VALIDATION REPORT

BIOGAS PLANT AT UNITED PLANTATIONS BERHAD, ULU BASIR PALM OIL MILL PROJECT IN MALAYSIA

REPORT NO. 2009-9284

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DET NORSKE VERITAS

VALIDATION REPORT

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Recommended for approval: Hendrik W. Brinks	Approved by: Hendrik W. Brinks	Organisational unit: DNV Climate Change and Environmental Services
Client: Danish Energy Management		Client ref.: Henrik Rytter Jensen/ Ole

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Summary:
Project Name: Biogas Plant at United Plantations Berhad, ULU BASIR Palm Oil Mill
Country: Malaysia
Methodology: AMS-III.H
Version: 13
GHG reducing Measure/Technology: Methane recovery from wastewater treatment
ER estimate: 21 534tCO_2e per year (average)
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 "Biogas Plant at United Plantations Berhad, ULU BASIR Palm Oil Mill Project in Malaysia" project, as described in the PDD of 27 September 2010, meets all relevant UNFCCC requirements for the CDM and all relevant host Party criteria and correctly applies the baseline and monitoring methodologies of AMS-III.H (version 13). DNV thus requests the registration of the project as a CDM project activity.

Report No.: 2009-9284	Subject Group: Environment
Report title: Biogas Plant at United Plantations Berhad, ULU BASIR Palm Oil Mill Project in Malaysia	
Work carried out by: Muniandy, Kamala Devi, Simon Wong Yon Sing	
Work verified by: Felipe Lacerda Antunes	

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Abbreviations

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction(s)
CSTR	Continuous stirred tank reactor
CH_4	Methane
CL	Clarification request
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
EFB	Empty fruit bunches
FAR	Forward Action Request
GHG	Greenhouse gas(es)
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of approval
LoI	Letter of intent
MPOB	Malaysian Palm Oil Board
NGO	Non-governmental Organisation
ODA	Official Development Assistance
PDD	Project Design Document
POME	Palm oil mill effluent
PKS	Palm kernel shell
tCO_2e	Tonnes of CO_2 equivalents
UNFCCC	United Nations Framework Convention on Climate Change
GWP	Global Warming Potential

1 EXECUTIVE SUMMARY – VALIDATION OPINION

Det Norske Veritas Certification AS (DNV) has performed a validation of the "Biogas Plant at United Plantations Berhad, ULU BASIR Palm Oil Mill*" project. 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 Malaysian DNA has provided written approval of voluntary participation in the project and confirmed that the project assists in achieving sustainable development /33/. *The participating Annex I country, Denmark, has also provided the letter of approval* /34/.

The host Party is Malaysia and the Annex I Party is Denmark. Both Parties fulfil the participation criteria and have approved the project and authorized the project participants. Conditional letter of approval from host party of Malaysia, has been obtained and submitted /2/. LOA was issued upon receiving validation report from DOE and confirmation from Department of Environment on project's compliance to Environmental Quality Act 1974. Letter of approval from Annex 1 Party (Denmark) has been issued and provided.

The project correctly applies the approved baseline and monitoring methodology AMS-III.H (version 13). By capturing and utilizing methane gas instead of passively venting it, the project results in reductions of CH_4 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.

It has been demonstrated that the project faces technological barrier and is thus 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 monitoring plan is in line with the approved methodology AMS-III.H (version 13). The monitoring plan makes sufficient provision for monitoring relevant project and baseline emission indicators. Detailed responsibilities and authorities for project management, monitoring and reporting and QA/QC procedures have also been envisaged.

The ex-ante GHG emission estimations are calculated and documented in a complete and transparent manner. The algorithm and methodologies for accounting GHG emissions are appropriate and the total emission reductions from the project are estimated to be 215 335 tCO_2e over the selected 10 year fixed crediting period.

In summary, it is DNV's opinion that the "Biogas Plant at United Plantations Berhad, ULU BASIR Palm Oil Mill" project as described in the PDD of 27 September 2010, meets all relevant UNFCCC requirements for the CDM and all relevant host Party criteria and correctly applies the baseline and monitoring the approved methodologies AMS-III.H (version 13). DNV thus requests the registration of the project as a CDM project activity

2 INTRODUCTION

Danish Energy Agency has commissioned Det Norske Veritas Certification AS (DNV) to perform a validation of the Biogas Plant at United Plantations Berhad, ULU BASIR Palm Oil Mill 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, the simplified modalities and procedures for small-scale CDM project activities 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, the simplified modalities and procedures for small-scale CDM project activities and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology AMS-III.H. The validation was based on the recommendations in the Validation and Verification Manual /35/

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 tables list the documentation that was reviewed during the validation.

3.1.1 Documentation provided by the project participants

/1/ Mr. Henrik Rytter Jensen and Mr. Ton Hansen: *CDM-PDD for project activity "Biogas Plant* at United Plantations Berhad, ULU BASIR Palm Oil Mill*" in Malaysia*, Version 01 dated 06 Nov 2009, version 2 dated 11 Nov. 2009, and version 3 dated, 21 February 2010 and version 4 dated 27 September 2010.

/2/ Eco-Ideal Consulting Sdn Bhd: *Study on Clean Development Mechanism Potential in the Waste Sectors in Malaysia (Renewable Energy & Energy Efficiency Component (SUB-Component III: CDM Action Plan)*, December 2004

/3/ Malaysia Energy Centre (PTM) ,Clean Development Mechanism for Energy Sector (1 August 2008) :
CDM Electricity Baseline 2006/2007
http://cdm.eib.org.my//up_dir/articles1044,article,1233800431,CDMBaseline_06n07.pdf

/4/ Mr. Henrik Rytter Jensen and Mr. Ton Hansen: CER calculation *20100916 ULU BASIR CER Calculation.xls*

/5/ Mr. Henrik Rytter Jensen and Mr. Ton Hansen: *20100224 Expected revenues without CDM.xls*

/6/ Proposed biogas plant at Ladang Ulu Basir (tank layout): (No: LUB/106/09B) issued by Ulu Bernam Engineering Dept of UP Plantations Bhd, dated 21 November 2009

/7/ MPOB, Malaysian Oil Palm Statistics 2007, http://econ.mpob.gov.my/economy/annual/stat2007/Processing2.1.htm

/8/ A CDM development offer was discussed between Danish Energy Agency and UP Bhd. dated 18 February 2009

/9/ Notice for the appointment of project manager for the CDM project dated 27 February 2009

/10/ Prior consideration of the CDM Form, dated 4 November 2009, for 'Biogas Plant at United Plantations Bhd., Ulu Basir Palm Oil Mill'

/11/ A Letter of Intention (LoI) was signed between the Danish Ministry of Climate and Energy and UP Bhd. regarding the purchase of certified emission reductions dated 22 April 2009

/12/ United Plantations Bhd 613th Board meeting minutes, held 16 May 2009

/13/ Quarterly report to the Department of Environment for Ulu Basir Palm oil mill:

i- COD and BOD readings (July – September 2009)

ii- COD and BOD readings (April – June 2009)

/14/ UNITATA internal laboratory, test report for 17 August 2009 (Report no: ES/UBa/0008)

/15/ Confirmation for 'foundation works for biogas digesters', issued from United Plantations Bhd to Build Cont & Engineering Enterprise dated 6 July 2009

/16/ Application letter for approval of proposed project to the State Department of Environment dated 28 October 2009

/17/ Contract signed between United Plantations Berhad and Novaviro Technology Sdn Bhd for 'Design, supply, fabrication, installation, testing and commissioning of a 400m^3/d POME Biogas-capture anaerobic digester plant at United Plantations Berhad Ulu Basir Palm Oil Mill, Perak', dated 18 November 2009

/18/ Ulu Basir: Comparison of energy generated by diesel generator and renewable energy (turbine) for year 2007, 2008 and 2009

/19/ Ulu Basir: FFB production records from 1996 to 2008

/20/ Ulu Basir: 13 days measurement campaign COD analysis test results

/21/ Ulu Basir Estate: Application to Department of Environment on project intention and application for mill compliance to EQA 1974 (dated 28 October 2009)

/22/ Climate in Malaysia : http://www.climatetemp.info/malaysia/

/23/ Meeting invitation for stakeholder consultation for dated 3 July 2009

/24/ Notice of stakeholder consultation published on New Straits Times

/25/ Oil Palm process synopsis, Volume 1: Oil palm mill, systems and process by Noel Wambeck, June 1999 to determine the NCV of PKS

/26/ Standards & Quality News SIRIM 3/2006 Vol.13 No. 3 (Page 12)

/27/ Ministry of Energy, Water and Communications, PTM, DANIDA (December 2004). Study on Clean Development Mechanism Potential in the Waste Sectors in Malaysia

/28/ List of POME biogas CDM projects employing Novaviro-KS anaerobic digester technology:
http://novaviro.com.my/cdm-proj-list.pdf

/29/ Anaerobic digestion news dated 18 December 2008: Four killed by biogas in digester tank in Philippines
http://anaerobic-digestion-news.blogspot.com/2008/12/four-killed-by-biogas-in-digester-tank.html

/30/ New Straits Times dated 26 January 2010 : Man killed in biogas explosion
http://www.nst.com.my/Current_News/NST/articles/31kill/Article/index_html

/31/ The Hindu dated 27 August 2009: Four killed in explosion at Aluva biogas plant
http://www.thehindu.com/2009/08/27/stories/2009082761930100.htm

3.1.2 Letters of approval

/32 Kementerian Sumber Asli dan Alam Sekitar (DNA of Malaysia) (Ref: NRE(S)62.120.010.001.002/013 Jld.10): Conditional Letter of Approval, dated 26

October 2009

/33/ Kementerian Sumber Asli dan Alam Sekitar (DNA of Malaysia): *Letter of approval* dated 2 March 2010

/34/ Danish Energy Agency (DNA of Annex I Party): *Letter of approval* dated 12 Feb 2010

3.1.3 Methodologies, tools and other guidance by the CDM Executive Board

/35/ CDM Executive Board: *Validation and Verification Manual.* Version 01.1

/36/ CDM Executive Board : Appendix B of the simplified modalities and procedures for a small-scale CDM project activities

/37/ CDM Executive Board: *Baseline and monitoring methodology AMS-III.H*, version 13

/38/ CDM Executive Board: G*rid connected renewable electricity generation*", AMS-I.D version 15 of EB50

/39/ CDM Executive Board: "The tool for the demonstration and assessment of additionality", version 5.2 of EB39.

/40/ CDM Executive Board: "*Guidance on the demonstration and assessment of prior consideration of the CDM"*, adopted at EB41

/41/ CDM Executive Board: "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption"*, Annex 7 of EB39.

/42/ CDM Executive Board: "*Tool to calculate the emission factor for an electricity system*", version 1.1 of EB 35

/43/ CDM Executive Board: "*Tool to determine project emissions from flaring gases containing methane"*, Annex 13 of EB28

/44/ Institute for Global Environmental Strategies (IGES): *2006 IPCC Guidelines for National Green House Gas Inventories*

3.1.4 Documentation used by DNV to validate / cross-check the information provided by the project participants

/45/ Federal Subsidiary Legislation of Malaysia: *Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987*, (www.doe.gov.my/v2/files/legislation/pua0362y1987.pdf)

/46/ Federal Subsidiary Legislation of Malaysia: *Environmental Quality (Licensing) Regulations 1977*,
http://www.doe.gov.my/v2/files/legislation/pua0198y1977.pdf

/47/ *"A Technical and Economic Analysis of Heat and Power Generation from Biomethanation of Palm Oil Mill Effluent"*, B.G. Yeoh, dated 14-16 January 2004
http://www.cogen3.net/doc/countryinfo/malaysia/TechnicalEconomicAnalysisCHPPalmEffluent_BG.pdf last assessed in 7 October 2008.

/48/ Parr, J., Smith, M.D. and Shaw, R.J., *"Wastewater Treatment Options"*, Waterlines, the Journal of Appropriate Technologies for Water Supply and Sanitation, April 2000.

/49/ Department of Environment Malaysia: Handbook #3: Industrial Processes & the Environment, Crude Palm Oil Industry, page 23 & 27

/50/ Safety Manual Biogas Plant (Section 1.4 : Fire and explosion safety)

/51/ Mohammad Dit , "*Palm Kernel Shell (PKS) is more than biomass for alternative fuel*

after 2005", MPOB International Palm Oil Congress 2007 (PIPOC 2007) (http://cdm.unfccc.int/Projects/DB/DNV-CUK1182238337.59/ReviewInitialComments/6MHGPZIM56I19DT6NGL30G9OGNTIOK)

3.2 Follow-up interviews with project stakeholders

On 9 December 2009, Kamala Devi Muniandy and Simon Wong Yon Sing of DNV visited United Plantations Berhad's Ulu Basir Estate and performed interviews with project stakeholders and Consultant (Danish Energy Management).

