:

1. Oxidation Factor, OX – 0.1 (managed landfill, this was verified through site visit);
2. Fraction of Degradable Organic Carbon Dissimilated, DOC_f – 0.5;
3. Methane Correction Factor, MCF – 1.0 (managed solid waste disposal sites, this was verified through site visit);
4. Model correction factor to account for model uncertainties – 0.9 (90%);

5. Fraction of Methane (CH_4) in Landfill Gas, F – 0.5;
6. Methane Density - (D_{CH4}, 0.0007168 tonne/m^3),
7. The following factors for the different waste categories is chosen based on an average of three actual waste characterization samples taken from Bukit Tagar Landfill in 2005 / 32/:

Waste category	Degradable organic carbon (DOC)	Fraction of waste sampled (percentage)	Decay factor of solid waste (k)
Food waste	0.15	47.51	0.4
Garden/Park wastes	0.2	2.72	0.17
Paper/Cardboard	0.4	18.54	0.07
Wood	0.43	4.41	0.035
Textiles	0.24	2.13	0.07
Nappies	0.24	3.81	0.17

The test results of the waste characterization were verified on site and were found to be in line with the figures reported in the PDD / 32/. For *ex-ante* estimate of LFG flared, since the project activity will be installing an enclosed flare, a flare efficiency of 0.9 was used; this is in accordance with the "*tool to determine project emissions from flaring gases containing methane*" / 7/. The values chosen were deemed acceptable by DNV.

4.5.2 Parameters monitored ex-post

The monitoring of the following GHG indicators will allow for an *ex-post* determination of emissions reductions:

1. Amount of LFG captured (m^3), measured;
2. Amount of LFG flared (m^3), measured;
3. Methane fraction in LFG (m^3CH_4/m^3 LFG), measured;
4. Pressure of LFG (Pa), measured;
5. Temperature of LFG (^oC), measured;
6. Temperature of the exhaust gas of the enclosed flare (^oC), measured;
7. Total auxiliary electricity consumed by the project activity (MWh), measured; and
8. Carbon emission factor of electricity (tCO_2/MWh), updated annually.
9. Monitoring of relevant policies and circumstances at the beginning of each crediting period

When the power plant becomes operational, the following parameters will also be monitored:

1. Amount of LFG combusted in the power plant (m^3), measured;
2. Amount of electricity exported to the grid (EG_{LFG}, MWh), measured.
3. The operation hours of the power plant (hours), measured.

As the LFG will be flared in an enclosed flare, the project correctly calculates the project emissions assuming a default flare combustion efficiency of 90%. Project emissions from flaring of the residual gas stream in year y, will be calculated based on the default values for the flare efficiency and the flow meter readings according to the *"Tool to determine project emissions from flaring gases containing methane"* / 7/.
The actual emissions reductions would be calculated *ex-post* based on the actual amount of methane captured and flared.

4.5.3 Management system and quality assurance

It was stated in the PDD that the monitoring and recording of the required parameters will be carried out by trained personnel who will be managed by a dedicated ER monitoring manager.

Some of the procedures required for proper project management include procedures for (a) addressing erroneous data measurements, (b) registration, monitoring, measurement and reporting, (c) handling of day-to-day records, (d) internal review of monitoring data, and (e) corrective actions. These procedures should be established and implemented prior to the start of the project activity and should be verified during first periodic verification

As the project construction has not begun at the point of validation, detailed procedures for training monitoring personnel have not being developed yet. The project design document has indicated that operator personnel will receive the necessary training required to operate and maintain the project activity. Training must be implemented before the start of the project activity. It has been confirmed during follow-up interview that training will be implemented before the start of the project activity. The application of the monitoring methodology is transparent and DNV considers the project participants able to implement the monitoring plan.

All critical data are either measured or calculated. The data will be archived for at least 2 years after the end of the crediting period.

4.6 Estimate of GHG Emissions

The emission reductions for LFG combustion will be directly monitored and calculated using the approach of the approved methodology, ACM0001 version 08 / 5/.

Baseline methane emissions from solid waste disposal

DNV was able to verify through The Solid Waste and Public Cleansing Management Act 2007 (Act 672) and Environmental Quality Act 1974 that no regulation for the collection and destruction of biogas currently exists in Malaysia. During the site visit, visual inspection by the auditor and interview with landfill operator has confirmed that no biogas was being burned at the gas wells of the landfill. It was also confirmed that no biogas had ever been burnt or uncontrolled flaring had occurred before at the closed advance cell. As such, no adjustment factor (AF) is introduced. The project host will monitor the regulatory requirement from regulatory agencies annually. Appropriate adjustment factor will be introduced at the renewal of the crediting period once directive is given.

Annual LFG generation by the landfill is estimated correctly and conforms to the First Order Decay (FOD) model of the 2006 IPCC Guidelines for National Green House Gas Inventories. Actual waste composition data collected and sampled in 2005 was applied in the FOD model / 33/. Three waste characterization samples from Bukit Tagar Landfill were conducted by an external accredited lab in 2005 and the results have been verified on-site and included as

Annexes in the PDD. It was verified on-site that there are currently no systems in place to segregate the waste delivered to the landfill to allow proper waste characterization / 32/.

The total quantity of waste deposited at the landfill is the actual amount recorded by weighbridge. The calculation has assumed 5% annual increment of wastes deposited in the landfill for *ex-ante* calculation purposes. DNV was able to verify through the waste monitoring records that the incoming waste amount has been growing an average of 11% since operation in 2005, hence the 5% increment in the waste collection for emission reduction estimation purposes is deemed conservative and appropriate. The historical waste amount received at the landfill from the start of operation in the landfill (2004) until December 2007 was verified on-site and is in line with the figures reported in the PDD / 33/.

It has been estimated that 50% and 40% of the LFG is captured in the closed cell (advance cell) and the second cell (phase 1) respectively in the project scenario, as compared to the baseline where there was no collection and combustion of landfill gas. It is DNV's opinion that the gas recovery efficiencies for both cells is reasonable as the gas extraction in the closed cell is likely to be more effective compared to the second cell, as the continuing operation on waste land filling in the second cell may reduce the collection efficiency. This is conservative as further investigation shows that landfill gas capture projects in well managed landfills are able to achieve higher efficiency rates of between 50-70%, due to better technology and better project management. This *ex-ante* emission reduction estimate is for reference only, as actual emissions reduction will be determined *ex-post* through direct monitoring of the destroyed methane.

Baseline methane emissions from electricity displacement

For the calculation of emission reductions due to the displacement of electricity from the grid, the calculation of grid emission factors for the plants use the *"Tool to calculate the emission factor for an electricity system"* / 9/, based on earlier study on the grid in Malaysia published by the Malaysia Energy Centre (PTM) / 11/, which DNV was able to verify that emission factor is based on the most recent data available at the time of the submission of the PDD for validation and has been recalculated using 2006 IPCC emission factors, in accordance to the applied *"Tool to calculate the emission factor for an electricity system"* / 10/. The calculation of the grid emission factor was conducted using the latest publicly available electricity generation data for West Malaysia (2003 to 2005). The Simple OM Method was used to calculate the Operating Margin (OM) because data for dispatch data analysis not available and low-cost/must-run power plants constitute less than 50% of the electricity generation, while the Build Margin (BM) was calculated using the set of power units that have been built most recently.

$CEF_{electricity}$ is the weighted average of the OM (0.598 tCO_2e/MWh) and BM (0.645 tCO_2e/MWh), and is equal to 0.622 tCO_2e/MWh, calculated *ex-ante*.

Project emissions

Project emissions for the project activity are due to the incomplete combustion of methane by the flaring and the consumption of grid electricity and/or fossil fuel in the project scenario.

a) *Project emissions from incomplete combustion ($PE_{,flaring}$)*- The combustion efficiency of the enclosed flare is claimed to be 99%. The combustion efficiency of the flare system is based on the manufacturer's specifications and is within the normal range for such equipment. For *ex-ante* calculation purposes, the project proponent calculates the project emissions assuming a default flare combustion efficiency of 90%, as stipulated in the

"Tool to determine project emissions from flaring gases containing methane" / 7/. The actual combustion efficiency will be monitored *ex-post*. The estimated project emissions from incomplete combustion are dependent on the quantity of methane that is sent to the flare.

b) *Project emissions from consumption of grid electricity and/or fossil fuel ($PE_{EC,y}$)*- The project emissions generated due to import of grid electricity during power plant down time have been taken into account. It was verified on-site that the project equipment will consume grid electricity during the crediting period. The Transportation and Distribution Losses (TDLy) value applied in this project is 10%. DNV was able to verify this value through the latest Tenaga National Berhad Annual Report 2007 / 17/. $PE_{EC,y}$ was calculated by multiplying the project's electricity consumption with the grid electricity emission factor ($CEF_{electricity}$).

As per ACM0001, no leakage is to be accounted for.