	Date	Name	Organization	Topic
/52/	9 December 2009	Mr. Ir V. Renganathan	Ulu Basir Estate	➢ Project technology. ➢ POME generation ➢ COD of wastewater ➢ Mill licenses. ➢ Legal and environmental issues. ➢ Stakeholder consultation process. ➢ Monitoring plan and project management.
/53/	9 December 2009	Mr. Henrik Rytter Jensen, Mr. Tom Ha nsen	Danish Energy Management	➢ Project technology. ➢ Project participants. ➢ Applicability criteria. ➢ Additionality. ➢ CDM consideration. ➢ Baseline, Project and Emission reduction calculations.
/54/	9 February 2010	Ms Radin Diana R. Ahmad	DNA technical secretariat (Malaysia Energy Centre)	➢ The approval and environmental compliance of project ➢ Host country approval status. ➢ Legal and environmental requirements ➢ Stakeholder consultation requirement ➢ Common practice in Malaysia

- Sustainable development issues
- Electricity generation data
- Confirmation of grid emission factor

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

- *Revision to PDD as per the responses to the CAR's and CL's raised during the validation.*
- *Starting date and start of crediting period of the project activity.*
- *CER estimates have been revised.*

3.3 Resolution of outstanding issues

The objective of this phase of the validation is to resolve any outstanding issues which need 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 four tables. The different columns in these tables are described in the figure below. The completed validation protocol for the project activity "Biogas Plant at United Plantations Berhad, ULU BASIR Palm Oil Mill" in Malaysia is enclosed in Appendix A to this report.

A corrective action request (CAR) is raised if one of the following occurs:

(a) The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;

(b) The CDM requirements have not been met;

(c) There is a risk that emission reductions cannot be monitored or calculated.

A clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

A forward action request (FAR) is raised during validation to highlight issues related to project implementation that require review during the first verification of the project activity. FARs shall not relate to the CDM requirements for registration.

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**) or a **corrective action request (CAR)** if a requirement is not met.*

Validation Protocol Table 2: Requirement Checklist				
Checklist question	***Reference***	***Means of verification (MoV)***	***Assessment by DNV***	***Draft and/or Final Conclusion***
The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in different sections, following the logic of the CDM-PDD	*Gives reference to documents where the answer to the checklist question or item is found.*	*Means of verification (MoV) are **document review (DR)**, **interview (I)** or any other follow-up actions (e.g., on site visit and telephone or email interviews) and **cross-checking (CC)** with available information relating to projects or technologies similar to the proposed CDM project activity under validation.*	*The discussion on how the conclusion is arrived at and the conclusion on the compliance with the checklist question so far.*	*OK is used if the information and evidence provided is adequate to demonstrate compliance with CDM requirements. A c**orrective action request (CAR)** is raised when project participants have made mistakes, the CDM requirements have not been met or there is a risk that emission reductions cannot be monitored or calculated. A **clarification request (CL)** is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met. A **forward action request (FAR)** during validation is raised to highlight issues related to project implementation that require review during the first verification of the project activity.*

Validation Protocol Table 3: Resolution of Corrective Action and Clarification Requests			
Corrective action and/ or clarification requests	***Ref. to checklist question in table 2***	***Response by project participants***	***Validation conclusion***
*The **CARs** and/ or **CLs** raised in Table 2 are repeated here.*	*Reference to the checklist question number in Table 2 where the CAR or CL is explained.*	*The responses given by the project participants to address the CARs and/or CLs.*	*The validation team's assessment and final conclusions of the CARs and/or CLs.*

Validation Protocol Table 4: Forward Action Requests		
Forward action request	***Ref. to checklist question in table 2***	***Response by project participants***
The FARs raised in Table 2 are repeated here.	*Reference to the checklist question number in Table 2 where the FAR is explained.*	*Response by project participants on how forward action request will be addressed prior to first verification.*

Figure 1 Validation protocol tables

3.4 Internal quality control

The validation report underwent a technical review 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	***Last Name***	***First Name***	***Country***	Administrative	Desk review	Site visit / Interviews	Reporting	Supervision of work	Technical review	Expert input
CDM validator / technical team leader	Muniandy	Kamala Devi	Malaysia	√	√	√	√			
CDM Validator with sectoral knowledge	Wong	Yon Sing	Malaysia			√				√
Technical reviewer	Antunes	Felipe Larceda	Brazil						√	

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 project design documentation of 27 September 2010 /1/.

4.1 Participation requirements

The project participants are United Plantations Berhad of host Party of Malaysia and Ministry of Climate and Energy from Annex I Party of Denmark. The host Party (Malaysia) and the Annex I Party (Denmark) meet all relevant participation requirements.

Written approvals of voluntary participation from the DNAs of Malaysia and Denmark have been received /33//34/.

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.

4.2 Project design

The project activity involve implementation of an anaerobic digester at an existing wastewater treatment system at Ulu Basir Palm Oil Mill of United Plantations located in Ladang Ulu Basir of Perak state of Malaysia.

The proposed project activity involves the installation of a closed anaerobic digester system to replace the existing open anaerobic lagoons for the treatment of POME. Biogas generated in the process will be captured and utilized in the existing biomass boiler as supplementary fuel to biomass waste. Excess methane will be flared in a closed flare system.

The project involves diverting the POME (palm oil mill effluent) generated from the mill to the anaerobic digester. The treated discharge from the digester will be sent to existing lagoons which will still be operating. The treated POME and sludge is currently pumped and land applied through piping system throughout the plantation area.

The energy demand of the palm oil mill is supplied by biomass boiler for generation of electricity for own use and general purpose for workers quarters. When mill is not in operation or during shutdown, grid electricity will be used to supply electricity to workers quarters. Only on occasions when there is power failure from the grid, will the diesel generator be used. This only occurs at times when the mill is not in operation or during shutdown for maintenance when there is failure of grid electricity.

The starting date of the project activity is defined as 6 July 2009 /15/, corresponding to the date of the first contract related to the construction of the biogas plant. This is in compliance with EB's definition of first financial commitment to be used as the starting date of a project as the other contract was signed on 18 November 2009 /17/.

The project selects a fixed crediting period of 10 years, expected to start from 15 October 2010. The project activity is estimated to reduce a total of 215 335 tCO_2e emissions over a ten year fixed crediting period. The expected operational lifetime of the project is 20 years. The

20 year operational lifetime period has been chosen based on the agreement signed with technology provider /17/ which is deemed appropriate.

It was confirmed on-site /52/ that the project activity is not a de-bundled component of a larger project activity as there is no other small scale project activity with the same project participant, and in the same project category, and registered within the previous two years, and whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The project description is to the consideration of DNV complete and accurate.

4.3 Application of selected baseline and monitoring methodology

The project applies the simplified baseline methodology of type III.H (methane recovery in wastewater treatment) /37/ small-scale CDM project activity.

The project fulfils the following conditions under which AMS-III.H /37/ is applicable:

- It involves the introduction of an anaerobic digester to an existing wastewater system. DNV was able to confirm during site visit /52/ that the current practice involved open anaerobic lagoons system with no methane recovery;
- The existing wastewater treatment system has been verified on-site to have depth of of ponds is between 2.5 to 5.5 which is more than 2 metres /6/,
- The site where the project activity is based has tropical climate, with average ambient temperature of 25 ^{o}C to 30 ^{o}C (above 15^{o}C) /22/,
- The volumetric loading rate of existing baseline lagoon was calculated to be 65.5 kg COD/m^{3}day which is above 0.1 kg COD/m^{3}day, as demonstrated in the spreadsheet /4/,
- The recovered biogas from the above measures may also be utilized for the application of 'thermal or electricity energy generation directly' instead of combustion/flaring as confirmed from the project design document /17/,
- The approved baseline and monitoring methodology AMS-I.D /38/ is used for the electricity generation component of the project activity, and
- Ex-ante emission reduction is estimated lower than the 60 000 tCO_2e threshold as confirmed from the verified spreadsheet /4/.

Thus DNV was able to confirm that the proposed project applies the correct baseline and monitoring methodology of AMS-III.H version 13 /37/.

4.4 Baseline determination

The project applies the simplified baseline methodology of type III.H /37/ (methane recovery in wastewater treatment) small-scale CDM project activity as outlined in Appendix B of the simplified modalities and procedures for a small-scale CDM project activities /36/.

In line with the methodology AMS III.H, version 13 [para 23 (iv)] /37/, the baseline scenario for the methane component of the project is defined to be the existing anaerobic wastewater treatment system consisting of the open anaerobic lagoons, without methane recovery.

The baseline would have thus included all the methane generated in the open anaerobic lagoons being emitted into the atmosphere. DNV was able to confirm the pre-project practice

is anaerobic wastewater treatment system without methane recovery as confirmed during the site visit /52/. It was also verified with the representatives of local DNA /54/ that there are presently no regulatory or contractual requirements that enforce implementation of a specific wastewater treatment technology, such as anaerobic digester or aerobic treatment system to palm oil processing plants for effluent treatment. Current Malaysia regulation allows utilization of open lagoon systems for wastewater treatment in the palm oil industry.

The project boundary is clearly defined as the site of the project activity which includes site of the renewable generation source and wastewater treatment and soil application of POME/ sludge. The selected sources and gases are justified for the project activity.

The system boundaries can be presented in tabular format:

	GHGs involved	*Description*
Baseline emissions	*CH_4*	*Capturing methane emitted from the open lagoon system.*
Project emissions	*CO_2*	*Emissions from using diesel when the biomass cogeneration plant is not in operation.* *Emissions from the consumption of grid electricity*
	CH_4	*Emissions from methane released in flare system and the biogas recovery equipment*
Leakage	*No leakage*	*No transfer of equipment from another activity vice versa.*

The application of the baseline methodology is thus deemed to be transparent and conservative.

4.5 Additionality

The project developer has demonstrated the additionality of the project through the use of "The tool for the demonstration and assessment of additionality" version 5.2 of EB39 /39/.

4.5.1 Evidence for prior CDM consideration and continuous actions to secure CDM status

The starting date of the project activity is 6 July 2009, which is the date of the agreement for civil construction /6/. This is deemed acceptable as the earliest of financial commitments for the project activity, as other financial commitment, contract document for 'Design, supply, fabrication, installation, testing and commissioning of the project' was only signed on 18 November 2009 /17/.

CDM was seriously considered in the decision to proceed with the project activity (as per EB guidelines on the demonstration and assessment of prior consideration of the CDM) through the following actions:

Date	Event
18 February 2009	A CDM development offer was discussed between Danish Energy Agency and UP Bhd. after a preliminary visit on United Plantations in January 2009 /8/
27 February 2009	UP Bhd. has appointed the advisor for the development of the Ulu Basir biogas project under the CDM mechanism /9/
22 April 2009	A Letter of Intention (LoI) was signed between the Danish Ministry of Climate and Energy and UP Bhd. regarding the purchase of certified emission reductions /11/
16 May 2009	A board meeting was held on this day to discuss biogas capture project for both Ulu Basir and UIE palm oil mills. The board was also briefed on the technology (provided by Novaviro Technology) which has the potential to generate substantial revenue to support implementation of this project. The board unanimously approved the project /12/.
18 November 2009	Contract signed between United Plantations Berhad and Novaviro Technology Sdn Bhd for 'Design, supply, fabrication, installation, testing and commissioning of a 400m^3/d POME Biogas-capture anaerobic digester plant at United Plantations Berhad Ulu Basir Palm Oil Mill, Perak' /17/

Continued actions to secure CDM status from the starting date of 6 July 2009 /15/ in parallel with the physical implementation is demonstrated through the following:

31 July 2009	The PDD was submitted to Malaysian DNA for approval.
21 September 2009	The validation contract was signed between DNV and Danish Energy Agency (DEA).
26 October 2009	The Ulu Basir project was provided the conditional letter of approval from the Malaysian DNA.
5 November 2009	Notification of UNFCCC or DNA has also been demonstrated, received on 5 November 2009
13 November 2009	The validation started with the webhosting of the PDD

DNV was able to confirm that real actions to secure CDM status in parallel with the physical implementation of the project have been found satisfactory.

In accordance with "The tool for the demonstration and assessment of additionality" version 5.2 of EB39 /39/ the following step-wise approach has been demonstrated to assess additionality:

4.5.2 Identification of alternatives to the project activity

Two alternatives have been identified for the proposed project:

1. Closed anaerobic digester (without being registered as a CDM project activity)
2. Open anaerobic digester (continuation of the current situation)

Both alternatives comply with mandatory laws and regulations in Malaysia.

4.5.3 Barrier analysis (technological barrier)

In accordance with "The tool for the demonstration and assessment of additionality" version 5.2 of EB39 /39/ technological barrier has been identified would prevent the implementation of the proposed project CDM activity with the following justifications:

The technological barrier arises from 3 main factors: lack of infrastructure and risk of technological failures which lead to another barrier, namely safety risks. The mill where the project is located does not face a lack of energy sources through biomass boiler, diesel gen-set and grid electricity. It was also confirmed from site visit that there are also no potential nearby off-takers to utilize the gas generated. Infrastructure for the distribution of biogas to other users was not put in place. The transportation of methane to off-site utilization is limited and difficult to implement as it is not practical to liquidify methane, as evidenced through a third party reference (S. L. Tong and A. Bakar Jaafar) /25/. There is no incentive to implement such technology as confirmed with local DNA /54/. DNV is thus also able to confirm that the lack of a gas transmission and distribution network in the region does indeed pose as a barrier to the implementation of biogas distribution to any possible industrial users.There is however no difficulty in transporting biogas within the facility.

In addition, the risk of technological failure arises due to the unfamiliarity of the technology within the palm oil mill industry. The success of the project is highly dependent on the biogas generation in the anaerobic digester implemented. The biogas produced from the POME is also corrosive in nature as evidenced through a third party reference (SIRIM) /24/ and therefore requires additional treatment to ensure the existing boilers do not suffer from breakdown. The anaerobic digestion system requires ongoing precise management of a variety of elements in order to avoid disruptions to the anaerobic treatment process. A third party reference (Parr and Smith) /48/ clearly shows that anaerobic process requires precise management for the inflow or composition of the incoming wastewater. Reduced performance of the reactor affects the quality of the biogas generated and hence smooth operation of the generator-set. The interconnection of the systems involved requires constant and ongoing precise management of a variety of elements, water flows, pH etc. and therefore is challenging. The implementation of project activity also exposes the project proponent to additional safety requirements due to the explosive and combustible nature of methane. Appropriate measures and procedures have to be addressed by the project proponent in an effort to prevent accidents from occurring. This is confirmed from the safety manual that requirement of flame arrestors, special safety precautions with respect to electrical equipment and electronic instrumentation at the hazardous area. The strict zoning of boundaries are also

enforced at site to ensure IEC safety standards /50/. This demonstrates that the introduction of biogas to the site increases the risk of incidents arising from technological failure. This has been substantiated with various news and articles from recent accidents in biogas plants /29//30//31/.Theses barriers are all prohibitive in nature, as they prevent the project owner from venturing into the biogas project, as there is no immediate use of the gas, risk of technological failure and potentially explosion risks. The project would therefore not be implemented unless some sort of incentive is provided to install additional safety features.

As oppose to alternative 1, the current situation which is the operation of the open lagoon does not face any of the barriers mentioned above. In addition, DNV was able to verify through the biogas production estimated through the emission reduction calculations, in the absence of the sale of CER credits, the potential revenues from the partial displacement of PKS (RM 4.8 million @ PKS price of RM 107/ton /25/ over the operational period of 20 /5/ years through utilization of biogas in the biomass boiler, is not sufficient to cover the investment cost of the project activity (approximately RM 4.5 million) without considering other costs (O&M, fuel costs etc). By taking into consideration of the additional revenues from CDM, the significant contribution from CDM can alleviate the identified technological barriers that prevent the project from being implemented.

4.5.4 Common practice analysis

According to the latest statistics released by the Malaysian Palm Oil Board (MPOB) /7/ Malaysia has about 434 palm oil mills and most oil palm mills in Malaysia treat POME through the use of open anaerobic lagoons or tanks. This is due to its low capital costs and its ability to comply with existing effluent discharge standards. Treatment of POME in anaerobic digesters is not common due to its high capital costs and the lack of incentives for installing such treatment systems. Additionally, the existing practices of open anaerobic lagoon treatment are able to meet the environmental standards for the effluent discharge. It has been demonstrated based on public references that currently more than 85% of the palm oil mills use solely open pond systems and the remaining 10% uses open tank systems (B.G. Yeoh /47/ and PTM, DANIDA /27/). Currently, there are only 2 other biogas projects similar to the proposed project activity that have been implemented in palm oil mills in the past without the support of CDM. Both mills displace fossil fuel for power generation and thereby generating revenues from the avoided purchase of diesel. DNV has also verified that there are six similar projects which have been registered as CDM projects (UNFCCC # 916, 1153, 2181, 2185, 2330, 2332). Further, United Plantation's Ulu Basir Palm Oil Mill and UIE Palm Oil Mill Biogas projects and KDC Mill 1 & Mill 2 Biogas Project are under the process of validation. This clearly shows that such projects are implemented only with consideration of CDM /28/.

This demonstrates that the common practice for treatment of POME in Malaysia is still open lagoon.

Given the above, it is sufficiently demonstrated that the project activity is not a likely baseline scenario and that emission reductions are hence additional.

4.6 Monitoring

The monitoring plan is in line with the approved methodology AMS-III.H "*methane recovery in wastewater treatment*" version 13 /37/. This has also been correctly applied in the

monitoring parameters. The monitoring plan will give opportunity for real measurements of achieved emission reductions.

4.6.1 Parameters determined ex-ante

The following *ex-ante* values were provided for estimation of Baseline Emissions:

1. Methane correction factor for existing anaerobic wastewater treatment system "i"($MCF_{ww,treatement,i}$, 0.8),
2. Methane producing capacity of the wastewater ($B_{o,ww}$, 0.21 kg CH_4/kg COD), and
3. Global warming potential for methane ($GWP_{CH4,}$ 21 tCO_2e/ CH_4).

The plant operational parameters, which include the $COD_{y,removed,i}$ has been taken from mill's difference between influent and effluent from production data /14/ which is in accordance with methodology requirement to use at least 10 days data. Methane correction factor for existing anaerobic treatment system is deemed appropriate as the anaerobic lagoons have been confirmed to have depth between 2.5 to 5.5 meters /6/.

Degradable organic content of the untreated sludge (DOC_s) has assumed industrial sludge, in accordance with AMS-III.H, which DNV considers as appropriate.

The following *ex-ante* values were provided for Project Emissions:

a. Methane emissions on account of inefficiencies of wastewater treatment and presence of DOC in treated wastewater:

1. Methane producing capacity of the wastewater ($B_{o,ww}$, 0.21 kg CH_4/kg COD),and
2. Global warming potential for methane ($GWP_{CH4,}$ 21 tCO_2e/CH_4).
3. Methane correction factor based on type of treatment and discharge pathway of wastewater ($MCF_{ww,final}$, 0.1),
4. Emission factor for diesel fuel (EF_{diesel}, 1.3 tCO_2e/MWh),
5. Emission factor for grid electricity (EF_{grid}, 0.684 tCO_2e/MWh),
6. Average technical transmission and distribution losses for providing electricity to source *j* in year y ($TDL_{j,y,}$ 20%),
7. Methane producing capacity of the wastewater ($B_{o,ww}$, 0.21 kg CH_4/kg COD), and
8. Global warming potential for methane ($GWP_{CH4,}$ 21 tCO_2e/tCH_4).

Methane fugitive emission on the account of inefficiencies in capture and flare system as no sludge treatment will be involved in the project, capture and flare efficiency of combustion equipment ($CFE_{ww,combusted}$, 0.9).

The COD removal efficiency of digester (80%) has been sourced from the design document /17/ furnished by the technology provider which has been used as basis of removal efficiency calculated ex-ante for this project. DNV considers this as appropriate.

As the project involves flaring of excess biogas generated, the flaring efficiency has taken into consideration "Tool to determine project emissions from flaring gases containing methane" /42/. The capture and flare efficiency of combustion equipment has appropriately taken the default value in AMS-III. H /36/. The emission factor was verified to be 0.684

tCO_2/MWh for the grid the UIE mill is connected to, which was adopted accordingly from the 'Study on Grid Connected Electricity Baseline in Malaysia, Year 2006 and 2007' by the Malaysian Energy Centre /3/. DNV was able to verify through a detailed assessment of the grid emission calculation provided by Malaysian Energy Centre /54/ that:

a. *Ex-ante* Simple OM calculation was adopted as the low cost must run constitute less than 50% of the total grid generation in 2007;

b. *Ex-ante* Option (a) of the Build Margin calculation was adopted as the five most recently build power units comprises of the larger generation compared to the 20% of the system generation and that have been built most recently.

National data for the Net Calorific Value and fuel oil density was applied while the latest 2006 IPCC default values /44/ were applied for emission factors for other fuel sources in this study. As part of Malaysian Energy Centre procedures to ensure the information supplied is kept confidential as required by the data providers, a non disclosure agreement has been signed by the project participant and DNV prior to the Centre's releasing the data on the power plant for the CDM baseline emission factor. Nevertheless, DNV was able to verify the accuracy of the grid emission data calculation during the meeting /54/.

The values chosen in determining the project and emission emissions were verified and deemed acceptable by DNV.

4.6.2 Parameters monitored ex-post

The monitoring plan makes provisions for the measurement of the following parameters, which will allow for an *ex-post* assessment of emissions reductions:

1. Volume of wastewater treated in year *y* $Q_{y,ww}/m^3$ (measured),
2. Chemical oxygen demand of wastewater entering the anaerobic treatment system with methane capture in year *y*, $COD_{y,ww,untreated}$, t/m^3 (measured),
3. Chemical oxygen demand of the final treated wastewater in year *y* , $COD_{y,ww,treated}$/ t/m^3, (measured),
4. Methane correction factor of the disposal site that receives the final sludge, $MCF_{s,PJ,final}$ (recorded),
5. Amount of final sludge generated by the project wastewater treatment system in the year y (tonnes dry matter), $S_{final,PJ,y}$ /tonne (measured),
6. Amount of dry matter (tonnes dry mass) discharged to aerobic treatment , in the year y, $S_{PJ,y}$ / tonne (measured),
7. Total amount of electricity consumed by the project activity in the year y, $EC_{PJ,y,}$ MWh (measured),
8. Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h, $FV_{digester,h}$ Nm^3/h (measured)
9. Fraction of methane in the biogas $fv_{CH4,h}$ (measured),
10. Volumetric flow rate of the residual gas combusted in the boiler in dry basis at normal conditions in the hour h, $FV_{boiler,h}$, Nm^3/h (measured),

11. Volumetric flow rate of the residual gas flared in dry basis at normal conditions in the hour h , $FV_{flare,h,}$ Nm^3/h (measured),
12. Temperature in the exhaust gas of the flare, $T_{Flare,}$ °C (measured),
13. Detection of flame in boiler, D_{Boiler} (detection),
14. Efficiency of the enclosed flaring process which is based on a measurement of the fraction of time in which gas is combusted, FE (measured),
15. Detection of physical leakage of digester tanks for safety purposes (detection),
16. Quantity of electricity supplied to the mill from the grid in the year y, $EG_{grid,y,}$ kWh (measured),
17. Quantity of electricity generated from the diesel generator in the year y. $EG_{genset,y}$, kWh (measured),
18. Quantity of electricity generated from the biomass boiler in the year y, $EG_{biomass\ boiler,y}$ kWh (measured).

As biomass storage is not stored under anaerobic conditions in the baseline scenario, DNV also was able to confirm that the biomass storage is relatively short /52/ and will not result in anaerobic emissions. As usage of PKS sold by the mill will not be monitored by the mill, DNV considers there will be no anaerobic storage due to increasing demand of PKS in Malaysia after 2005 /51/. DNV considers that monitoring of biomass is not required.

The monitoring of these parameters will allow for an ex-post assessment of project and baseline emissions during the course of the project. In accordance to Para 30 of AMS-III.H /37/, ex-post emission reductions shall be based on the lowest value of the following:

a. The amount of biogas recovered and fuelled or flared (MD_y) during the crediting period, that is monitored ex-post;
b. Ex-post calculated baseline, project and leakage emissions based on actual monitored data for the project activity.

As a requirement in AMS-III.H, at anytime the temperature of the flare is below 500^oC, 0% default value would be used in the period and if in any specific hour any of the parameters is out of the range of specifications, 50% of default value should be used for this specific hour.

The monitoring method, equipment, interval and QA/QC procedures are acceptable and in accordance to the approved monitoring methodology. Calibration frequency will be in accordance with manufacturer specification.

Monitoring of leakage emissions is not required as the project equipment is not transferred from another project activity.

4.6.3 Management system and quality assurance

The monitoring and recording of the required parameters will be carried out by trained personnel who will be managed by a CDM 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) maintenance and calibration of monitoring equipment, (d) handling of day-to-day records, (e) training of monitoring personnel, (f) handling of emergencies situations, (g)

internal review of monitoring data, and (h) corrective actions. These procedures should be implemented prior to the start of the project activity.

Adequate training will be provided to relevant personnel before the commencement of the project. Relevant project management procedures will also be established and implemented before the commencement of the project.

All monitoring data will be archived for the crediting period plus 2 years beyond as per the approved monitoring methodology.

The application of the monitoring methodology is transparent and DNV considers the project participants able to implement the monitoring plan.

4.7 Estimation of GHG emissions

The formulas and factors used in the baseline and project emissions are in accordance with the approved baseline methodologies AMS-III.H, "*Methane recovery in wastewater treatment*" option (iv), version 13 of EB 48 /37/.

Baseline scenario: methane is emitted from the treatment of POME in the anaerobic lagoons.

In the baseline scenario, methane is emitted from the treatment of POME in the anaerobic lagoons. In accordance to paragraph 18(a) and 19 of AMS-III.H, the baseline emission is determined from the COD removal efficiency of the wastewater treatment system through the measurement campaign from minimum 10 days.

In addition, other baseline emission sources in paragraph 19 such as power consumption per m^3 of wastewater treated is not determined in the baseline as these are not used in the emission reduction calculations for the following justifications:

i. Power consumption per m^3 of wastewater treated – The existing lagoon system will still be in operation and consume power in the project scenario. However, this will be less than in the baseline scenario. Thus it is conservative not to include this emission source. All electricity consumption due to the project activity has been considered as project emissions (but zero baseline emissions as the equipment would not have been installed in the baseline scenario).

ii. Dry matter in sludge – No sludge is treated in the baseline, thus baseline emissions from sludge is not included.

iii. Final sludge generated per tonne of COD treated - Sludge generated by existing lagoon system is removed every 3-5 years and will be land applied as fertilizer in aerobic conditions, thus the baseline emission from this source is conservatively treated as zero.

Baseline emissions from anaerobic lagoons- The baseline emissions are estimated from the influent flow rate and the COD value at the digester inlet. The wastewater flow is an estimate from the operating days and wastewater produced from FFB processing, which is 0.7 m^3 POME/ton of FFB processed. The conversion factor was calculated through measurement campaign of the COD and flow of waste water for at least 10 days /20/. DNV was able to verify that the validity of this factor through publicly available reference on the palm oil mill studies /49/.