A review of the spreadsheet used for emissions calculations was conducted and it was verified that relevant formulas were used in the calculation of emissions reduction. Based on the calculations shown in the PDD and spreadsheet, the proposed project activity will generate emission reductions of 219 625 tCO_2e annually over its first 7 year crediting period. The baseline emission estimate can be replicated using the data and parameter values provided in the PDD and supporting files submitted for registration. The data sources mentioned have been verified by DNV. No other project emission or leakage sources contributing more than 1% and not mentioned by the methodology have been found. However, experiences with other landfills have shown that the methane generation and collection efficiency of the landfills projected by the first order decay model has an inherent uncertainty of almost 50% and hence the amount of CERs, which will be monitored *ex-post*, might vary from the projected amount.

4.7 Environmental Impacts

Malaysian environmental regulations do not require an EIA for the project activity, as it will be covered under the EIA for the existing landfill. No long term negative impacts are expected whilst the project activity is under operational conditions. The project will contribute to the improvement of the local environment around the landfill by collection and combustion of LFG and reduction of foul odours. The treated effluent from the leachate treatment facility is used for irrigation within the project site. The effluent standard for irrigation complies with the discharge standard (Standard B) under the Environmental Quality Sewage Regulations 1979 (under EQA 1974). Special allowance for the COD level has been granted by the Department of Environment (DOE).

4.8 Comments by Local Stakeholders

The project stakeholders were consulted through a series of stakeholder consultation meetings which were held from 22 January 2008 onwards at Eastin hotel, Selangor, Malaysia.

The stakeholders were invited to the meeting through invitation letters issued by the project host and also press release of stakeholders meeting invitation on local newspapers in English and local language. The meeting was attended by participants from all interested parties, such as officials from the local government, representatives from private companies and NGOs and the local people living in the area surrounding the landfill. A copy of the attendance list has been provided for review / 39/. DNV has confirmed that all important stakeholders were

invited to the meeting. Questions raised by the stakeholders were related to the technology and socio-economic impacts and its environmental impact. DNV has checked the comments received during the meeting and confirmed that no adverse comments were received / 39/. A summary of the comments received has been provided and due account has been taken for the issues raised.

DNV considers the local stakeholder consultation carried out adequate and in line with the national requirements.

4.9 Comments by Parties, Stakeholders and NGOs

The PDD of 25 March 2008 was made publicly available on DNV's climate change website (http://www.dnv.com/focus/climate_change/Projects/ProjectDetails.asp?ProjectId=1802) and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 8 April 2008 to 7 May 2008.

No comments were received during the 30 days commenting period.

APPENDIX A

CDM VALIDATION PROTOCOL

Table 1 Mandatory Requirements for Clean Development Mechanism (CDM) Project Activities

Requirement	Reference	Conclusion
About Parties		
1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3.	Kyoto Protocol Art.12.2	OK
2. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC.	Kyoto Protocol Art.12.2.	~~CAR 1~~ OK
3. The project shall have the written approval of voluntary participation from the designated national authority of each Party involved.	Kyoto Protocol Art. 12.5a, CDM Modalities and Procedures §40a	~~CAR 1~~ OK
4. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof.	Kyoto Protocol Art. 12.2, CDM Modalities and Procedures §40a	~~CAR 1~~ OK
5. In case public funding from Parties included in Annex I is used for the project activity, these Parties shall provide an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of these Parties.	Decision 17/CP.7, CDM Modalities and Procedures Appendix B, § 2	OK
6. Parties participating in the CDM shall designate a national authority for the CDM.	CDM Modalities and Procedures §29	OK
7. The host Party and the participating Annex I Party shall be a Party to the Kyoto Protocol.	CDM Modalities §30/31a	OK
8. The participating Annex I Party's assigned amount shall have been calculated and recorded.	CDM Modalities and Procedures §31b	OK
9. The participating Annex I Party shall have in place a national system for estimating GHG emissions and a national registry in accordance with Kyoto	CDM Modalities and Procedures §31b	OK

Requirement	Reference	Conclusion
Protocol Article 5 and 7.		
About additionality		
10. Reduction in GHG emissions shall be additional to any that would occur in the absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.	Kyoto Protocol Art. 12.5c, CDM Modalities and Procedures §43	OK Table 2, Section B.
About forecast emission reductions and environmental impacts		
11. The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change.	Kyoto Protocol Art. 12.5b	OK. Table 2, Section B.4 to B.7.
For large-scale projects only		
12. Documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, shall be submitted, and, if those impacts are considered significant by the project participants or the Host Party, an environmental impact assessment in accordance with procedures as required by the Host Party shall be carried out.	CDM Modalities and Procedures §37c	OK. Table 2, Section D.1.1 to D.1.6.
About stakeholder involvement		
13. Comments by local stakeholders shall be invited, a summary of these provided and how due account was taken of any comments received.	CDM Modalities and Procedures §37b	OK. Table 2, Section E.1.1
14. Parties, stakeholders and UNFCCC accredited NGOs shall have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available.	CDM Modalities and Procedures §40	OK. The PDD of 25 March 2008 was made publicly available on DNV's climate change

Requirement	Reference	Conclusion
		website (www.dnv.com/focus/climatechange) and Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 8 April 2008 to 7 May 2008. No comments were received.
Other		
15. The baseline and monitoring methodology shall be previously approved by the CDM Executive Board.	CDM Modalities and Procedures §37e	OK. Table 2, Section B.1.1
16. A baseline shall be established on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances.	CDM Modalities and Procedures §45c,d	OK
17. The baseline methodology shall exclude to earn CERs for decreases in activity levels outside the project activity or due to force majeure.	CDM Modalities and Procedures §47	OK
18. The project design document shall be in conformance with the UNFCCC CDM-PDD format.	CDM Modalities and Procedures Appendix B, EB Decision	OK The PDD is in conformance with CDM-PDD version

Requirement	Reference	Conclusion
		03.
19. Provisions for monitoring, verification and reporting shall be in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP.	CDM Modalities and Procedures §37f	OK Table 2, Section A.5.

Table 2 Requirements Checklist

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
A. General Description of Project Activity *The project design is assessed.*					
A.1. Project Boundaries *Project Boundaries are the limits and borders defining the GHG emission reduction project.*					
A.1.1. Are the project's spatial boundaries (geographical) clearly defined?	/ 1/	DR	Yes. The project will be located at Bukit Tagar Sanitary Landfill located in the vicinity of Mukim Sg. Tinggi, District of Hulu Selangor in the state of Selangor, Malaysia.		OK
A.1.2. Are the project's system boundaries (components and facilities used to mitigate GHGs) clearly defined?	/ 1/	DR I	Yes. The project's system is comprised of the landfill gas (LFG) collection system, an enclosed flaring system, LFG gas engine and power plant (1 MW for stage 1 & 2 MW for stage 2 planned). The electricity transmission to Peninsula Malaysia grid will be assessed and considered at later stage. Further specifications of the existing back-up diesel generator is also needed with regards to: a) Capacity and efficiency; b) Remaining operational lifetime; and c) How the generator-set will be used after project implementation.	~~CL 1~~	OK
A.2. Participation Requirements					

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Referring to Part A, Annex 1 and 2 of the PDD as well as the CDM glossary with respect to the terms Party, Letter of Approval, Authorization and Project Participant.					
A.2.1. Which Parties and project participants are participating in the project?	/ 1/	DR	Malaysia is the participating non-Annex 1 Party, while the Annex 1 Party is the Japan. Project participants are KUB-Berjaya Enviro Sdn Bhd (KBE) and participant from Japan is Japan Carbon Finance, Ltd. (JCF).		OK
A.2.2. Have all involved Parties provided a valid and complete letter of approval and have all private/public project participants been authorized by an involved Party?	/ 1/	DR I	The Letter of Approvals from Malaysia and Japan are pending.	~~CAR 1~~	OK
A.2.3. Do all participating Parties fulfil the participation requirements as follows: - Ratification of the Kyoto Protocol - Voluntary participation - Designated a National Authority	/ 1/	DR	**Host Country – Malaysia:** - Malaysia ratified the Kyoto Protocol on 4 September 2002 and Denmark ratified the Kyoto Protocol on 31 May 2002. - DNA of Malaysia: Conservation and Environmental Management Division, Ministry of natural Resources and the Environment; **Annex-1 Party – Japan** - Ratified the Kyoto Protocol on 4 June 2002. - DNA of Japan: The Liaison Committee for the Utilization of the Kyoto		OK

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			Mechanisms Ministry of Foreign Affairs, Climate Change Division, International Cooperation Bureau.		
A.2.4. Potential public funding for the project from Parties in Annex I shall not be a diversion of official development assistance.	/ 1/	DR	The project does not involve any public funding from an Annex I Party, and the validation did not reveal any information that indicates that the project can be seen as a diversion of official development assistance (ODA) funding towards Malaysia. This has been confirmed with the DNA of Malaysia.		OK
A.3. Technology to be employed *Validation of project technology focuses on the project engineering, choice of technology and competence/ maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is used.*					
A.3.1. Does the project design engineering reflect current good practices?	/ 1/	DR I	The project design engineering consists of construction and installation of the following equipment: a. LFG collection network b. LFG flare c. Electricity generating equipment and distribution lines for delivery of electricity to end users d. Monitoring and control system		OK