Due to the lack of one year historical records of the COD removal efficiency of the wastewater treatment system prior to the project implementation, a 13-day measurement campaign /20/ was performed on the open anaerobic lagoon system in accordance to the methodology which requires a minimum of 10 days. DNV further verify through the operational records of the palm oil mill and it is assessed that the measurement campaign was performed during the typical operation conditions by verifying the historical FFB production records in the mill which did not indicate significant deviation as compared to the period where the measurement campaign was conducted /19/. The values from the measurement campaign were applied and the result has been multiplied by 0.89 to account for the uncertainty range, in accordance with paragraph 18(a) of the methodology. For *ex-ante* determination of the *ex-ante* baseline emission calculation, the project proponent has estimated an output of 170 000 t-FFB to 200 000 t-FFB/year, which provides an estimated 127 500 to 150 000 m^3/yr of POME. The amount of POME will be monitored continuously in the project scenario. The formulae used in the calculation of the baseline methane emissions are transparently documented in the PDD.

The baseline emissions will be calculated based on the actual amount of methane recovered. The total baseline emission is calculated to be 250 112 tonnes CO_2e over the 10-year crediting period.

Project scenario: the total estimated project emissions are the sum of the (a) Fugitive emissions from the methane capture and flare system and (b) Emissions from grid electricity and diesel consumption due to the project activity.

Emissions from methane capture and flare system - The enclosed flare was assumed to have a combustion efficiency of 90%, as per "*Tool to determine project emissions from flaring gases containing* methane" (CFE_{flare}) /43/. The biogas generated by the digester will be primarily fed into the biogas burners and excess will be flared. The quantity of project activity emission from this source is dependent upon the volume of wastewater treated in the year ($Q_{y,ww}$), flare efficiency (CFE_{flare}) and the chemical oxygen demand removed by the digester ($COD_{y,removed,j}$). As the mill is running capacity of 70% /52/, DNV considers the remaining 30% when the methane is flared is when mill is not operating is deemed conservative. For *ex-ante* calculation purposes, a 90% or 0.9 default value for flare efficiency has been chosen (CFE_{flare}).

The project emissions from methane capture and flare system is calculated to be 6 694 tonnes CO_2e over the 10-year crediting period.

Emissions from electricity consumption due to the project activity- It was confirmed during site visit that main power supply of the mill is through the biomass cogeneration system, which is back-up with the electricity from grid and diesel generators. Verification of the 2008 engineering report of the Ulu Basir Palm Oil Mill confirms that diesel generators only constitute 1.6% of electricity generated used at the mill /52/. The diesel consumption in the mill has been reduced significantly since grid connection (diesel consumption of 62 995 litres in 2008 is reduced to 11 665 litres in 2009) and the primary back-up power source for the mill has been the grid /18/. As per paragraph 19 of the AMS-III.H /37/ emissions from electricity are determined as per the procedures described in the AMS-I.D /38/. In accordance with AMS-I.D paragraph 10(b), the weighted average emissions of the current generation mix and the data of the year in which project generation occurs was correctly applied and

transparently demonstrated in the calculation of project emissions from consumption of electricity /4/. In addition, it has been checked through the specification provided in the biogas plant construction contract /17/ that the anticipated total parasitic capacity of the feed system and the auxiliary facilities operating within the biogas plant is 0.08 MW. By applying a conservative assumption that these facilities run at full capacity for 8 760 hours per year, the *ex-ante* project power consumption was thus calculated to be 701 MWh.

Nevertheless for *ex-ante* calculation purposes, the project proponent has calculated the weighted average of the emission factor for the 3 sources with the following data:

i. 0.684 tCO_2/MWh for the grid /54/,

ii. 0.8 tCO_2/MWh applied for the diesel gen-sets (i.e. minimum capacity for the diesel genset on-site is 280 kW) as per Table I.D.1 /38/ ,and

iii. 0 tCO_2/MWh for biomass cogeneration system.

The *ex-post* project emissions will be monitored through the electricity meters installed in each 3 power sources to determine the kWh consumed multiplied with the respective emission factors determined *ex-ante*. Leakage has not been considered for the project due to that the renewable energy technology equipment is not transferred from another activity or to another activity.

Other project emissions accounted for in the methodology have been verified to be not taken into consideration for the following reasons:

Emission from degradable organic carbon in treated wastewater– Since the treated waste water from the anaerobic digester is discharged to existing aerobic treatment lagoons, and used for soil application in a well managed system, the $MCF_{discharge}$ is 0, and therefore no project emissions are accounted for in the project activity.

Emission from anaerobic decay of the final sludge- Final sludge is used for soil application under aerobic conditions in a well managed system, the MCF_{sludge} is 0, and therefore project emission is negligible.

Emission from biomass stored under anaerobic conditions– It was verified on-site that with the generation of biogas, the project activity will displace PKS, which will be subsequently sold on the market. Since the mill is already practicing the selling of excess PKS and that the storage of the biomass is less than 2 months, the project owner explained that due to the project activity, the increase volume of excess PKS to be sold will reduce the storage time as less time is needed to develop a quantity large enough for the bulk sale, hence it is reasonable that the storage of biomass will be less than 2 months. This storage time is below the “few months or longer” as stipulated in footnote 11 of AMS-III.H version 13, and thus not considered to induce anaerobic decay. Hence, project emission from storage of biomass under anaerobic conditions is negligible.

The emissions reductions due to project activity have been estimated to be averagely 21 534 tCO_2e/year. The baseline emission estimate can be replicated using the data and parameter values provided in the PDD and supporting files submitted for registration /4/. The data sources mentioned have been verified by DNV. The emission reduction forecast has been checked and it is deemed likely that the state amount is achieved given that the underlying assumptions do not change.

In summary, the GHG calculations are complete and transparent, and their accuracy has been verified. No other project emission or leakage sources contributing more than 1% and not mentioned by the methodology have been found.

4.8 Environmental impacts

The mill complies with their effluent discharge license, whereby treated effluent that is discharged to a watercourse will have a BOD concentration of less than 100 parts per million (ppm) /13/ as verified during site visit through a review of the mills' quarterly report to the Department of Environment. As the mill has yet to receive confirmation of proposed project approval, the application however has been sighted /16/. This is deemed acceptable as EIA is not required for the project activity as the project is not a prescribed activity or premise under the prevailing Environmental Quality (Environmental Impact Assessment) Regulations, 1987 /45/.

No adverse environmental impacts are foreseen. The summary of findings has been addressed in the project design document. It is expected to have positive environmental impacts as a result of reduced methane emissions and odour from the anaerobic ponds.

4.9 Comments by local stakeholders

Local stakeholders' comments were invited to a stakeholder consultation meeting that was held at BOP Club of Ulu Bernam Estate on 16 July 2009. The stakeholders were invited through written invitations /23/, notice at ferry terminal and local English newspaper, New Straits Times and Malay language newspaper, Berita Harian /24/. Representatives from local authorities, community and producer representatives were consulted as evidenced by the minutes of meeting, the attendance list and invitation letters. Summary of comments received from the stakeholders' consultation and due action taken were provided in the PDD. DNV was able to verify through follow-up interviews with the stakeholders that there were no negative comments received.

The local stakeholder consultation process is deemed appropriate and in line with national requirements.

DNV considers the local stakeholder consultation carried out adequate.

4.10 Comments by Parties, stakeholders and NGOs

The PDD, version 01 dated 11 Nov 2009, was made publicly available on the CDM website and Parties, stakeholders and NGOs were through the CDM website (http://cdm.unfccc.int/Projects/Validation/DB/PNWSICWN9ZNN42Z1Z7EW2KJ1NFK5ZO/view.html) invited to provide comments during a 30 days period from 13 Nov 2009 to 12 Dec 2009.

No comments were received.

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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	~~CAR 1~~ 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 Protocol Article 5 and 7.	CDM Modalities and Procedures §31b	OK
About additionality		
10. Reduction in GHG emissions shall be additional to any that would occur in the	Kyoto Protocol Art. 12.5c,	OK

Requirement	Reference	Conclusion
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.	CDM Modalities and Procedures §43	
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
About small-scale project activities (if applicable)		
12. The proposed project activity shall meet the eligibility criteria for small scale CDM project activities set out in § 6 (c) of the Marrakech Accords and shall not be a debundled component of a larger project activity.	Simplified Modalities and Procedures for Small Scale CDM Project Activities §12a,c	OK
13. The proposed project activity shall confirm to one of the project categories defined for small scale CDM project activities and use the simplified baseline and monitoring methodology for that project category.	Simplified Modalities and Procedures for Small Scale CDM Project Activities §22e	OK
14. If required by the host country, an analysis of the environmental impacts of the project activity is carried out and documented.	Simplified Modalities and Procedures for Small Scale CDM Project Activities §22c	NA
About stakeholder involvement		
15. 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	
16. 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	
Other		
17. The baseline and monitoring methodology shall be previously approved by the CDM Executive Board.	CDM Modalities and Procedures §37e	OK
18. 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
19. The baseline methodology shall exclude to earn CERs for decreases in activity	CDM Modalities and Procedures §47	OK

Requirement	Reference	Conclusion
levels outside the project activity or due to force majeure.		
20. 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 Requirements checklist