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A.3.2. Does the project use state of the art technology or would the technology result in a significantly better performance than any commonly used technologies in the host country?	/ 1/	DR	The project will employ proven technology and engineering approach in the design of the landfill gas extraction, flaring and electricity generation. Electricity generated by the project will be exported to the grid at later stages. The project activity involves a new technology which is not prevalent in Malaysia. Further description of the project activity is to be included in the PDD, specifically about biogas collections in the new and old phases of the landfill: a) Preliminary lining of the terrain; b) Nature and layout of the tubing and piping; c) Regular landfill operations; and d) Subsequent treatment of leachate.	~~CL 2~~	OK
A.3.3. Does the project make provisions for meeting training and maintenance needs?	/ 1/	DR I	The project design has indicated that operator personnel will receive the necessary training required to operate and maintain the project activity. Training must be implemented before the start of the project activity. It has been confirmed during follow-up interview that training will be implemented before the start of the project activity.		OK

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A.4. Contribution to Sustainable Development *The project's contribution to sustainable development is assessed.*					
A.4.1. Has the host country confirmed that the project assists it in achieving sustainable development?	/ 1/	DR	Confirmation from the DNA of the Malaysia that the project is in line with the sustainable development policies of the host country is pending.		OK
A.4.2. Will the project create other environmental or social benefits than GHG emission reductions?	/ 1/	DR	Yes, the project would be addressing the environmental, health and safety concerns of the local government and also help in creating a better environment for people residing in the immediate surroundings of the facility. The project will also promote technology related to LFG extraction, collection, flaring and for power generation.		OK
B. Project Baseline *The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.*					
B.1. Baseline Methodology *It is assessed whether the project applies an appropriate baseline methodology.*					
B.1.1. Does the project apply an approved methodology and the correct version thereof?	/ 1/	DR	Yes. The project correctly applies the baseline methodology of ACM0001, Version 8 *"Consolidated baseline methodology for*		OK

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			landfill gas project activities" of EB 36 and also the *"Tool to determine project emissions from flaring gases containing methane".*		
B.1.2. Are the applicability criteria in the baseline methodology all fulfilled?	/ 1/	DR	Yes. The project activity conforms to the applicability criteria of ACM0001. The project is a landfill gas capture activity, where the baseline scenario is the total atmospheric release of the gas. The project activity involves the use of captured gas for electricity generation, and the flaring of excess gas. The electricity generated by the project will be initially used on-site and export to the Peninsula Malaysia grid is scheduled in 2010.		OK
B.2. Baseline Scenario Determination *The choice of the baseline scenario will be validated with focus on whether the baseline is a likely scenario, and whether the methodology to define the baseline scenario has been followed in a complete and transparent manner.*					
B.2.1. What is the baseline scenario?	/ 1/	DR I	The baseline scenario is that of the current landfill operational and management practices; carried out by using controlled landfill and passive LFG venting. There are no mandatory laws, regulation or a national standard that forces the municipal governments to collect and flare methane or to use it for any other purpose. There is a		OK

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			total atmospheric release of LFG in the baseline scenario. Visual inspection and interview with landfill operator has confirmed that no biogas was being burned at the gas wells of the closed landfill site. It was also confirmed that no biogas had ever been burnt or uncontrolled flaring had occurred before at the closed advance cell.		
B.2.2. What other alternative scenarios have been considered and why is the selected scenario the most likely one?	/ 1/	DR I	The project correctly applies the approved baseline methodology ACM0001 "*Consolidated methodology for landfill gas project activities"*, (Version 8.1). *"The tool for the demonstration and assessment of additionality"*, version 04 of EB 36 was used to identify all realistic and credible baseline alternatives for this project. ***Step 1: Identification of alternatives to the project activity consistent with current laws and regulations*** ***Step 1a: Define alternatives to the project activity*** In the case of disposal of municipal solid waste (MSW), five alternatives have been identified: LFG1 – atmospheric release of the landfill gas or partial capture of landfill gas and destruction to comply with regulation or contractual agreements;	~~CL 3 CAR 2~~	OK

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			LFG2 – landfill gas is recovered for flaring without CDM; LFG3 – landfill gas is recovered for power generation on-site and flaring without CDM; LFG4 – the project activity not implemented as a CDM project; LFG5 – landfill gas is recovered for thermal energy generation and flaring without CDM. In the case of power generation, six alternatives have been identified: P1 – power generated from landfill gas undertaken without being registered as CDM project activity; P2 – existing or construction of a new on-site or off-site fuel fired cogeneration plant; P3 – existing or construction of a new on-site or off-site renewable based cogeneration plant; P4 – existing or construction of a new on-site or off-site fossil fuel fired captive power plant; P5 – existing or construction of a new on-site or off-site renewable based captive power plant; P6 – existing and/or new grid-connected power plants.		

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			Alternative LFG2 involves the flaring of captured gas and do not generate any revenue, this is not a viable option for the project host. Alternatives LFG4 and P1 were deemed to be not financially attractive to investors in lieu of cost and revenues. Further demonstration of the financial unattractiveness related to Alternatives LFG4 and P1 will be discussed in Section 4.4. Alternatives LFG5, P2, P3, and P4 generates both electricity and heat, however the technology supplier do not have the expertise in this field. In addition to it, there is no heat requirement for the project, hence these alternatives were not considered realistic since they are not in line with the Project Developer's core business. P5 is also not in the business expertise of the technology supplier and is not within the scope of the Project Developer's core business which involves the treatment of solid waste in landfills. This leaves alternatives LFG1 and P6, full atmospheric release of GHG emissions and existing supply of fossil fuel-based sources to the regional grid. Alternatives LFG2 and P6 would be the most likely baseline if the project participants are able to provide documentary evidence to support the claim that alternative LFG3 which involves		

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			electricity generation from biogas for on-site use, the savings of electricity will not be sufficient enough to overcome the investment involved. ***Step 1b: Consistency with mandatory laws and regulations*** Malaysia has existing Federal Laws and State policies in place, the Solid Waste and Public Cleansing Management Act 2007 and the Local Government Act 1976. It was verified that both legislations only address the requirement for final solid waste disposal in landfill, but no requirements for LFG collection or flaring. Hence, an adjustment factor (AF) has not been taken into account for this project activity. This is deemed acceptable based on the current ongoing practice in Malaysia which is open dumpsite and landfill with no gas capture. It was also confirmed with the DNA of Malaysia that the common practice in existing landfills in the country is still open dumpsites with no LFG collection. The project boundary is the site of the project activity where the gas is captured and subsequently flared or utilized for electricity generation and the connected grid where the generated electricity will be sold. The		

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			estimated quantity of LFG flared and utilized was selected as the baseline emissions indicator for this project. Step 2: *"Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable"* as stipulated in the methodology needs to be included in the PDD to identify all realistic and credible baseline alternatives for this project.		
B.2.3. Has the baseline scenario been determined according to the methodology?	/ 1/	DR	Yes. The project activity conforms to the applicability criteria of ACM0001, as the baseline scenario for the project is the total atmospheric release of the gas and the project activity is predominantly the capture and flaring of the gas. In addition, the project will utilize the extracted gas to generate electricity for running the gas extraction system and to export to the local grid. The electricity generation is scheduled to begin in 2010.		OK
B.2.4. Has the baseline scenario been determined using conservative assumptions where possible?	/ 1/	DR I	Yes.		OK
B.2.5. Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political aspirations?	/ 1/	DR I	Yes, there are no current laws and regulations for managing and controlling methane gas produced in controlled dumpsites or landfills. Malaysia has existing Federal Laws and State		OK

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			policies in place, the Solid Waste and Public Cleansing Management Act 2007 and the Local Government Act 1976. It was verified that both legislations only address the requirement for final solid waste disposal in landfill, but no requirements for LFG collection or flaring. Hence, an adjustment factor (AF) has not been taken into account for this project activity. This is deemed acceptable based on the current ongoing practice in Malaysia which is open dumpsite and landfill with no gas capture.		
B.2.6. Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced?	/ 1/	DR	Yes. The baseline scenario determination is compatible with the available data and all the literature sources were clearly referenced. An adjustment factor (AF) has not been taken into account for this project activity. This is deemed acceptable based on the current ongoing practice in Malaysia.		OK
B.2.7. Have the major risks to the baseline been identified?	/ 1/	DR	The material risk identified relates to the potential implementation of legislations and regulations requiring the destruction of LFG. To overcome this problem, the PDD will include the monitoring of laws and regulations at the beginning of each crediting period and this shall be incorporated in the procedures.		OK