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A General description of project activity					
A.1 Title of the project activity					
A.1.1 Does section A.1 of the PDD include a clearly identifiable project title, version number of the PDD and date of the PDD?	/1/	DR	☒ Clearly identifiable title of the project activity ☒ Version number of the PDD is included ☒ Date of the PDD is included. Information with reference to project title, version number and date of PDD have been appropriately identified in the PDD.		OK
A.1.2 Is the PDD is in accordance with the applicable requirements for completing PDDs?	/1/	DR	☒ Yes *If no, list where the PDD is not in accordance:*		OK
A.2 Description of the project activity					
A.2.1 How was the design of the project assessed?	/1/ /17/	DR	*What type is the project?* ☒ Project in existing facility or utilizing existing equipment(s) ☐ Large scale project ☐ bundled small scale projects, each with emission reductions not exceeding 15 000 tCO_2e per year ☒ individual small scale project activity with emission reductions not exceeding 15 000 tCO_2e per year ☐ Greenfield project The project design has been confirmed, sighted from the contract signed between United Plantations Berhad and Novaviro Technology		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				Sdn Bhd. ☒ Physical site inspection ☒ Reviewing available designs and feasibility studies		
A.2.2	If a greenfield project, describe the physical implementation of the project when the validation was commenced.	/1/	DR	Project is not a greenfield project.		OK
A.2.3	If physical site visits were performed based on sampling (only applicable for bundled small scale projects, each with emission reductions not exceeding 15 000 tCO_2e per year), justify the sampling through a statistical analysis:	/1/ /52/	DR I	Only one site is applicable to this project activity, which was visited. Hence, sampling through site visit is not applicable.		OK
A.2.4	Is the description of the proposed CDM project activity as contained in the PDD sufficiently covers all relevant elements, is accurate and that it provides the reader with a clear understanding of the nature of the proposed CDM project activity?	/1/ /52/	DR I	Yes, as confirmed from site visit, the proposed CDM project activity has been appropriately described.		OK
A.2.5	Does the project activity involve alteration of existing installations? If so, have the differences between pre-project and post-project activity been clearly described in the PDD?	/1/ /52/	DR I	Pre-project scenario, wastewater was sent to aerobic lagoons and subsequently discharged for land application. Post-project activity however, wastewater will be sent to a closed anaerobic digester system (CSTR), and treated effluent will be sent to anaerobic ponds and subsequently discharged for land application. Existing biomass boiler will be retrofitted with a biogas burner of combustion of biogas captured. This has been clearly described in the PDD. However, it was verified at site that in the event of power failure and start up, electricity is imported from the grid. Fossil fuel diesel generator is also used occasionally in the event of grid power failure. PDD has not clarified this.	~~CL 1~~	OK
A.2.6	Does the project design engineering reflect current good	/1/	DR	The project envisages the primary treatment of		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	practices?	/2/		the mill's wastewater in an anaerobic digester to capture methane and utilize it in a gas engine for electricity generation. The technology reflects current good practices, as the common practice for palm oil mill effluent treatment in the region is the use of open lagoon system without methane capture.		
A.2.7	Would the technology result in a significantly better performance than any commonly used technologies in the host country? Is any transfer of technology from any Annex-I Party involved?	/1/	DR	The technology being used by the project is a well proven technology and is expected to significantly increase the wastewater quality over the previous treatment system commonly used in the host country. There is transfer of technology from Annex-1 party, however local expertise will be utilized during operations of the project.		OK
A.2.8	Does the project qualify as a small scale CDM project activity as defined in paragraph 6(c) of decision 17/CP.7 on the modalities and procedures for the CDM?	/1/	DR	Yes, project qualifies for small scale CDM project activity, as the project results in emission reductions of less than 60 kt CO_2e per year.		OK
A.2.9	Is the small scale project activity a debundled component of a larger project activity?	/1/	DR	This small scale project activity is not a debundled component of a large scale. It has been confirmed from site visit that there is no other registered small-scale CDM project activity : (a) With the same project participants; (b) In the same project category and technology/measure; and (c) Registered within the previous 2 years; and (d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.		OK
A.3	**Participation requirements**					
A.3.1	Do all participating Parties fulfil the participation requirements as follows:	/1/	DR			OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			Malaysia (host) / Denmark		
a) Party has ratified the Kyoto Protocol			☒ Yes ☐ No / ☒ Yes ☐ No		
b) Party has designated a Designated National Authority			☒ Yes ☐ No / ☒ Yes ☐ No		
c) The assigned amount has been determined			☒ Yes ☐ No / ☒ Yes ☐ No		
A.3.2 Do the letters of approval meet the following requirements?	/1/	DR	Only letter of approval from host country (Malaysia) is pending. Letter of approval from Denmark has been submitted.	~~CAR 1~~	OK
			Malaysia (host) / Denmark		
a) LoA confirms that Party has ratified the Kyoto Protocol			☒ Yes ☐ No / ☒ Yes ☐ No		
b) LoA confirms that participation is voluntary			☒ Yes ☐ No / ☒ Yes ☐ No		
c) The LoA confirms that the project contributes to the sustainable development of the host country?			☒ Yes ☐ No / NA		
d) The LoA refers to the precise project activity title in the PDD			☒ Yes ☐ No / ☒ Yes ☐ No		
e) The LoA is unconditional with respect to (a) to (d) above			☒ Yes ☐ No / ☒ Yes ☐ No		
f) The LoA is issued by the respective Party's DNA			☒ Yes ☐ No / ☒ Yes ☐ No		
g) The LoA was received directly by the DNA or the PP			☐ DNA ☒ PP / ☐ DNA ☒ PP		
h) In case of doubt regarding the authenticity of the letter of approval, describe how it was verified that the letter of approval is authentic			OK.		
A.3.3 Have all private/public project participants been authorized by an involved Party?	/1/	DR	Pending closing of A.3.2.	~~CAR 1~~	OK
A.4 Technical description of the project activity					
A.4.1 Is the project's location clearly defined?	/1/	DR	GPS coordinates for the project is included in the PDD, 3°44'41" N and 101°8'44" E. However, methodology requires location of the wastewater treatment plant and source generating the wastewater uniquely described in the PDD. This is requested.	~~CL 2~~	OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
A.5	**Public funding of the project activity**					
A.5.1	In case public funding from Parties included in Annex I is used for the project activity, have these Parties provided 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?	/1/ /54/	DR I	No diversion of official development assistance has been provided for this project, DNA of host country has been consulted.		OK
B Application of a baseline and monitoring methodology						
B.1	**Methodology applied**					
B.1.1	Does the project apply an approved methodology and the correct version thereof?	**/1/**	DR	The project fulfils the applicability AMS-III.H version 13 whereby the project follows applicability condition (iv) of the methodology, AMS.III-H, (introduction of methane recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic lagoons). Please refer to B.2.1.		OK
B.2	**Applicability of methodology and tools**					
B.2.1	How was it validated that project complies with the following applicability criteria: baseline lagoons are anaerobic lagoons	/1/	DR	- It involves the introduction of an anaerobic digester to an existing wastewater system. DNV was able to confirm during site visit /52/ that the current practice involved open anaerobic lagoons system with no methane recovery; - The existing wastewater treatment system has been verified on-site to have depth of depth of ponds is between 2.5 to 5.5 which is more		OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				than 2 metres /6/, - The site where the project activity is based has tropical climate, with average ambient temperature of 25 ^{o}C to 30 ^{o}C (above 15^{o}C) /22/, The volumetric loading rate of existing baseline lagoon was calculated to be 65.5 kg COD/m^3day which is above 0.1 kg COD/m^3day, as demonstrated in the spreadsheet /4/,		
B.2.2	How was it validated that project complies with the following applicability criteria: This methodology comprises measures that recover biogas from biogenic organic matter in wastewaters by means of one, or a combination of the following options in paragraph 1?	/1/	DR	Option (iv) criteria (Introduction of biogas recovery and combustion to an existing anaerobic wastewater treatment system such as anaerobic reactor, lagoon, septic tank or an on site industrial plant). As project involves the installation of a closed anaerobic digester system to replace the existing open anaerobic lagoons for the treatment of POME. The treated POME will be discharged to the existing aerobic ponds. Hence, the applicability to the methodology has been appropriately defined.		OK
B.2.3	How was it validated that project complies with the following applicability criteria: The recovered biogas may be utilised for the applications instead of combustion flaring in paragraph 2??	/1/	DR	As in para 2 (a), the recovered biogas is utilised for applications in biomass boiler as thermal energy. Excess methane will be flared in a closed flare system.		OK
B.2.4	How was it validated that project complies with the following applicability criteria: methane emissions reductions resulting from the project activity are expected to be less than 60 000 tCO_2e per year in paragraph 12?	/1/	DR	As in para 12, the methane emissions reductions resulting from the project activity is expected to be less than 60,000 tCO_2e per year.		OK
B.2.5	Is the selected baseline on of the baseline(s) described in the methodology and this hence confirms the applicability of the	/1/ /52/	DR I	The baseline described in the methodology requires wastewater and sludge treatment systems		OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
methodology?			equipped with biogas recovery facility to be excluded from baseline emission calculations. The baseline in the PDD is use of a series of open anaerobic and aerobic lagoons to treat POME. Treated POME is sent to the palm oil estate via a furrow system and used for soil application. This has been confirmed from site visit. Hence, this confirms the applicability of the methodology being complied. It has also been verbally confirmed with the project owner that : a. No additional investment is envisaged to be planned for the open lagoon system in order to facilitate a possible future increase in wastewater volume without the project activity, and b. the maximum capacity of effluent that the current system could treat in line with environmental standards.		
B.3 Project boundary					
B.3.1 What are the project's system boundaries (components and facilities used to mitigate GHGs)? Are they clearly defined and in accordance with the methodology?	/1/ /52/	DR	Project system boundaries have been defined as the facility digester tanks, aerobic treatment points and furrows (in soil application). These have been clearly defined in accordance with the methodology as emissions affected by the project activity, as in B.3 of PDD. However, power plants connected to the grid need to be included in the project boundary. Though minimum use of diesel generator is demonstrated, the fact that it is used at the mill requires this to be included. Consideration of power utilized from these	~~CL 3~~	OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				sources for meeting the internal energy requirements of the project activity during shutdown and maintenance of the biomass boilers is required.		
B.3.2	Which GHG sources are identified for the project? Does the identified boundary cover all possible sources linked to the project activity? Give reference to documents considered to arrive at this conclusion.	/1/ /52/	DR I	GHG sources identified for the project are from: a. Methane release in capture system from capture inefficiencies in anaerobic wastewater, b. Methane emissions due to incomplete flaring, c. Emission from electricity consumption, d. Methane fugitive emissions on account of inefficiencies in capture system, and This has been confirmed from site visit. Though emission from electricity produced from diesel generator has been demonstrated to be small in comparison with electricity produced from biomass boiler, GHG sources from electricity imported from the grid and diesel generators need to be included. Please refer to B.3.1.	~~CL 3~~	OK
B.3.3	Does the project involve other emissions sources not foreseen by the methodologies that may question the applicability of the methodology? Do these sources contribute with more than 1% of the estimated emission reductions of the project?	/1/	DR	The project is not expected to involve other emissions not foreseen by the methodologies.		OK
B.4	**Baseline scenario determination**					
B.4.1	Which baseline scenarios have been identified? Is the list of baseline scenarios complete?	/1/	DR	The baseline scenario identified is the continuation of the existing open pond-based		OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				wastewater treatment system without methane capture and combustion. The mill is currently treating the raw POME (palm oil mill effluent) through a series of ponds which include a cooling, two deep anaerobic ponds and two aerobic ponds before discharging treated POME for soil application. Two alternatives have been identified in the baseline scenario: 1. Closed anaerobic digester (without being registered as a CDM project activity), and 2. Open anaerobic digester (continuation of the current situation). The list of baseline scenarios are considered completed. This is also confirmed from site visit.		
B.4.2	How have the other baseline scenarios been eliminated in order to determine the baseline?	/1/	DR	Baseline scenarios have been eliminated by way of 'technological barrier' assessment.		OK
B.4.3	What is the baseline scenario?	/1/ /52/	DR	The baseline scenario of this project activity is the continuation of the existing open pond-based wastewater treatment system without methane capture and combustion. Treated POME (palm oil mill effluent) is land applied.		OK
B.4.4	Is the determination of the baseline scenario in accordance with the guidance in the methodology?	/1/	DR	Methodology does not provide specific guidance in determining the baseline scenario.		OK
B.4.5	Has the baseline scenario been determined using conservative assumptions where possible?	/1/ /13/ /52/	DR	Yes, it was confirmed from site visit that there is production increase to upgrade facilities. The Ulu Basir palm oil mill is also complying with local regulations, and it does not require methane capture to ensure discharge below legal limit.		OK
B.4.6	Does the baseline scenario sufficiently take into account	/1/	DR	Yes, as in PDD Section A.2.		OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	relevant national and/or sectoral policies, macro-economic trends and political aspirations?					
B.4.7	Is the baseline scenario determination compatible with the available data and are all literature and sources clearly referenced?	/1/ /52/	DR	It has been confirmed from site visit that the baseline scenario has been determined correctly.		OK
B.4.8	Is the baseline determination adequately documented in the PDD? • 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. • All documentation is relevant as well as correctly quoted and interpreted. • Assumptions and data can be deemed reasonable • Relevant national and/or sectoral policies and circumstances are considered and listed in the PDD. • The methodology has been correctly applied to identify what would occurred in the absence of the proposed CDM project activity	/1/ /52/	DR	The following have been verified from site visit: a. Assumptions and data used by project participants have been properly referenced and taken from the mill records, b. Though one year historical data is not available, at least 10-day readings have been used (from 1 August 2009 to 16 August 2009) for baseline emission assumption in accordance to the methodology, c. Production records during the 10-day period (1 August 2009 to 16 August 2009) have also been checked and verified that production is running in normal operations, d. Relevant national and sectoral policies have been listed in A.2 of the PDD, and e. Methodology has also been correctly applied to identify what would have occurred in the absence of the proposed CDM project activity.		OK
B.5	**Additionality determination.**					
B.5.1	What approach/tool does the project use to assess additionality? Is this in line with the methodology?	/1/	DR	The project applies the additionality tool "Tool for the demonstration and assessment of additionality version 5.2".		OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				Methodology does not specify approach/tool to assess additionality.		
B.5.2	Have the regulatory requirements correctly been taken into account to evaluate the project activity and the alternatives?	/1/ /54/	DR	Yes, regulatory requirements have been appropriately considered in the evaluation of project activity alternatives. This has been confirmed with DNA.		OK
B.5.3	Is sufficient evidence provided to support the relevance of the arguments made?	/1/	DR	Technological barriers are discussed as arguments. Please refer to B.5.17		OK
B.5.4	What is the project additionality mainly based on (Investment analysis or barrier analysis)?	/1/	DR	Project additionality is mainly based on arguments on technology barrier.		OK
	Prior consideration of CDM					
B.5.5	What is the evidence for serious consideration of CDM prior to the time of decision to proceed with the project activity?	/1/	DR	Evidence for prior decision to implement the project by the project developer requires further clarification in the timeline of key events.	~~CL 4~~	OK
B.5.6	If the starting date is after 2 August 2008 and before the global stakeholder consultation, has the DNA and UNFCCC confirmed that the project participants have informed in writing of the project's intention to seek CDM status?	/1/ /10/ /32 /40/	DR	The starting date is after 2 August 2008. Local DNA has been informed of the projects intention to seek CDM status, provisional LOA has been issued. UNFCCC has also been informed in writing of the project's intention to seek CDM status.		OK
	Continuous efforts to secure CDM status (only to be completed if starting date is before 2 August 2008)					
B.5.7	What initiatives where taken by the project participants from the starting date of the project activity to the start of validation in parallel with the physical implementation of the project activity?	/1/	DR	Project starting date has been stated as tentatively November 2009. It was verified during site visit that contract with the technology provider has been signed on 18 November 2009. However, civil works has already started during site visit on 7 December 2009. It is unclear when the civil works contract was signed.	~~CL 5~~	OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				Initiatives taken by project participants will be assessed after contract has been submitted, and timeline of events have been revised.		
B.5.8	When did the construction of the project activity start?	/1/	DR	Evidence is requested to demonstrate the start of the construction of the project activity.	~~CL 5~~	OK
B.5.9	When was the project commissioned?	/1/	DR	Project is expected to commission in June 2010.		OK
B.5.10	Does the timeline of the project confirm that continuous actions in parallel with the implementation were taken to secure CDM status?	/1/	DR	The project starting date is November 2009, indicating starting date of the proposal signed with the technology provider. Contract signed for civil works is requested to determine the earliest of the implementation, construction or real action of the project activity. Continuous actions in parallel with implementation will be re-assessed.	~~CL 5~~	OK
	Investment analysis					
B.5.11	Does the project activity or any of the remaining alternatives generate revenues apart from CDM? Is this reflected in the PDD?	/1/	DR	The project activity will generate revenue from saving from use of biogas, as electricity currently supplied by grid electricity will be replaced with the electricity generated from biogas.		OK
B.5.12	Do any of the alternatives to the project activity involve investment? Is this reflected in the PDD?	/1/	DR	The project does not use investment analysis argument.		OK
	Barrier analysis					
B.5.13	Are the barriers identified complimentary to a potential investment analysis? Does the barrier have a clear impact on the financial returns so that it can be assessed in an investment analysis? Each barrier is discussed separately.	/1/	DR	Barriers identified are not related to potential investment analysis, hence has no clear impact on financial returns. Refer to B.5.12		OK
B.5.14	How were the investment barriers assessed to be real? Are the investment barriers substantiated by a source independent of the project participants?	/1/	DR	Refer to B.5.12		OK
B.5.15	How does CDM alleviate the investment barriers?	/1/	DR	Refer to B.5.12		OK
B.5.16	Is the project activity prevented by the investment barriers and at least one of the possible alternatives to the project	/1/	DR	Refer to B.5.12		OK

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	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
	activity is feasible under the same circumstances?					
B.5.17	How were the technological barriers assessed to be real? Are the technological barriers substantiated by a source independent of the project participants?	/1/	DR	The following barriers were not considered sufficiently supported by independent sources and are requested to be removed: a) Demand for an improved wastewater facility: It is unclear what are the barriers faced by the project owner under this subtopic as the project proponent has mainly described the distinction of the baseline open lagoon system and project activity. Further clarification is needed on why the distinction between the two scenarios could qualify as a technological barrier. b) Demand for an energy generated by the project activity: The project proponents argue that combustion of both biogas and biomass in the boilers require more maintenance than mainstream fossil fuel boilers, which will mean higher maintenance costs. However, as this would directly impact the financial returns of the project, DNV is of the opinion that this is an investment barrier rather than a technological barrier, and should be quantified in an investment analysis. Furthermore, clarification is requested on what additional maintenance is needed for the biomass boilers since both biogas and biomass are combusted in the same combustion chamber. c) Lack of local and national standard: The project proponents argue that due to no standards found locally and nationally to design and operate the biogas digesters, the	~~CAR 2~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			project proponent faces technological barrier. However the risks of no standards to help the design the digesters are related to the technology supplier which has expertise in this field and has implemented the same technology in several sites in Malaysia. In addition, the risk of no standards to help operate the biogas digester has been addressed through the training provided by the technology supplier and DNV do not deem a lack of national and local operation standards would prevent the project activity from being operational. d) Demanding operation, supervision and maintenance: The PDD is inconsistent as on one hand it is being argued that with no biogas the steam generation to the palm oil mill will be affected, while on the other hand the project owner has clarified on-site that the switching of dual fuel operation to single biomass combustion operation is relatively simple. In addition, the project owner does not lack biomass within the mill vicinity for the combustion of thermal energy; hence it is unclear to how the steam generation will be affected under these circumstances. e) Occupational health and safety issues: The issue of health and safety issues are part and parcel of every organisation, more so in a hazardous environment such as a biogas plant. Hence it is unclear how would benefits from CDM would help alleviate the barrier in addressing the occupational health and safety		

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				issues. In addition, the technological barriers and prevailing practice barriers need to be supported by independent sources, and complete references to these sources have to be provided in the PDD.		
B.5.18	How does CDM alleviate the technological barriers?	/1/	DR	It is claimed that the new technology gives rise to barriers as in B.5.33. However, it is unclear how CDM would help to alleviate the technological barriers.	~~CAR 2~~	OK
B.5.19	Is the project activity prevented by the technological barriers and at least one of the possible alternatives to the project activity is feasible under the same circumstances?	/1/	DR	The other alternative to the project activity is Open anaerobic digester, which is the continuation of the current situation. This alternative does not face technological barrier. The claim that the project activity is prevented by technological barriers is pending independent source, as in B.5.33.	~~CAR 2~~	OK
B.5.20	How were the barriers due to prevailing practise assessed to be real? Are the barriers due to prevailing practise substantiated by a source independent of the project participants?	/1/ /2/ /7/ /54/	DR I	The barrier has also been substantiated with independent sources. This will be further confirmed with DNA.		OK
B.5.21	How does CDM alleviate the barriers due to prevailing practise?	/1/	DR	It is unclear how CDM will alleviate the barriers due to prevailing practice. Please refer to B.5.17.	~~CAR 2~~	OK
B.5.22	Is the project activity prevented by the barriers due to prevailing practise and at least one of the possible alternatives to the project activity is feasible under the same circumstances?	/1/	DR	The other alternative to the project activity is open anaerobic digester, which is the continuation of the current situation. This alternative does not face prevailing practice barrier. However, the claim that the project activity is prevented by prevailing practice barrier requires further evidence to substantiate.	~~CAR 2~~	OK

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Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.5.23	How were the other barriers assessed to be real? Are the other barriers substantiated by a source independent of the project participants?	/1/	DR	No other barriers are discussed in the PDD.		OK
B.5.24	How does CDM alleviate the other barriers?	/1/	DR	Please refer to B.5.21	~~CAR 2~~	OK
B.5.25	Is the project activity prevented by the other barriers and at least one of the possible alternatives to the project activity is feasible under the same circumstances?	/1/	DR	Please refer to B.5.22		OK
Common practice analysis						
B.5.26	What is the geographical scope of the common practice analysis? Is this justified?	/1/	DR	Geographical scope of the common practice is the host country, Malaysia. This is deemed acceptable.		OK
B.5.27	What is the scope of technology and size (e.g. capacity of power plant) for the common practice analysis and how has this been justified?	/1/ /2/ /7/ /54/	DR I	Technology and size for common practice discussed is related to treatment of POME in open anaerobic lagoons in Malaysia. This has been justified with the discussion that the baseline scenario for existing POME treatment is open anaerobic lagoon system where methane is emitted to the atmosphere. To be confirmed with DNA.		OK
B.5.28	What is the data source(s) used for the common practice analysis?	/1/ /2/ /7/	DR	The source of data from common practice is quoted from PTM Danida, and MPOB which cover palm oil activities in Malaysia.		OK
B.5.29	How many similar non-CDM-projects exist in the region within the scope?	/1/	DR	It is claimed that there are two similar non-CDM projects exist in the region. Independent reference is requested to substantiate this.	~~CL 6~~	OK
B.5.30	How were possible essential distinctions between the project activity and similar activities assessed?	/1/	DR	The distinctions between this proposed project with one non-CDM project is biogas plant is based on tank digesters and the biogas is utilized	~~CL 6~~	OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				in steam boilers in a palm oil refinery. The other plant however, is claimed as no longer using biogas for power generation but is sent for flaring instead. However, justification to substantiate these distinctions is requested.		
B.5.31	What is the conclusion of the common practice analysis?	/1/	DR	The conclusion that it is not a common practice for palm oil industry in the host country, Malaysia to capture biogas to power generation is pending closure of B.5.29 and B.5.30	~~CL 6~~	OK
	Conclusion					
B.5.32	What is the conclusion with regard to the additionality of the project activity?	/1/	DR	The conclusion will be reserved until related corrective actions/clarifications are closed.	~~CL 4~~ ~~CL 5~~ ~~CAR 2~~ ~~CL 6~~	OK
B.6	**Calculations of GHG emission reductions**					
	Data and parameters that are available at validation and that are not monitored					
B.6.1	How was the 'anaerobic lagoon treatment system depth' verified?	/1/ /6/	DR	The parameter (Anaerobic lagoon treatment system depth) was verified during site visit with anaerobic lagoon drawing to ensure that the depth is more than 5 metre.		OK
B.6.2	How was the $B_{o,ww}$, $MCF_{treatment}$, $MCF_{ww,discharge}$ GWP_CH_4, available at validation verified?	/1/ /6/ /44/	DR	The following parameters are taken from AMS-III. H default values: a. Methane correction factor for waste water treatment system that will be equipped with methane recovery and combustion ($MCF_{ww,\ treatment,}$ 0.8), (This is verified from the depth of lagoon and Table III.H1 which shows appropriate		OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			$MCF_{wwtreatment}$ value used) b. Methane correction factor based on discharge pathway of the wastewater ($MCF_{ww, discharge}$, 0), (This has been confirmed from site visit, that the treated POME is land applied and hence is categorised under 'aerobic treatment, well managed' discharge pathway or system) c. Global Warming Potential of Methane (GWP_CH_4, 21), and (IPCC default value is used) d. The rate of conversion of COD to CH_4 within the wastewater ($B_{0,ww}$, 0.21 kg CH_4 per kg COD) (IPCC default value is used).		
B.6.3 How was the $TDL_{j,y}$ (average technical transmission and distribution losses for providing electricity to source j in year y) available at validation verified?	/1/ /41/	DR	The parameter 'Average technical transmission and distribution losses for providing electricity to source *j* in year *y*' ($TDL_{j,y}$, 20%) is from "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".		OK
Baseline emissions					
B.6.4 Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/ /6/	DR I	Baseline emissions calculations have been documented in accordance with the approved methodology AMS-III. H. The emissions of the wastewater treatment systems affected by the project activity in year *y* were assessed and found to be acceptable: i. Appropriate MCF and B_o values were applied in the formula, and ii. Lagoons' depth have been substantiated with drawings.	~~CL 1~~	OK

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Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			The following emissions are claimed as negligible: i. emissions from electricity or fuel consumption ($BE_{power,y}$), ii. emissions of the sludge treatment systems affected by the project activity ($BE_{s,treatment,y}$), iii. emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake ($BE_{ww,treatment,y}$), and iv. emissions from anaerobic decay of the final sludge produced ($BE_{s,final}$). These are deemed acceptable, as it has been confirmed from site visit that treated wastewater and sludge are sent for land application. There is also no sludge treatment required to the ponds as the ponds use continuous des-slitting technology. It has been verified during site visit, that the plant uses grid electricity for plant start-up. In the event of grid power failure and plant shutdown, fossil fuel diesel generator will be utilised. Hence contribution of emissions from electricity or fuel consumption ($BE_{s,treatment,y}$) though will be more conservative, need to be clarified in the PDD.		
B.6.5 Have conservative assumptions been used when calculating the baseline emissions?	/1/	DR	Please refer to B.6.4. Though it is more conservative to not consider baseline emissions on account of electricity or fossil fuel, this need to be clarified in the PDD.	~~CL 1~~	OK
B.6.6 Are uncertainties in the baseline emission estimates properly addressed?	/1/	DR	Uncertainties in the baseline emission estimates have been properly addressed, in accordance with	~~CL 1~~	OK

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Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			the methodology. However, please refer to B.6.4. for emissions from electricity of fossil fuel.		
Project emissions					
B.6.7 Are the calculations documented according to the approved methodology and in a complete and transparent manner?	/1/ /52/	DR I	Calculations are documented as per the chosen methodology of AMS-III.H. The following emissions are considered: - Methane emissions from biogas release in capture systems ($PE_{fugitive}$), - Methane emissions due to incomplete flaring ($PE_{flaring,y}$), and - Emissions from electricity or fuel consumption ($PE_{power,y}$). The following emissions are not claimed : - Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery ($PE_{ww,treatment,y}$) (Note: this is deemed acceptable as all wastewater is treated by the project activity and equipped with biogas recovery), - Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery ($PE_{s,treatment,y}$) (Note: this is deemed acceptable as there is no sludge being discharged and treated in the project activity) - Methane emissions from degradable organic carbon in treated wastewater	~~CL 7~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			($PE_{y,ww,discharge}$) (Note: this is deemed acceptable, as treated wastewater is sent for land application, and hence is not discharged to sea, river or lake in project situation), - Methane emissions from anaerobic decay of the final sludge produced ($PE_{s,final,y}$) (Note: no final sludge is generated as land application of treated water removes sludge in de-slitting process at the same time) - Methane emissions from biomass stored under anaerobic conditions ($PE_{biomass,y}$) (Note: biomass is not stored under anaerobic conditions. It has been confirmed from site visit that PKS (palm kernel shell) is stored on-site. Upon site inspection, DNV is able to accept that the storage of PKS at site will be less than two months. Further confirmed that the use of PKS is used in biomass boilers in United Plantations Group and can be transported to other mills.) Project activity emissions clarification related to biomass storage needs clarification, as it is unclear how existing aerobic procedures for storage of biomass during project activity and changes to the procedures will lead to anaerobic decay.		
B.6.8 Have conservative assumptions been used when calculating the project emissions?	/1/ /3/	DR	Clarification is sought on: a. COD removal efficiency for the digester ($COD_{ww,discharge,PJ}$) is assumed same as the current open water treatment lagoons and not project situation, and	~~CL 8~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			b. Grid emission factor is calculated using the latest available data at the time the PDD was webhosted, and using latest available tool "*Tool to calculate the emission factor for an electricity system*".		
B.6.9 Are uncertainties in the project emission estimates properly addressed?	/1/ /54/	DR	Please refer to B.6.8.	~~CL 8~~	OK
Leakage					
B.6.10 Are the leakage calculations documented according to the approved methodology and in a complete and transparent manner?	/1/ /52/	DR	As this project activity the equipment is new and not transferred from any other activity, there is no leakage due to project activity. This is also confirmed from the contract signed with the technology provider.		OK
Emission Reductions					
B.6.11 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/ /54/	DR	The following assumptions require justification and correction: a. COD removal efficiency for the digester ($COD_{ww,discharge,PJ}$) is determined by using data from current operating lagoon, and b. It needs to be clarified if the Grid emission factor is calculated using the latest available data at the time the PDD was webhosted, and using latest available tool "*Tool to calculate the emission factor for an electricity system*".	~~CL 8~~	OK
B.7 Monitoring plan					
Data and parameters monitored					
B.7.1 Do the means of monitoring described in the plan comply with the requirements of the methodology?	/1/	DR	The monitoring plan is in line with AMS-III.H, "*Methane recovery in wastewater treatment*",	~~CL 9~~	OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			version 13, with the exception of B.7.2.		
B.7.2 Does the monitoring plan contains all necessary parameters, and are they clearly described?	/1/	DR	The following monitoring data will be collected for the emission reduction estimation: i. Flow of waste water from the palm oil mill ($Q_{y,ww}$, m^3), ii. Chemical oxygen demand entering the anaerobic treatment system with methane capture ($COD_{ww,untreated,y,}$ kg COD/m^3), iii. Chemical Oxygen Demand of the treated waste water ($COD_{ww,treated,y,}$ kg COD / m^3), iv. Methane correction factor of the disposal site that receives the final sludge ($MCF_{s,PJ,final}$**),** v. Amount of final sludge generated by the project wastewater treatment system in the year ($S_{final,PJ,y}$**,** tonne), vi. Amount of dry matter (tonnes dry mass) discharged to aerobic treatment (tonnes/ m^3) in the year y (**$S_{PJ,y,\ tonne/m3)}$,** vii. Electricity consumed by the project activity ($EC_{PJ,y,}$ MWh), viii. Grid Emission Factor (Peninsular Malaysia) ($EF_{grid,CM,y,}$ tCO_2/MWh), ix. Volumetric flow rate of the residual gas in dry basis at normal conditions ($FV_{digester,h,}$ Nm^3/h), x. Fraction of methane in the biogas ($fv_{CH4,h,}$ fraction),	~~CL 9~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			xi. Volumetric flow rate of the residual gas combusted in the boiler in dry basis at normal conditions in the hour ($FV_{boiler,h}$, Nm^3/h), xii. Volumetric flow rate of the residual gas flared in dry basis at normal conditions in the hour ($FV_{flare,h}$, Nm^3/h), xiii. Temperature in the exhaust gas of the flare (T_{Flare}, °C), xiv. Detection of flame in boiler (D_{Boiler}, on/off), xv. all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer's specifications ($Other_{Flare}$), xvi. Efficiency of the enclosed flaring process (FE/%), and xvii. Detection of physical leakage of digester tanks for safety purposes It is deemed conservative to assume that the machinery/equipment in the palm oil mill is running 365 days (8760 hours) even though the mill operates only on average 5400hour/year, with scheduled shutdown every Friday. It has been verified from site that the use of fossil fuel in diesel generator is small (2%) compared to electricity generated by biomass boiler /20/. Monitoring of diesel consumption from diesel		