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B.3. Additionality Determination *The assessment of additionality will be validated with focus on whether the project itself is not a likely baseline scenario.*					
B.3.1. Is the project additionality assessed according to the methodology?	/ 1/	DR I	Additionality is addressed through the use of *"The tool for the demonstration and assessment of additionality"*, version 04 of EB 36. ***Step 1: Identification of alternatives to the project activity consistent with current laws and regulations*** Step 1 has already been demonstrated in Section 4.3, where it was demonstrated that the most plausible baseline scenario is the continuation of current practice if it is demonstrated that the savings of electricity will not be sufficient enough to overcome the investment involved in Alternative LFG3. ***Step 2: Investment*** This step was not chosen by the project proponents. ***Step 3: Barrier Analysis:*** ***Sub-step 3a: Identifying barriers that would prevent the implementation of type of the proposed activity*** a) Investment barrier –During follow-up interviews, it was reported by the project participant that the project activity involves high capital investments and	~~CL 4~~ ~~CL 5~~ ~~CL 6~~ ~~CAR 3~~	OK

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			low electricity tariffs. In addition to it, the process to set-up selling of electricity to the national grid is commonly subjected to a lengthy application process and licensing conditions. DNV was able to verify that this is especially true as the lengthy process is related to difficulty in obtaining permits and approvals from relevant local authorities, and a more thorough technical and economic evaluation has been established by the Energy Commission. Evidence to substantiate the above statements has been provided for review and was found appropriate. Further information is required if the revenues from the electricity sales to the grid operator and savings from the purchase of electricity from grid would not be significant enough to overcome the investment risks/barriers associated with the project activity. b) Technological barrier – Due to the lack of technological know-how and suppliers locally, the project proponents have to source the technology from overseas suppliers and represent a barrier to the project proponent. However, it is unclear to how the barriers relating to lack of technological provider in Malaysia and		

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			import of technology from foreign country are significant enough to present technical challenges for the sustainability of the project activity. c) Lack of prevailing practice – The prevalent practice of waste management is open dumping and unmanaged landfill as it represents lowest cost option. DNV was able to verify that data as received from the National Solid Waste Management confirms that almost 90% of the dump sites in Malaysia are open dumps with no pollution control whatsoever. Thus the current waste management method and proposed project activity is already considered above industry standard. ***Sub-step 3b- Eliminate alternative scenarios which are prevented by the identified barriers:*** The identified barriers do not prevent scenarios (c) and (d) in Step 1, which is the continuation of the current practices of not collecting or utilizing LFG from the landfill and consumption of fossil fuel based grid electricity. This would be the most likely baseline if the project participants are able to provide documentary evidence to support the claim that alternative LFG3 which involves the electricity generation from biogas for on-		

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			site purposes, the project proponent needs to be demonstrate if the savings of electricity will not be sufficient enough to overcome the investment involved. ***Step 4 – Common Practice Analysis*** ***Sub-step 4a – Analyze other activities similar to the proposed project activity*** It was argued that open dumping remains the common practice in Malaysia. DNV was able to verify through DANIDA Solid Waste Management Component, at the end of 2007, the state of Selangor had 11 dumpsites, where 5 remain open and only 1 has an operating landfill gas system. An analysis of the status of landfill gas management in the State of Selangor was provided to substantiate the prevailing practice of disposal method for solid waste. More information is to be provided on the waste management practices on a national level. ***Sub-step 4b – Discuss any similar options that are occurring*** Similar project activities in Malaysia are either in the process of applying for CDM while 2 landfill gas utilization projects have been registered as CDM at the point of validation, however the CERs have not been materialized yet. It is thus demonstrated that landfill gas utilization project is not a		

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			common practice due to the perceived risks involved.		
B.3.2. Are all assumptions stated in a transparent and conservative manner?	/ 1/	DR	Yes.		OK
B.3.3. Is sufficient evidence provided to support the relevance of the arguments made?	/ 1/	DR	The project participants are required to provide sufficient documentary evidence to support the barriers identified in the barrier analysis.	~~CL 4~~ ~~CL 5~~ ~~CL 6~~	OK
B.3.4. If the starting date of the project activity is before the date of validation, has sufficient evidence been provided that the incentive from the CDM was seriously considered in the decision to proceed with the project activity?	/ 1/	DR	The starting date of the project activity was given as 27 May 2008. The starting date of the project activity is the earliest date of when the implementation, construction or real action begins. Evidences for the dates are requested.	~~CL 7~~	OK
B.4. Calculation of GHG Emission Reductions – Project emissions *It is assessed whether the project emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.*					
B.4.1. Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/ 1/	DR I	Project emissions for the project activity are due to the incomplete combustion of methane by the flaring and the consumption of grid electricity and/or fossil fuel in the project scenario. *Project emissions from incomplete combustion ($PE_{,flaring}$)*- The combustion	~~CL 8~~	OK

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			efficiency of the enclosed flare is claimed to be 99%. The combustion efficiency of the flare system is based on the manufacturer's specifications and is within the normal range for such equipment. However, for *ex-ante* calculation purposes, the project proponent calculates the project emissions assuming a default flare combustion efficiency of 90%, as stipulated in the "*Tool to determine project emissions from flaring gases containing methane*". The actual combustion efficiency will be monitored ex-post. The estimated project emissions from incomplete combustion are dependent on the quantity of methane that is sent to the flare. *Project emissions from consumption of grid electricity and/or fossil fuel ($PE_{EC,y}$)*- The project emissions generated due to import of electricity form the grid during plant down time have been taken into account. It was confirmed during the site visit that the project equipment will consume grid electricity or consume fossil fuel in the event of down time of the gas generator during the crediting period. $PE_{EC,y}$ was calculated by multiplying the project's electricity consumption with the grid electricity emission factor ($CEF_{electricity}$). $CEF_{electricity}$ was correctly calculated using power plant generation data obtained from		

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			Energy Commission of Malaysia. Power plant efficiencies were not available publicly. Therefore, efficiencies of power plants were determined based on type of power plant, obtained from a case study. The calculation of the grid emission factor was conducted using the latest publicly available electricity generation data for West Malaysia (up to the year 2005). The Simple OM Method was used to calculate the Operating Margin (OM) because data for dispatch data analysis is not available and low-cost/must-run power plants constitute less than 50% of the electricity generation, while the Build Margin (BM) was calculated using the set of power units that have been built most recently. $CEF_{electricity}$ is the weighted average of the OM (0.598 tCO_2e/MWh) and BM (0.645 tCO_2e/MWh), and is equal to 0.622 tCO_2e/MWh, calculated ex-ante. Further details on the calculation of the most recently available grid emission factor data released by the PTM/DANIDA needs to be included in the PDD. The emission reduction calculations need to be updated accordingly. The selected sources and gases are justified for the project activity.		
B.4.2. Have conservative assumptions been used when calculating the project emissions?	/ 1/	DR	The assumed combustion efficiencies of the flare are within the normal range for such		OK

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			equipment. The combustion efficiency of both the components will be monitored ex-post.		
B.4.3. Are uncertainties in the project emission estimates properly addressed?	/ 1/	DR	Uncertainties related to project emissions in B.4.1 need to be addressed.	~~CL 8~~	OK
B.5. Calculation of GHG Emission Reductions – Baseline emissions *It is assessed whether the baseline emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.*					
B.5.1. Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/ 1/	DR I	Yes. The following values were determined before the start of the project activity to determine the *ex-ante* estimation of projected landfill gas generation from the landfill: 1. Carbon emission factor for grid electricity- (0.622, tCO_2/MWh): o Operating Margin factor for grid electricity, EF_{OM} – (0.598 tCO_2/MWh), and o Build Margin emission factor for grid electricity, EF_{BM} – (0.645 tCO_2/MWh) 2. Total waste in closed cell (advance cell) – (1 429 279.34 metric tonnes); 3. Total waste in placed (phase 1) – (219 863 metric tonnes until Feb 2008);		OK

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			4. Regulatory requirements relating to landfill gas projects, AF - (0); and 5. Global warming potential of methane, GWP_{CH4} - (21). The total quantity of waste deposited at the landfill is the actual amount recorded by weighbridge, records were verified on-site. The grid electricity emission factor is determined using the '*tool to calculate the emission factor for an electricity system*". The following 2006 IPCC default values for waste generation were used: 1. Oxidation Factor, OX – 0.1 (managed landfill, this was verified through site visit); 2. Fraction of Degradable Organic Carbon Dissimilated, DOC_f – 0.5; 3. Methane Correction Factor, MCF – 1.0 (managed solid waste disposal sites, this was verified through site visit); 4. Model correction factor to account for model uncertainties – 0.9 (90%); 5. Fraction of Methane (CH_4) in Landfill Gas, F – 0.5; 6. Methane Density - (D_{CH4}, 0.0007168 tonne/m^3), and 7. Factors for the different waste categories is chosen based on an		