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				generator is not required, as assumption of mill machinery/equipment running 8760 hours with 10% transmission loss is considered conservative. In accordance with the methodology, *ex post* emission reductions are determined based on the lowest value of the following which parameters have been included in the monitoring plan: (i) The amount of biogas recovered and fuelled or flared (MD_y) during the crediting period, that is monitored *ex post*; (ii) *Ex post* calculated baseline, project and leakage emissions based on actual monitored data for the project activity. In order to determine which is the lowest value of *ex-post* emission reductions calculation, the parameter, $COD_{removed,PJ,k}$ (Chemical oxygen demand removed by project wastewater treatment system k in year *y* (tonnes/m_3). Monitoring is also requested to include fraction of time in which gas is combusted for the calculation of flare efficiency.		
B.7.3	In case parameters are measured, is the measurement equipment described? Describe each relevant parameter.	/1/	DR	Yes, parameter measuring equipment has been included in PDD Section B.7.1.		OK
B.7.4	In case parameters are measured, is the measurement accuracy addressed and deemed appropriate? Describe each relevant parameter.	/1/	DR	Further clarification is requested as to how the measurement accuracy for the parameters is addressed.	~~CL 10~~	OK
B.7.5	In case parameters are measured, are the requirements for maintenance and calibration of measurement equipment described and deemed appropriate? Describe each relevant parameter.	/1/	DR	Maintenance of measuring equipment has been included in the PDD, to be carried out as recommended by the manufacturer.		OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
B.7.6 Is the monitoring frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	Monitoring frequency have been specified for the following parameters: i. Continuous monitoring of flow of waste water from the palm oil mill ($Q_{y,ww}$, m^3), ii. Monthly monitoring of chemical oxygen demand entering the anaerobic treatment system with methane capture ($COD_{ww,untreated,y,}$ kg COD/m^3), iii. Monthly monitoring of chemical oxygen demand of the treated waste water ($COD_{ww,treated,y,}$ kg COD / m^3), iv. Continuous monitoring of electricity consumed by the project activity ($EC_{PJ,y,}$ MWh), v. Continuous monitoring of volumetric flow rate of the residual gas in dry basis at normal conditions ($FV_{digester,h,}$ Nm^3/h), vi. Continuous monitoring of fraction of methane in the biogas ($fv_{CH4,h}$, fraction), vii. Continuous monitoring of volumetric flow rate of the residual gas combusted in the boiler in dry basis at normal conditions in the hour ($FV_{boiler,h,}$ Nm^3/h), viii. Continuous Volumetric flow rate of the residual gas flared in dry basis at normal conditions in the hour ($FV_{flare,h}$, Nm^3/h),	~~CL 11~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			ix. Continuous monitoring of temperature in the exhaust gas of the flare (T_{Flare}, °C), x. Continuous detection of flame in boiler (D_{Boiler}, on/off), xi. all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturer's specifications ($Other_{Flare}$), xii. Efficiency of the enclosed flaring process (FE/%), and xiii. Detection of physical leakage of digester tanks for safety purposes (leakage). It is also unclear what frequency is the parameter, Grid Emission Factor (Peninsular Malaysia) ($EF_{grid,CM,y,}$ tCO_2/MWh) will be monitored.		
B.7.7 Is the recording frequency adequate for all monitoring parameters? Describe each parameter.	/1/	DR	Recording frequency have been specified for the following parameters: i. Electronic recording of flow of waste water from the palm oil mill ($Q_{y,ww}$, m^3), ii. Monthly recording of chemical oxygen demand entering the anaerobic treatment system with methane capture ($COD_{ww,untreated,y,}$ kg COD/m^3), iii. Monthly recording of chemical oxygen demand of the treated waste	~~CL 11~~	OK

Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
			water ($COD_{ww,treated,y,}$ kg COD / m^3), iv. Methane correction factor of the disposal site that receives the final sludge ($MCF_{s,PJ,final}$) will be recorded every disposal, v. Recording of every disposal of amount of final sludge generated by the project wastewater treatment system in the year ($S_{final,PJ,y}$, tonne), vi. Monthly recording of amount of dry matter (tonnes dry mass) discharged to aerobic treatment (tonnes/ m^3) in the year y ($S_{PJ,y,\ tonne/m3),}$ vii. Electronically recorded continuous measurement of volumetric flow rate of the residual gas in dry basis at normal conditions ($FV_{digester,h,}$ Nm^3/h), viii. Hourly or shorter interval recording of fraction of methane in the biogas ($fv_{CH4,h}$, fraction), ix. Electronically recorded volumetric flow rate of the residual gas combusted in the boiler in dry basis at normal conditions in the hour ($FV_{boiler,h,}$ Nm^3/h), x. Electronically recorded volumetric flow rate of the residual gas flared in dry basis at normal conditions in the hour ($FV_{flare,h}$, Nm^3/h), xi. Continuous recording of detection of flame in boiler (D_{Boiler}, on/off), xii. all data and parameters that are		

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				required to monitor whether the flare operates within the range of operating conditions according to the manufacturer's specifications ($Other_{Flare}$), xiii. Efficiency of the enclosed flaring process (FE/%), and xiv. Quarterly monitoring of detection of physical leakage of digester tanks for safety purposes (leakage). Recording frequency for Grid Emission Factor (Peninsular Malaysia) ($EF_{grid,CM,y,}$ tCO_2/MWh).		
	Ability of project participants to implement monitoring plan					
B.7.8	How has it been assessed that the monitoring arrangements described in the monitoring plan are feasible within the project design?	/1/	DR	The monitoring arrangements are seen as feasible within the project design. This is provided the CAR/CLs raised in B.7.2., B.7.4., B.7.6 and B.7.7. are closed.	~~CL 9~~ ~~CL 10~~ ~~CL 11~~	OK
B.7.9	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 I	Project management procedures are in preparation stage, which will be completed by the time the project is in operation. Implementation of these will be verified in follow up verification.		OK
B.7.10	Are the data management and quality assurance and quality control procedures sufficient to ensure that the emission reductions achieved by/resulting from the project can be reported ex post and verified?	/1/	DR	Ulu Basir has an operational and management structure in place to monitor emission reductions from the project activity. The palm oil mill engineer shall assign subordinates to collect and record monitoring parameters and verify monthly. CDM Project coordinator in Ulu Basir palm oil mill will receive and screen the monthly		OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				monitoring reports and may assign a third party consultant or in-house expertise to calculate the emission reduction and prepare annual monitoring reports.		
B.7.11	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	Data will be kept for at least two years after the crediting period in both hard and soft copy at UP Berhad.		OK
	Monitoring of sustainable development indicators/ environmental impacts					
B.7.12	Is the monitoring of sustainable development indicators/ environmental impacts warranted by legislation in the host country?	/1/ /54/	DR	The DNA of Malaysia and the methodology does not require the monitoring of sustainable development parameters which has been confirmed with the DNA.		OK
C Duration of the project activity / crediting period						
C.1.1	**Start date of project activity**					
C.1.2	How has the starting date of the project activity been determined? What are the dates of the first contracts for the project activity? When was the first construction activity?	/1/ /52/	DR I	Project starting date has been stated as tentatively November 2009. It was verified during site visit that contract has been signed with the technology provider on 18 November 2009. However, civil works has started, as confirmed from site visit on 7 December 2009. It is unclear when the civil works contract was signed. In light of the guidance provided at EB41, clarification and evidence is sought on the start date as the date should be the earliest date of implementation, construction or real action of the project activity. The following is requested:	~~CL 5~~	OK

	Checklist Question	Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
				a. the dates of the civil contract has been signed, and b. the date of the first construction activity.		
C.1.3	Is the stated expected operational lifetime of the project activity reasonable?	/1/	DR	The expected operational lifetime is 20 years. This is deemed reasonable.		OK
C.1.4	Is the start date, the type (renewable/fixed) and the length of the crediting period clearly defined and reasonable?	/1/	DR	The start date of the crediting period is 1 March 2010, with fixed crediting period of 10 years.		OK
D Environmental Impacts						
D.1.1	Are there any host country requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved? Does the approval contain any conditions that need monitoring?	/1/ /16/ /45/ /46/	DR	An EIA is not required for the project activity as the project is not a prescribed activity or premise under the prevailing Environmental Quality (Environmental Impact Assessment) Regulations, 1987. Hence, there is no need for Environmental impact assessment. Application has also been submitted to the state Department of Environment on the project intention and license from the state Department of Environment for new licensing regulation.		OK
D.1.2	Does the project comply with environmental legislation in the host country?	/1/ /13/ /16/ /54/	DR I	The mill complies with their effluent discharge license, whereby effluent that is land applied will have a BOD of less than 1000 ppm. Verification of the mill's effluent discharge license and quality reports shown confirms that the mill is in compliance with this regulation. This was verified through a review of the mill's quarterly report to the Department of Environment and records of their treated effluent quality. This has also been confirmed with DNA.		OK

Checklist Question		Ref	MoV	Assessment by DNV	Draft Concl.	Final Concl.
D.1.3	Will the project create any adverse environmental effects?	/1/	DR	The project is not likely to create any significant adverse environmental effect.		OK
D.1.4	Have identified environmental impacts been addressed in the project design?	/1/	DR	Project is not likely to create significant and adverse environmental impacts, but positive environmental benefits: • Reduction of methane emission, • Generation of renewable energy, and • Significant reduction of odor.		OK
E Stakeholder Comments						
E.1.1	Have relevant stakeholders been consulted?	/1/	DR	Yes. Local stakeholder consultation meeting was held on 16 July 2009 at BOP Club, Ulu Bernam Estate. The consultations were carried out with representatives of the local community ,		OK
E.1.2	Have appropriate media been used to invite comments by local stakeholders?	/1/	DR	Local stakeholders were invited via advertisement in local newspaper (New Straits Times and Berita Harian), written invitations to local stakeholders and statutory bodies and email invitations to non-governmental organizations. Clarification is requested to provide the advertisement published in Berita Harian.	~~CL 12~~	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/ /54/	DR I	The local stakeholder comments process is deemed appropriate and in line with national requirements as confirmed with the DNA.		OK
E.1.4	Is a summary of the stakeholder comments received provided?	/1/	DR	A summary of comments received from the stakeholders' consultation and due action taken has been included in the PDD.		OK
E.1.5	Has due account been taken of any stakeholder comments received?	/1/	DR	As there were no negative comments with regard to the project, no due action was necessary.		OK

MoV = Means of Verification, DR= Document Review, I= Interview, CC= Cross-Checking

Table 3 Resolution of corrective action requests and clarification requests

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
CAR 1 Letters of approval from the DNAs of Malaysia and Denmark are yet to be provided.	A.3.2. A.3.3.	The letters of approval will be obtained after the draft validation report has been issued.	The letter of approval from the DNA of Malaysia dated 2 March 2010 and the letter of approval from the DNA of Denmark dated 12 February 2010 have been received. **CAR 1 is closed.**
CAR 2 The following barriers are requested to be removed: a) Demand for an improved wastewater facility: It is unclear what are the barriers faced by the project owner under this subtopic as the project proponent has mainly described the distinction of the baseline open lagoon system and project activity. Further clarification is needed on why the distinction between the two scenarios could qualify as a technological barrier. b) Demand for an energy generated by the project activity: The project proponents argue that combustion of both biogas and biomass in the boilers require more maintenance than mainstream fossil fuel boilers, which will mean higher maintenance costs. However, as this would directly impact the financial returns of the project, DNV is of the opinion that this is an investment barrier rather than a technological barrier, and should be quantified in an investment analysis. Furthermore, clarification is requested on what additional maintenance is needed for the biomass boilers	B.5.17 B.5.18 B.5.19 B.5.21 B.5.22 B.5.24 B.5.32	The PDD has been updated with revised barriers in sub-step 3a supported by independent sources. Sub-step 3b has been updated with further discussions regarding how it is concluded that at least one alternative scenario, other than the proposed CDM project activity is not prevented by any of the identified barriers. The following barriers were removed: a) Demand for an improved wastewater facility: This barrier has been removed. b) Demand for energy generated by the project activity: This barrier has been removed. However, the argument "demand for energy generated by the project activity" is still in use in the barrier analysis as a supporting argument for the following barrier: "Lack of infrastructure for implementation of the technology." c), d) and e) This barrier has been updated with	OK. Barriers related to the demand for improved wastewater facility, demand for energy and local and national standard have been removed. The PDD has been revised to only reflect 3 technological barriers: lack of infrastructure, technological failures and stringent safety procedure. This has been elaborated in section 4.4.4 in the main body of the report. OK, barriers discussion has been improved. Independent sources have been included in the PDD and provided to the DOE. **CAR 2 is closed.**

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
since both biogas and biomass are combusted in the same combustion chamber. c) Lack of local and national standard: The project proponents argue that due to no standards found locally and nationally to design and operate the biogas digesters, the project proponent faces technological barrier. However the risks of no standards to help the design the digesters are related to the technology supplier which has expertise in this field and has implemented the same technology in several sites in Malaysia. In addition, the risk of no standards to help operate the biogas digester has been addressed through the training provided by the technology supplier and DNV do not deem a lack of national and local operation standards would prevent the project activity from being operational. d) Demanding operation, supervision and maintenance: The PDD is inconsistent as on one hand it is being argued that with no biogas the steam generation to the palm oil mill will be affected, while on the other hand the project owner has clarified on-site that the switching of dual fuel operation to single biomass combustion operation is relatively simple. In addition, the project owner does not lack biomass within the mill vicinity for the combustion of thermal energy; hence it is unclear to how the steam generation will be affected under these circumstances. e) Occupational health and safety issues: The		further explanation supported by independent sources. This barrier has been updated with further explanation supported by independent sources.	