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			average of three actual waste characterization samples taken from Bukit Tagar Landfill in 2005. The test results of the waste characterization were verified on site and were found to be in line with the figures reported in the PDD. It was confirmed during follow-up interview that there are currently no systems in place to segregate the waste delivered to the landfill to allow proper waste characterization. During the site visit, DNV was able to verify through The Solid Waste and Public Cleansing Management Act 2007 (Act 672) and Environmental Quality Act 1974 that no regulation for the collection and destruction of biogas currently exists in the host country (Malaysia). Visual inspection and interview with landfill operator has confirmed that no biogas was being burned at the gas wells of the closed landfill site. It was also confirmed that no biogas had ever been burnt or uncontrolled flaring had occurred before at the closed advance cell. As such, no adjustment factor (AF) is introduced. The project developer will monitor the regulatory requirement from regulatory agencies annually. Appropriate adjustment factor will be introduced at the renewal of the crediting period once directive is given. Annual LFG generation by the landfill is		

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			estimated correctly and conforms to the First Order Decay (FOD) model of the 2006 IPCC Guidelines for National Green House Gas Inventories. Actual waste composition data collected and sampled in 2005 was applied in the FOD model. Three waste characterization samples from Bukit Tagar Landfill were conducted by an external accredited lab in 2005 and the results have been verified on-site and included in the PDD. It was confirmed during follow-up interview that there are currently no systems in place to segregate the waste delivered to the landfill to allow proper waste characterization. The total quantity of waste deposited at the landfill is the actual amount recorded by weighbridge. The PDD has assumed 5% annual increment of wastes deposited in the landfill for *ex-ante* calculation purposes. DNV was able to verify that the waste amount has been growing an average of 11% since operation in 2005, hence the 5% increment in the waste collection for emission reduction estimation purposes is deemed appropriate. The historical waste amount received at the landfill from the start of operation in the landfill (2004) until December 2007 was verified on-site and is in line with the figures reported in the PDD. It has been estimated that 50% and 40% of		

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			the LFG is captured in the closed cell (advance cell) and the second cell (phase 1) respectively in the project scenario, as compared to the baseline where there was no collection and combustion of landfill gas. The project proponent has explained that the gas extraction in the closed cell will be more effective compared to the second cell, as the continuing operation on land filling in the second cell may reduce the collection efficiency. This is conservative as further investigation from DNV shows that gas capture projects in well managed landfills are able to achieve higher efficiency rates of between 50-70%. The baseline emissions during the crediting period will be determined *ex-post* through on-site measurements of LFG extraction. The selected sources and gases are justified for the project activity.		
B.5.2. Have conservative assumptions been used when calculating the baseline emissions?	/ 1/	DR	Yes. PDD has assumed fraction of Methane (CH_4) in Landfill Gas of 0.5.		OK
B.5.3. Are uncertainties in the baseline emission estimates properly addressed?	/ 1/	DR I	The material risk identified relates to the potential implementation of legislations and regulations requiring the destruction of LFG. To overcome this problem, the PP has agreed to monitor the laws and regulations at every		OK

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			renewal period.		
B.6. Calculation of GHG Emission Reductions – Leakage *It is assessed whether leakage emissions are stated according to the methodology and whether the argumentation for the choice of default factors and values – where applicable – is justified.*					
B.6.1. Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner?	/ 1/	DR	As per ACM0001, Version 8, there is no need of accounting for leakage effects.		OK
B.7. Emission Reductions *The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change.*					
B.7.1. Are the emission reductions real, measurable and give long-term benefits related to the mitigation of climate change.	/ 1/	DR	Yes. The emission reductions were found to be real, measurable and shall give long-term benefits related to the mitigation of climate change.		OK
B.8. Monitoring Methodology *It is assessed whether the project applies an appropriate monitoring methodology.*					
B.8.1. Is the monitoring plan documented according to the approved methodology and in a complete and transparent manner?	/ 1/	DR	Yes. The monitoring plan is consistent with the monitoring methodology given in ACM0001, Version 8 and the "*Tool to determine project emissions from flaring gases containing methane*".		OK

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B.8.2. Will all monitored data required for verification and issuance be kept for two years after the end of the crediting period or the last issuance of CERs, for this project activity, whichever occurs later?	/ 1/	DR	All data collected as part of monitoring plan should be archived electronically and be kept after the end of crediting period. This was not stated in the PDD.	~~CL 9~~	OK
B.9. Monitoring of Project Emissions *It is established whether the monitoring plan provides for reliable and complete project emission data over time.*					
B.9.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period?	/ 1/	DR	Project emissions are due to the consumption of grid electricity and/or fossil fuel during the gas generators in the project scenario and from the incomplete combustion of methane by the flare. The monitoring plan provides for the measurement of both these parameters. As the LFG will be flared in an enclosed flare, the project correctly calculates the project emissions assuming a default flare combustion efficiency of 90%. Project emissions from flaring of the residual gas stream in year y, it will be calculated based on the default values for the flare efficiency and the flow meter readings according to the *"Tool to determine project emissions from flaring gases containing methane"* adopted in EB 28. It needs to be clarified what are the parameters that will be monitored in the crediting period to take into account of	~~CL 10~~ ~~CL 11~~	OK

* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			project emissions from flaring of the residual gas stream in year y. It was confirmed during the site visit that the project equipments will consume primarily grid electricity or electricity generated from fossil fuel powered diesel generator set in the event of down time of the gas generator during the crediting period. Electricity and/or fossil fuel consumption for on-site use is not monitored in line with the methodology.		
B.9.2. Are the choices of project GHG indicators reasonable and conservative?	/ 1/	DR	The choice of CH_4 and CO_2 as the project GHG indicator is reasonable.		OK
B.9.3. Is the measurement method clearly stated for each GHG value to be monitored and deemed appropriate?	/ 1/	DR	Yes. The parameters for project emissions will be measured on-site.		OK
B.9.4. Is the measurement equipment described and deemed appropriate?	/ 1/	DR	Yes. The measurement equipments are clearly described in the monitoring plan and are in line with the methodology's requirements.		OK
B.9.5. Is the measurement accuracy addressed and deemed appropriate? Are procedures in place on how to deal with erroneous measurements?	/ 1/	DR	Procedures on how to deal with erroneous measurements were briefly identified in the PDD and needs to be implemented at the latest prior to the start of the crediting period to enable subsequent verification of emission		OK

* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			reductions.		
B.9.6. Is the measurement *interval* identified and deemed appropriate?	/ 1/	DR	The measurement interval for the baseline emission data has been sufficiently described.		OK
B.9.7. Is the *registration, monitoring, measurement* and *reporting* procedure defined?	/ 1/	DR	The registration, monitoring, measurement and reporting procedures are not clearly defined in the PDD and needs to be implemented at the latest prior to the start of the crediting period to enable subsequent verification of emission reductions.		OK
B.9.8. Are procedures identified for *maintenance* of monitoring equipment and installations? Are the calibration intervals being observed?	/ 1/	DR	The gas analyzer used to analyse the gas contents in the exhaust gas of the flare will be calibrated by a suitable company according to the manufacturing recommendation. A formal set of maintenance and calibration procedures should be developed and implemented before the commencement of the project.		OK
B.9.9. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)	/ 1/	DR	Procedures for record handling are in the stages of implementation. These procedures should at the latest be implemented prior to commencement of the project.		OK
B.10. Monitoring of Baseline Emissions *It is established whether the monitoring plan provides for reliable and complete baseline emission data over time.*					

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CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
B.10.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period?	/ 1/	DR	The monitoring of the following GHG indicators will allow for an *ex-post* determination of emissions reductions: 1. Amount of LFG captured (m^3), measured; 2. Amount of LFG flared (m^3), measured; 3. Methane fraction in LFG (m^3CH_4/m^3 LFG); 4. Pressure of LFG (Pa), measured; 5. Temperature of LFG (^oC), measured; 6. Temperature of the exhaust gas of the enclosed flare (^oC), measured; 7. Carbon emission factor of electricity (tCO_2/MWh), updated annually. Monitoring of relevant policies and circumstances at the beginning of each crediting period needs to be included in the monitoring plan to adjust the baseline accordingly. When the power plant becomes operational, the following parameters will also be monitored: 1. Amount of LFG combusted in the power plant (m^3), measured; 2. Amount of electricity exported to the grid (EG_{LFG}, MWh), measured; and 3. The operation hours of the power plant	~~CL 12~~	OK

* MoV = Means of Verification, DR= Document Review, I= Interview

CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			(hours), measured.		
B.10.2. Are the choices of baseline GHG indicators reasonable and conservative?	/ 1/	DR	The choice of CH_4 and CO_2 as the project GHG indicator is reasonable.		OK
B.10.3. Is the measurement method clearly stated for each baseline indicator to be monitored and also deemed appropriate?	/ 1/	DR	Yes. The GHG values will be monitored through on-site measurement or calculations.		OK
B.10.4. Is the measurement *equipment* described and deemed appropriate?	/ 1/	DR	The measurement equipment for each parameter is clearly indicated in the PDD and is deemed appropriate.		OK
B.10.5. Is the measurement *accuracy* addressed and deemed appropriate? Are procedures in place on how to deal with erroneous measurements?	/ 1/	DR	Procedures on how to deal with erroneous measurements were briefly identified in the PDD and needs to be implemented at the latest prior to the start of the crediting period to enable subsequent verification of emission reductions.		OK
B.10.6. Is the measurement *interval* for baseline data identified and deemed appropriate?	/ 1/	DR	Yes. The measurement intervals are in accordance to methodology's requirements.		OK
B.10.7. Is the registration, *monitoring*, *measurement* and *reporting* procedure defined?	/ 1/	DR	The registration, monitoring, measurement and reporting procedures are in the stages of implementation.		OK
B.10.8. Are procedures identified for *maintenance* of monitoring equipment and installations? Are the calibration intervals being observed?	/ 1/	DR	Procedures for maintenance and calibration of monitoring equipment are in the stages of implementation. These procedures should at the latest be implemented prior to		OK

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CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			commencement of the project.		
B.10.9. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)	/ 1/	DR	Procedures for record handling are in the stages of implementation. These procedures should at the latest be implemented prior to commencement of the project.		OK
B.11. Monitoring of Leakage *It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.*					
B.11.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining leakage?	/ 1/	DR	Leakage need not be accounted for under ACM0001.		OK
B.12. Monitoring of Sustainable Development Indicators/ Environmental Impacts *It is assessed whether choices of indicators are reasonable and complete to monitor sustainable performance over time.*					
B.12.1. Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host country?	/ 1/	DR	There are no such requirements as per the applied methodology. Monitoring plan for sustainable development indicators has been submitted to the Local DNA as part of the requirement for LoA application. The plan has been accepted with the granting of LoA. This has been confirmed with the DNA of the Malaysia.		OK
B.13. Project Management Planning *It is checked that project implementation is properly*					

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CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
prepared for and that critical arrangements are addressed.					
B.13.1. Is the authority and responsibility of overall project management clearly described?	/ 1/	DR	Yes. The monitoring plan will be carried out by the project host and an independent consultant. Their roles and responsibilities are briefly highlighted in the monitoring plan.		OK
B.13.2. Are procedures identified for training of monitoring personnel?	/ 1/	DR	It was explained by the project host that the technology supplier will provide training to the operations and maintenance responsible of the project activity. The provisions for meeting training needs should be implemented prior to the start of the project activity.		OK
B.13.3. Are procedures identified for emergency preparedness for cases where emergencies can cause unintended emissions?	/ 1/	DR	It is unclear if emergencies that can affect the emission reductions are likely to occur. If yes, emergency preparedness procedures should at the latest be implemented prior to the commencement of the project.		OK
B.13.4. Are procedures identified for review of reported results/data?	/ 1/	DR	The procedures for review of reported data has been briefly described. These procedures should be implemented prior to the start of the project activity.		OK
B.13.5. Are procedures identified for corrective actions in order to provide for more accurate future	/ 1/	DR	The corrective action procedures have been briefly described. These procedures should		OK

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CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
monitoring and reporting?			be implemented prior to the start of the project activity.		
C. Duration of the Project/ Crediting Period *It is assessed whether the temporary boundaries of the project are clearly defined.*					
C.1.1. Are the project's starting date and operational lifetime clearly defined and evidenced?	/ 1/	DR	The starting date of the project activity was given as 27 May 2008. The starting date of the project activity is the earliest date of when the implementation, construction or real action begins. Evidences for the dates are requested. The project is expected to have an operational lifetime of 21 years.	~~CL 7~~	OK
C.1.2. Is the start of the crediting period clearly defined and reasonable?	/ 1/	DR I	A renewable crediting period starting on 1 January 2009 is selected. It was confirmed during follow-up interviews that the commissioning of the project activity is not likely to begin until March 2009. This needs to be revised and the emission reduction calculations need to be updated accordingly.	~~CL 13~~	OK
D. Environmental Impacts *Documentation on the analysis of the environmental impacts will be assessed, and if deemed significant, an EIA should be provided to the validator.*					
D.1.1. Has an analysis of the environmental impacts of the project activity been sufficiently described?	/ 1/	DR	No long term negative impacts are expected whilst the project activity is under		OK

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CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			operational conditions.		
D.1.2. Are there any Host Party requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved?	/ 1/	DR	An EIA was carried out for the existing landfill. The project activity does not fall under the category of activities requiring an EIA.		OK
D.1.3. Will the project create any adverse environmental effects?	/ 1/	DR	The project will contribute to the improvement of the local environment around the landfill by collection and combustion of LFG and reduction of foul odours.		OK
D.1.4. Are transboundary environmental impacts considered in the analysis?	/ 1/	DR	The project is not likely to produce any significant transboundary environmental impacts.		OK
D.1.5. Have identified environmental impacts been addressed in the project design?	/ 1/	DR	The project will contribute to the improvement of the local environment around the landfill by collection and combustion of LFG and reduction of foul odours.		OK
D.1.6. Does the project comply with environmental legislation in the host country?	/ 1/	DR I	Yes. An EIA approval letter was provided. The effluent standard for irrigation complies with the discharge standard (Standard B) under the Environmental Quality Sewage Regulations 1979 (under EQA 1974). Special allowance for the COD level has been grated		OK

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CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
			by the Department of Environment (DOE).		
E. Stakeholder Comments *The validator should ensure that stakeholder comments have been invited with appropriate media and that due account has been taken of any comments received.*					
E.1.1. Have relevant stakeholders been consulted?	/ 1/	DR I	Yes. The meeting was attended by participants from all interested parties, such as officials from the local government, representatives from private companies and NGOs and the local people living in the area surrounding the landfill. A copy of the attendance list has been provided for review.		OK
E.1.2. Have appropriate media been used to invite comments by local stakeholders?	/ 1/	DR I	Yes. The meeting was attended by participants from all interested parties, such as officials from the local government, representatives from private companies and NGOs and the local people living in the area surrounding the landfill. A copy of the attendance list has been provided for review.		OK
E.1.3. If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	/ 1/	DR I	The local stakeholder commenting process is deemed appropriate and in line with national requirements.		OK
E.1.4. Is a summary of the stakeholder comments received provided?	/ 1/	DR	Yes. A summary of the comments received has been provided.		OK
E.1.5. Has due account been taken of any stakeholder	/ 1/	DR	Questions raised by the stakeholders were		OK

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CHECKLIST QUESTION	Ref.	MoV*	COMMENTS	Draft Concl.	Final Concl.
comments received?			related to the technology and socio-economic impacts and its environmental impact. No adverse comments were received.		

* MoV = Means of Verification, DR= Document Review, I= Interview

Table 2b: Additional requirements checklist for VVM version 1 (EB 44)

A.1. Letter of approval					
A.1.1 Is the LoA received directly from the DNA or through the project participant.	/ 1/ / 2/ / 3/	DR	Both LoAs (Malaysia and Japan) were received from the project particpant.		OK
A.2. Project design					
A.2.1 Does the PDD describe the CDM project activity with all relevant elements in a transparent and accurate way?	/ 1/	DR	Yes, relevant elements in the project activity have been described transparently in the PDD following the response from project participant in CL 2.		OK
A.2.2 Has the CDM project activity at the start of the validation been constructed or does the CDM project activity use existing facilities or equipment?	/ 1/	DR	It was confirmed through on-site visit on 15 May 2008 that the proposed project activity has not been constructed yet.		OK
A.2.3 Is the project a large scale project, a small scale project with average annual emission reductions above 15 000 tonnes or a bundled small scale project? Has on-site visit been carried out?	/ 1/	DR	The project is a large scale project. On-site visit was carried out on 15 May 2008.		OK
A.2.4 Does the project activity involved alteration of existing installations? If so, have the differences between pre-project and post-project activity been clearly described in the PDD?	/ 1/	DR	The validation did not identify alteration of existing installations. All equipments related to the project activity will be purchased from the technology supplier.		OK
A.3. Project emissions not addressed by the methodology					
A.3.1 Does the methodology describe all project emission source for the project activity that contributes all 1% of the emission reductions? Sources that the methodology considers not to take into account are not relevant (e.g. cement and iron consumption for building hydropower plants).	/ 1/	DR	The validation did not identify other project emission or leakage soures which could contirbute more than 1% and not mentioned by the methodology. The methodology has sufficiently identified all sources of project emissions and these have been taken into account for the project emission calculations.		OK