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
issue of health and safety issues are part and parcel of every organisation, more so in a hazardous environment such as a biogas plant. Hence it is unclear how would benefits from CDM would help alleviate the barrier in addressing the occupational health and safety issues. In addition, these barriers need to be supported by independent sources, and complete references to these sources have to be provided in the PDD.			
CL 1 It has been verified during site visit, that the plant uses grid electricity for plant start-up. In the event of grid power failure and plant shutdown, fossil fuel diesel generator will be utilised. PDD need to be revised to: o clarify pre-project scenario transparently, and o contribution of emissions from electricity or fuel consumption ($BE_{s,treatment,y}$) though will be more conservative, need to be clarified in the PDD.	A.2.5. B.6.4. B.6.5. B.6.6.	a) The PDD has been updated to include grid and diesel generator in section B.4. b) There will be electricity consumed from grid and diesel generator during power failure. There is only one negligible consumer of electricity in the baseline scenario. The consumer is a pump located at the last lagoon used for pumping POME from the last lagoon to the fields for land application. The pump (44 kW) is backed up by a spare pump (also 44kW) in case of maintenance. The pump is used in both the baseline and project scenario and is not affected by the project activity i.e. the flow of POME to be pumped will be the same and there will not be any changes to the electricity mix caused by the project activity. This shows that baseline emission from this pump is negligible.	OK. The PP has clearly stated all the source of electricity in the mill. **This CL is closed.**
CL 2	A.4.1.	The PDD has been updated to uniquely	OK. The coordinates of the source

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
Methodology requires location of the wastewater treatment plant and source generating the wastewater uniquely described in the PDD. This is requested.		identify both the location of the wastewater treatment plant and the source generating the wastewater.	generating the wastewater has been included in the PDD. **This CL is closed.**
CL 3 Project boundary needs to be revised to include: i. power plants connected to the grid, and ii. internal supply of power using diesel generator and biomass boiler.	B.3.1. B.3.2.	The PDD has been updated to include these in section B.3.	OK. Project boundary has been revised to include both: - grid, and - biomass boiler and diesel generator. **This CL is closed.**
CL 4 Evidence for prior decision to implement the project by the project developer requires further clarification in the timeline of key events.	B.5.5. B.5.32	The PDD has been updated with additional information regarding the timeline of key events.	OK. PDD has been updated and further elaborated with more details pertaining to the events leading to start of validation. **This CL is closed.**
CL 5 Project starting date has been stated as tentatively November 2009. It was verified during site visit that contract with the technology provider was signed on 18 November 2009. However, civil works is already in progress during site visit on 7 December 2009. To assess initiatives taken by the project participants from the starting date to the start of validation in parallel with the physical implementation, and continuous actions in parallel with implementation, the following requires clarification and justification: 1. It is unclear when the civil works contract was signed, and 2. Evidence for start of the civil construction of the project activity.	B.5.7. B.5.8. B.5.10 B.5.32 C.1.2.	1) The starting date of the project activity has been updated in the PDD to show the earliest date on which the project participant has committed to expenditures related to the implementation of the project activity. 2) Please find attached the evidence.	OK. Starting date has been further evidenced with the memo on foundation works to start at the project site. This is the earliest financial commitment evidenced, in comparison with other contracts signed. **This CL is closed.**
CL 6	B.5.29	The PDD has been updated with revised	OK, independent sources have been

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
Barriers need to be supported by independent sources which shall be provided in the PDD in relation to the following statements: 1. Two similar non-CDM projects in the region, and 2. The distinctions between this proposed project with one non-CDM project is biogas plant is based on tank digesters and the biogas is utilized in steam boilers in a palm oil refinery.	B.5.30 B.5.31 B.5.32	barriers and independent sources. 1) The source is making reference to the year of construction (1984) on page 103 which was long before the introduction of CDM. This shows that the two projects were non-CDM. 2) The PDD has been updated with further discussions regarding barriers related to the application of the biogas.	included in the PDD and provided to the DOE. **This CL is closed.**
CL 7 Project activity emissions clarification related to biomass storage needs clarification, as it is unclear how existing aerobic procedures for storage of biomass during project activity and changes to the procedures will lead to anaerobic decay.	B.6.7.	The PDD has been updated to clarify that there will be no changes to the current aerobic procedures for storage of biomass and these emissions are therefore negligible.	OK. The DOE was able to confirm that the biomass storage is relatively (i.e. less than a week) short and will not result in anaerobic emissions. **This CL is closed.**
CL 8 The following assumptions require justification and correction: a. COD removal efficiency for the digester ($COD_{ww,discharge,PJ}$) is determined by using data from current operating lagoon, and b. It needs to be clarified if the Grid emission factor is calculated using the latest available data at the time the PDD was webhosted, and using latest available tool "*Tool to calculate the emission factor for an electricity system*".	B.6.8. B.6.9. B.6.11	a) The PDD has been updated with the digester efficiency proposed by the equipment supplier to take into account the efficiency of the treatment system in the project scenario. b) The PDD has been updated to show that it is using the grid emission factor published by PTM for Peninsular Malaysia using three years of data. The grid emission factor is fixed ex-ante and will not be monitored in the project activity.	a. OK. The COD removal efficiency has considered the technology provider assumption. b. This has been confirmed with PTM that the data used is the latest data available at the time the PDD was web-hosted. **This CL is closed.**
CL 9 Monitoring parameters need to include: i. $COD_{removed,PJ,k}$ (Chemical oxygen demand removed by project wastewater	B.7.1. B.7.2. B.7.8.	a) $COD_{removed,PJ,k}$ will be calculated continuously (along with other relevant figures for emission calculations) in the project activity based on the two monitored	a. OK. The $COD_{ww,untreated,y}$ and $COD_{ww,treated,y}$ have been included in the ex-post monitoring plan. b. OK. The monitoring the fraction of

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
treatment system k in year *y* (tonnes/m_3), to determine which is the lowest value of *ex-post* emission reductions calculation as in para 30 of meth, and ii. fraction of time in which gas is combusted for the calculation of flare efficiency.		parameters $\mathbf{COD_{ww,untreated,y}}$ and $\mathbf{COD_{ww,treated,y}}$ (as it is the difference between these). b) The PDD has been updated to clarify that monitoring flare efficiency means monitoring the fraction of time in which gas is combusted.	time in which gas is combusted has been elaborated in the ex-post monitoring plan. **This CL is closed.**
CL 10 Further clarification is requested as to how the measurement accuracy for the *ex-post* parameters is addressed.	B.7.4. B.7.8.	The PDD has been updated to show that instrument readings are recorded using the most conservative value in accordance with manufacturer's specification.	OK. This has been included in the PDD. **This CL is closed.**
CL 11 It is also unclear what frequency is the parameter, Grid Emission Factor (Peninsular Malaysia) ($EF_{grid,CM,y,}$ tCO_2/MWh) will be monitored.	B.7.6. B.7.7. B.7.8.	The PDD has been updated to show that the grid emission factor ($EF_{grid,CM,y,}$ tCO_2/MWh) for Peninsular Malaysia will not be monitored but fixed ex-ante.	OK. The calculation and data have been verified through a follow-up interview with PTM /54/. **This CL is closed.**
CL 12 Local stakeholders were invited via advertisement in local newspaper (New Straits Times and Berita Harian), written invitations to local stakeholders and statutory bodies and email invitations to non-governmental organizations. Clarification is requested if invitation was also made through Berita Harian. Evidence is requested.	E.1.2.	Invitation was also made through Berita Harian. Please refer to attached evidence.	OK. Evidence has been provided. **This CL is closed.**
CL 13 Based on the biogas production estimated in the emission reduction calculations, clarification is sought on whether the potential revenues would		Based on the CER calculation, the project will save 215,335 tCO2e during the crediting period and 430,669 tCO2 over a period of 20 years.	OK. Based on the biogas production estimated from the emission reduction calculations, in the absence of the sale of

Corrective action and/ or clarification requests	Reference to Table 2	Response by project participants	Validation conclusion
help in alleviating the barrier in the absence of CDM benefits.		Methane has a lower heating value of 50 GJ/ton, so the project savings in terms of heating value is 1,025,403 GJ. The biogas will be utilised in the mill boiler and displace biomass. This can only take place when the mill boiler is in operation. It is assumed that the biogas digester tanks can allow approximately 2 hours/day of gas buffer, so the amount gas that can be used in the boiler is 70% of all the produced gas the balance 30% will be flared during the night.. Therefore, the project savings in terms of heating value is 717,548 GJ. Since PKS has a lower heating value of 15.9 GJ/ton, the project savings in terms of PKS is 45,129 ton. Based on a PKS price of 107 MYR/ton, the simple net present value of the potential project revenues over a period of 20 years are MYR 4,828,784. This demonstrates that the revenues can not alleviate any barriers since the revenues are not sufficient to pay for the project investment itself. Therefore, the potential revenues in the absence of CDM would not help alleviate the barriers.	CER credits, the potential revenues from the partial displacement of PKS (RM 3.5 million @ PKS price of RM 107/ton /25/ over the operational period of 20 /5/ years through utilization of biogas in the biomass boiler, is not sufficient to cover the investment cost of the project activity (approximately RM 4.5 million /17/) without considering other costs (O&M, fuel costs etc) /5/. Considering the PKS price offered by other suppliers (http://www.carigold.com/portal/forums/showthread.php?t=33612), PKS price at RM 107/ton is deemed conservative. By taking into consideration of the additional revenues from CDM, the significant contribution from CDM can alleviate the identified technological barriers that prevent the project from being implemented. **This CL is closed.**

APPENDIX B

CERTIFICATES OF COMPETENCE

CERTIFICATE OF COMPETENCE

Kamala Devi Muniandy

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-8-1-CDMJI-i1)

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Knowledge***	***Sector Expert***	***Technical Reviewer***
Landfill gas		Jan 2009				
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		Nov. 2009		
Energy efficiency						
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery						
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

Høvik, 27 November 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-8-1-CDMJI-i1)

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Knowledge***	***Sector Expert***	***Technical Reviewer***
Landfill gas						
Renewables	*Hydro power*	Jan 2010				
	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		Aug 2009				
Waste / wastewater treatment		Jan 2009		Nov 2009		
Energy efficiency						
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal						
CO_2 recovery						
Transport						
Non-renewable biomass						
Biofuel						
Pipeline leakage reduction						
SF_6						

Høvik, 7 January 2010

Michael Lehmann
Technical Director, Climate Change Services

CERTIFICATE OF COMPETENCE

Felipe Antunes

Qualification in accordance with DNV's Qualification Scheme CDM/JI (ICP-8-1-CDMJI-i1)

GHG Auditor:		Yes				
Technical Area		***CDM Validator***	***CDM Verifier***	***Sector Expert***	***Methodology Expert***	***Technical Reviewer***
Landfill gas			Sept 2009			
Renewables	*Hydro power*	Jan 2009	Sept 2009		Jan 2009	Jan 2009
	Wind power		Sept 2009			
	Other renewable		Sept 2009			
Biomass		Jan 2009	Jan 2009			
Grid connection of isolated system			Sept 2009			
Cement						
Waste-heat / waste-gas recovery						
Efficiency of thermal power plants						
Coal mine methane						
Fuel switch						
Manure management		Jan 2009	Jan 2009			
Waste / wastewater treatment		Jan 2009	Jan 2009			Feb 2010
Energy efficiency						
N_2O						
HFCs						
Flare reduction						
PFCs						
Charcoal			Sept 2009			
CO_2 recovery						
Transport						
Non-renewable biomass			Sept 2009			
Biofuel						
Pipeline leakage reduction						
SF_6						

Høvik, 3 February 2010

Michael Lehmann

Michael Lehmann
Technical Director, Climate Change Services