A.4. Documentation of baseline emissions					
A.4.1 Documentation of the baseline determination: a. All assumptions and data used by the project participants are listed in the PDD and related document to be submitted for registration. The data are properly referenced. b. All documentation is relevant as well as correctly quoted and interpreted. c. Assumptions and data can be deemed reasonable d. Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD. e. The methodology has been correctly applied to identify what would occurred in the absence of the proposed CDM project activity	/ 1/	DR	a) Assumptions used by the project participants such as waste amount and characteristics in the landfill has been evidenced by DNV as listed in the PDD. 2006 IPCC default data are properly referenced. b) Documentation used in determining the baseline emissions are correctly quoted and interpreted. c) Data provided such as the waste amount and characteristics in the landfill and assumptions used such as the annual increment in waste volume is deemed reasonable to the local condition. d) Malaysia has existing Federal Laws and State policies in place, the Solid Waste and Public Cleansing Management Act 2007 and the Local Government Act 1976. It was verified that both legislations only address the requirement for final solid waste disposal in landfill, but no requirements for LFG collection or flaring. These have been considered and listed in the PDD. e) The project activity correctly applies ACM0001. The project is a landfill gas capture activity, where the baseline scenario is the total atmospheric release		OK

			of the gas.		
A.5. Documentation of the calculations					
A.5.1 Algorithms and/or formulae used to determine emission reductions • All assumptions and data used by the project participants are listed in the PDD and related document submitted for registration. The data are properly referenced • All documentation is correctly quoted and interpreted. • All values used can be deemed reasonable in the context of the project activity • The methodology has been correctly applied to calculate the emission reductions and this can be replicated by the data provided in the PDD and supporting files to be submitted for registration.	/ 1/	DR	a) Assumptions used by the project participants such as waste amount and characteristics in the landfill has been evidenced by DNV as listed in the PDD. 2006 IPCC default data are properly referenced in the PDD. b) Documentation used in the emission reduciton calculations are correctly quoted and interpreted. c) Site specific values have been used for baseline emisison calculation while assumptions used in the project emission calculation are deemed reasonable in both the local condition and project activity. d) Data provided in the PDD and supporting files submitted to DNV to verify the correctness of the data have been verified to be correct. Formulaes from the methodology have been correctly applied to calculate the emission reduction.		OK
A.6. Implementation of the monitoring plan					
A.6.1 How were the plans for implementation of the monitoring plan, data management, QA/QC procedures assessed? To what extent can the emission reductions achieved by the project by monitored ex-post and verified later by a DOE?	/ 1/	DR	The application of the monitoring methodology is transparent and DNV considers the project participants able to implement the monitoring plan.		OK
A.7. CDM consideration prior to starting date					

A.7.1 The prior consideration of CDM for the project activity complies with EB41 annex 46	/ 1/ / 26/ / 27/ / 28/	DR	The project starting date is defined as 27 May 2008. In accordance with paragraph 5 of EB41 Annex 46, for project activities with a start date before 2 August 2008, the project participants are required to demonstrate that CDM was seriously considered in the decision to implement the project activity. IN lieu of this, DNV was able to verify that: a) Awareness of the CDM prior to the project activity start date was demonstrated through the submission of consultancy quotation for CDM consultancy from Eco-Ideal Consulting Sdn. Bhd. to the project host, KUB-Berjaya Enviro after the project host decided to go ahead with the project activity, and b) Continuing and real actions were taken to secure CDM status for the project in parallel with its implementation through the signing of term sheet with Japan Carbon Finance (CER buyer) on 24 November 2007 and the appointment of Eco-Ideal Consulting Sdn. Bhd. as the CDM consultant on 3 December 2007. Hence, it is in the opinion of DNV that above discussion sufficient demonstrate that the prior consideration of CDM for the project activity complies with EB41 annex 46.		OK

Table 3 Resolution of Corrective Action and Clarification Requests

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CAR 1 The Letter of Approvals from the DNA of Malaysia and Japan are pending.	A.2.2. A.4.1.	Letter of Approval from DNA Japan (for Japan Carbon Finance Ltd.) was obtained on 29 July 2008. Attached. Final Letter of Approval from DNA Malaysia (for KBE) was obtained on 22 January 2009. Attached.	OK. The Letters of Approval from both Parties have been received. CAR is closed.
CAR 2 Step 2: *"Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable"* as stipulated in the methodology needs to be included in the PDD to identify all realistic and credible baseline alternatives for this project.	B.2.2.	Reference to relevant policies/regulations applicable included in the latest PDD (V5.2), dated 9 December 2008, page 15-16.	DNV was able to verify that although the Malaysian government is taking steps to secure environmentally sustainable supplies of energy, there is no regulation or policy regulate the contribution of fossil fuel powered plants in the national grid. Hence, all 6 power generation alternatives identified in Step 1a is in compliance with all applicable legal and regulatory requirements in Malaysia. CAR is closed.
CAR 3 It is unclear to how the barriers relating to lack of technological provider in Malaysia	B.3.1.	The description of technological barrier has been strengthened to reflect technical challenges in implementing	Though it is argued that the technology is new and hence risk could arise from the implementation of the landfill gas

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
and import of technology from foreign country are significant enough to present technical challenges for the sustainability of the project activity.		the project activity. Several references were made to justify the statements. Basically, the challenges of implementing such landfill gas recovery system in Malaysia are subjected to the following technological barriers: ➢ Different waste composition and conditions : foreign technology cannot be directly applied to the Malaysian conditions. The differences in baseline conditions (differences of site characteristics such as the cell design, management, depth of waste, quality and consistency of waste are all critical design considerations that require skills and knowledge in system design) presents a technology barrier in implementing a foreign technology from country such as Denmark. ➢ High leachate production: due to the high moisture of waste and high rainfall level (3000 mm in	recovery due to the lack of skilled manpower and management experience within the country, these are common for all such initiatives and not a decisive barrier. It remains unclear why these technological barriers are prohibitive for the implementation of the project without the recognition as a CDM project and how these barriers are overcome by the CDM. DNV does not consider this barrier unique to the project type in question, and does not accept a technological barrier on this ground. The technological barrier needs to be removed in the revised PDD. CAR is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		Malaysia compared to 600mm in Denmark[1]). Actual measurement of high leachate level in wells was provided. ➢ Consistency of landfill gas supply for power generation has proven to be a major challenge in implementing such projects. Technological know-how in design of landfill gas extraction system is required.	

[1] Source : MSN Encarta. (http://encarta.msn.com/encyclopedia_761577747_2/denmark.html). Accessed 1 August 2008.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CL 1 Further specifications of the existing back-up diesel generator is also needed with regards to: a) Capacity and efficiency; b) Remaining operational lifetime; and c) How the generator-set will be used after project implementation.	A.1.2.	The following was included in the latest PDD (V5.2), pg 8: a)There are three existing diesel generator sets at the Bukit Tagar site with the following capacity and efficiency: ➢ 100 kW – 85% ➢ 120 kW – 85% ➢ 750 kW – 85% b) These engines were put in placed before the grid power was available. With grid power available, one of generators has been used as a back up generator that is hardly utilized. The remaining operational lifetime is expected to be more than 20 years. c) With the implementation of the landfill gas power generation to replace the existing power source from the TNB national grid, the national grid will become the backup for the landfill gas power generation. It was confirmed with KBE's site operation manager that running backup from TNB grid is more cost effective compared to the diesel generators. Therefore, the diesel generator sets listed above will not be	OK. It is not likely that the existing back-up diesel generator will be replaced in the coming years as the remaining operational lifetime is more than 20 years. Since the landfill is grid connect, the project activity will source electricity from the cheaper and reliable source grid electricity. Grid electricity consumption will be monitored *ex-post*. CL is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		required upon the start of project. According to KBE, these generator sets would likely to be transferred to other sites (outside the landfill) that may require these generator sets. Due to this, these diesel generator sets will not be included in the project boundary.	
CL 2 Further description of the project activity must be included in the PDD, specifically about biogas collections in the new and old phases of the landfill: a) Preliminary lining of the terrain; b) Nature and layout of the tubing and piping; c) Regular landfill operations; and d) Subsequent treatment of leachate.	A.3.2.	Further description on the landfill included in the latest PDD (V5.2), pg 3. a) An explanation on the lining system of Bukit Tagar landfill included. b) Description of the gas collection piping system included. c) General operation of landfill included. d) Description of the treatment of leachate included.	Further description of the project activity and how biogas collections in the new and old phases will be carried out in the old landfill has been included in the PDD. CL is closed.
CL 3 Alternatives LFG1 and P6 would be the most likely baseline if the project participants are able to provide documentary evidence to support the claim that alternative LFG3 which involves electricity generation from biogas for on-site use, the savings of electricity will not	B.2.2.	A financial analysis was conducted for the alternative LFG3 which involves electricity generation from biogas for on-site use to replace the existing grid power without consideration of CDM. The finding from the financial analysis shows that electricity generation from biogas is not a financially viable option	OK. The finding from the financial analysis shows that electricity generation from biogas is not a financially viable option if the only revenue is from the energy savings of electricity.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
be sufficient enough to overcome the investment involved.		if the only revenue is from the energy savings of electricity. Please refer to excel sheet (KBE_Financial_1MW(on-site only)_rev3Nov.xls) attached.	CL is closed.
CL 4 Further information is required if the revenues from the electricity sales to the grid operator and savings from the purchase of electricity from grid would not being significant enough to overcome the investment risks/barriers associated with the project activity.	B.3.1.	Referring to the detail financial analysis done (see excel sheet "KBE_Financial_3MW (031108).xls"attached), it can be concluded that revenues from the electricity sales in addition to the National TNB Grid in addition to the savings from the purchase of electricity from grid would not be significant to overcome the investment barrier. The Project IRR (computed according to guide - Annex 45, EB 41 meeting) calculated without CDM is much lower than the selected Project IRR benchmark. It can also be demonstrated in the same excel sheet referred above that the project becomes financially attractive with extra income from the CDM revenue generated. The investment analysis is included in the PDD (V5.2), pg 17-21.	A benchmark analysis was carried out and DNV has checked the IRR calculation and the sources referred above and can confirm that the investment analysis and the sensitivity assessment have been correctly performed and show that the project activity is unlikely to be the most financially attractive option. CL is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CL 5 The sensitivity analysis was conducted considering critical parameters like electricity tariff, total capacity outlay, and O&M costs with variations of -10% to +10%. It was demonstrated from the analysis in all scenarios presented, the values of the IRR is always lower than the benchmark. However, it also needs to be shown by the PP at which variation for each parameter the IRR corresponds with the benchmark. Also, the project proponent needs to substantiate the likelihood of such level of variation would occur. In addition to it, the production hours of the power plant needs to be included as one of the parameters in the sensitvity analysis.		The variation of parameter to correspond to the Project IRR benchmark is included in the latest PDD (V5.2), pg 17-20.. Production hour is included as one of the parameters for the sensitivity analysis as proposed. Refer to PDD (V5.2), pg 20-21.	It was demonstrated from the analysis in all scenarios presented, the values of the IRR is always lower than the benchmark. In addition, a sensitivity analysis considering at which value each parameter corresponds with the benchmark was carried out and DNV could confirm that the probability for any of the parameters reach those values is very low and this confirms that the project is not financially attractive for private investors. CL is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CL 6 An analysis of the status of landfill gas management in the State of Selangor was provided to substantiate the prevailing practice of disposal method for solid waste. More information is to be provided on the waste management practices on a national level.	B.3.1.	Waste management practices on a national level were included in the latest PDD (V5.2), pg26-28. References to several official sources were made.	It was found from the published reference that most landfills in Malaysia are not recovering the LFG. New landfills practices passive venting without recovering LFG. The 4 landfills that are implementing LFG utilization are currently developed considering the benefits of CDM. CL is closed.
CL 7 The starting date of the project activity was given as 1 December 2008. The starting date of the project activity is the earliest date of when the implementation, construction or real action begins. Evidences for the dates are requested.	B.3.4.	The starting data of the project activity was revised to 27/5/2008. This corresponds to the date of appointment of EPC Contractor to undertake the gas recovery works. Refer to PDD (V5.2), pg53. Documentation evidence (Letter of Award) is attached.	The starting date of project activity has been revised to 27 May 2008. This corresponds to the date of appointment of EPC Contractor to undertake the gas recovery works. This is deemed the earliest date of when the implementation, construction or real action begins. CL is closed.
CL 8 Further details on the calculation of the most recent available grid emission factor data released by the PTM/DANIDA needs to be included in the PDD. The emission reductions calculation needs to be updated accordingly.	B.4.1.	The most recent grid emission data (2003-2005) was obtained from Malaysia Energy Centre (PTM). The calculation of CEF was revised and included in the latest PDD (V5.2),	OK. The most recent available grid emission factor released by the PTM/DANIDA (2003-2005) at the point of PDD submission has been recalculated using 2006 IPPC Guideline values instead of 1996 IPPC Guideline values.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
		pg41-43. 2006 IPPC Guideline values were applied. The calculated grid emission factor for TNB national grid is 0.622 t CO_2/MWh. Calculation excel sheet (Malaysia_power_baseline_PENINSULA_MALAYSIA_updated_05Aug08.xls) attached.	The resultant grid emission factor for Peninsula Malaysia grid has been revised from 0.631 t CO_2/MWh to 0.622t CO_2/MWh. This is more conservative. CL is closed.
CL 9 All data collected as part of monitoring plan should be archived and be kept after the end of crediting period. This was not stated in the PDD.	B.8.2.	This has been included in the latest PDD (V5.2), pg50.	OK. All data collected as part of monitoring plan will be archived and be kept after the end of crediting period. CL is closed.

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
CL 10 It needs to be clarified what are the parameters that will be monitored in the crediting period to take into account of project emissions from flaring of the residual gas stream in year y.	B.9.1.	The project will install a high temperature enclosed flaring system with flaring efficiency around 99% (technical specification by flare supplier included as documentation evidence - attached). The project however undertakes a conservative approach with the monitoring of project emissions from flaring by selecting the default value (90%) for enclosed flares. For this approach, continuous monitoring of compliance with manufacturer's specification of flare (temperature ($T_{flare,y}$), flow rate of residual gas at the inlet of the flare ($LFG_{flare,y}$)) will be performed. If in a specific hour any of the parameters are out of the limit of manufacturer's specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour. Refer to PDD (V 5.2) , pg. 50.	OK. The monitoring of flaring operations will be done in accordance with the "Tool to determine project emissions from flaring gases containing methane". CL is closed.
CL 11 It was confirmed during the site visit that the project equipments will consume primarily grid electricity or electricity generated from fossil fuel powered diesel generator set in the event of down time of the gas generator	B.9.1.	As explained under the responses to CL1 above, during the project activity, the backup power to the landfill gas power generation will be the TNB grid. Thus, the diesel generator set will not be applied. The monitoring of grid	OK. It was verified on-site that the project activity is grid connected and will be the primary source of power during gas engine downtime. Quantity of electricity consumed by the project activity will be monitored with

Draft report clarifications and corrective action requests by validation team	Ref. to checklist question in table 2	Summary of project owner response	Validation team conclusion
during the crediting period. Electricity and/or fossil fuel consumption for on-site use is not monitored in line with the methodology.		electricity consumed in the event of down time is included in the latest PDD (V5.2), pg 50.	electricity meter. The measured value will be used to determine the project emissions. CL is closed.
CL 12 Monitoring of relevant policies and circumstances at the beginning of each crediting period needs to be included in the monitoring plan to adjust the baseline accordingly.	B.10.1.	This monitoring has been included in the latest PDD (V5.2), pg50.	OK. Monitoring of change of policies and circumstances will be done by consultation with relevant governmental authorities (Department of Environment and Department of National Solid Waste Management Malaysia). CL is closed.
CL 13 A renewable crediting period starting on 1 January 2009 is selected. It was confirmed during follow-up interviews that the commissioning of the project activity is not likely to begin until March 2009. This needs to be revised and the emission reduction calculations need to be updated accordingly.	C.1.2.	The starting of crediting period has been revised to 1 July 2009 in the latest PDD (V5.2), p53.	OK. Starting date of crediting period has been revised to 1 July 2009. CL is closed.

APPENDIX B

CERTIFICATES OF COMPETENCE

CERTIFICATE OF COMPETENCE

Anu Chaudhary

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-9-8-i1-CDMJI-i1

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas					Jan 2009	Jan 2009
Renewables	*Hydro power*				Jan 2009	Jan 2009
	Wind power					
	Other renewable					
Biomass						
Grid connection of isolated system						
Cement						
Waste-heat / waste-gas recovery						
Efficiency of thermal power plants						
Coal mine methane						
Fuel switch						
Manure management						
Waste / wastewater treatment						
Energy efficiency						
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery						
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

Høvik, 9 January 2009

Michael Lehmann
Technical Director, Climate Change Services

CERTIFICATE OF COMPETENCE

Chee Keong Lai

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-9-8-i1-CDMJI-i1

GHG Auditor:	Yes

Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas		Jan 2009				
Renewables	*Hydro power*					
	Wind power					
	Other renewable					
Biomass		Jan 2009	Jan 2009			
Grid connection of isolated system						
Cement						
Waste-heat / waste-gas recovery						
Efficiency of thermal power plants						
Coal mine methane						
Fuel switch						
Manure management		Jan 2009				
Waste / wastewater treatment		Jan 2009				
Energy efficiency						
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery						
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

Høvik, 9 January 2009

Michael Lehmann
Technical Director, Climate Change Services

CERTIFICATE OF COMPETENCE

Yon Sing (Simon) Wong

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-9-8-i1-CDMJI-i1

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas						
Renewables	*Hydro power*					
	Wind power					
	Other renewable					
Biomass						
Grid connection of isolated system						
Cement						
Waste-heat / waste-gas recovery						
Efficiency of thermal power plants						
Coal mine methane						
Fuel switch						
Manure management						
Waste / wastewater treatment		Jan 2009				
Energy efficiency						
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery						
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

Høvik, 9 January 2009

Michael Lehmann
Technical Director, Climate Change Services