CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	•The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. •As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	•The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Title: Methane capture from POME for electricity generation in Batu Pahat.
Version: 03
Date: 05 September 2008

A.2. Description of the small-scale project activity:

Introduction:

The purpose of the project activity is to install four (4) biogas tank digesters instead of the current open lagoon system to treat the wastewater (referred to as Palm Oil Mill Effluent, or POME) of the Crude Palm Oil (CPO) mill operated by Bell Palm Industries Sdn. Bhd. (BPI) in Batu Pahat, Malaysia. The biogas produced will be used to generate electricity. The project activity will therefore reduce emissions of greenhouse gases (GHG) from two sources: avoidance of methane emissions from the current open lagoons (where anaerobic digestion of the POME takes place), and displacement of grid electricity with less carbon-intensive electricity.

Background:

Currently, the wastewater treatment system of the BPI CPO mill consists of a succession of open lagoons where anaerobic digestion of the wastewater takes place. The anaerobic digestion in open lagoons generates methane that is currently emitted to the atmosphere.

Proposed project activity:

The project proposes to construct four (4) biogas digester tanks that will treat the wastewater instead of the open lagoons (for the anaerobic digestion part), thereby reducing emissions of methane to the atmosphere. The captured methane will then be used to generate electricity. This electricity will be sold to the grid. By doing so, the project will reduce GHG emissions by an estimated 48,234 tCO_2e per year.

The mill operations plan to increase its production output by increasing its in-take of Fresh Fruit Bunches (FFB) from 240,000 tons per year currently to 350,000 tons per year within 4 years. The project will therefore install two (2) biogas digester tanks with 2 MW (4 x 500kW) of electricity generation capacity at the beginning of the project; it is forecasted that the capacity will be increased to four (4) biogas digester tanks with 3 MW (6 x 500kW) by year 2011.

Contribution of the project to the sustainable development of Malaysia (host country):

(i) Social dimension of sustainable development

Issue of quality of life of local community

The installation of the closed methane recovery system will eliminate the foul odour currently emanating from the open lagoon. The project will therefore significantly improve the current situation for local environment.

Issue of improvement the access of community to energy services

The CPO mill where the biogas plant will be installed is located in a plantation area where the local communities already have a direct access to energy supply. In this respect, it has to be mentioned that access to energy is not an issue.

Issue of increasing the country's supply of Renewable Energy

The project will contribute positively to the Malaysian Government's sustainable development criteria of increasing the nation's supply of Renewable Energy (RE) sources for electricity production. Under the Eighth Malaysian Plan, RE was identified as the fifth fuel in the new Five Fuel Strategy in the energy supply mix. In the Ninth Malaysian Plan, the Malaysian Government continues with its efforts to promote and utilise RE whereby RE is expected to contribute 350MW to the Total Energy Supply by the year 2010.

(ii) Economic dimension of sustainable development

The project will create indirect employment during construction and commissioning. In addition, the operation of the biogas plant will create direct full-time employment opportunities for 3 operators, 2 technicians, and 2 skilled workers.

The project will in addition install an innovative system using the Completely Stirred Tank Reactor (CSTR) technology, based on German / British design. With more than 300 CPO mills in Malaysia that have not implemented methane capture systems, it is expected that this innovative system based on a proven technology could be disseminated widely throughout the country.

The project also directly results in the efficient utilization of resources by "transforming" a waste (POME) into a useful energy fuel, thereby displacing electricity from the grid (through selling of electricity to the grid).

(iii) Environmental dimension of sustainable development

First of all, the project (methane recovery in CPO mill and electricity generation (3 MW) does not fall under the Prescribed Activities listed under the Environmental Quality (Prescribed Activities) (EIA) Order 1987, of Malaysia and hence, has also an exemption from Malaysia's Department of Environment to conduct and submit an Environment Impact Assessment (EIA) report – vide letter dated 30th July 2007.

By recovering the methane that is currently emitted by the open lagoons anaerobic treatment system, and by generating electricity from the biogas, the project can contribute towards the reduction of the emissions of GHG.

The combination of CSTR tanks with aerobic ponds will ensure that the COD and BOD levels of the wastewater at the end of the system meets Malaysia's environmental regulation (less than 100 ppm[1]).

[1] Environmental Quality (Prescribed Premises) (Crude Palm Oil) Regulations 1977

In conclusion, it can be said that the proposed project has no negative impact whatsoever. It will reduce emissions of GHG, it will support the Malaysian policy to promote electricity production from renewable energy sources and increase supply of electricity from indigenous sources, thereby contributing to reduce Malaysia's dependency on imported fuels. The project will directly create skilled employment opportunities. Generally speaking, the project will bring significant benefits to the sector concerned, i.e. CPO mills, by bringing improved CSTR technology and demonstrating the feasibility and advantages of methane recovery from POME through the CDM.

A.3. Project participants:

Name of Party (*) involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participants (Yes/No)
Malaysia (Host)	• Bell Eco Power Sdn. Bhd. (private entity) • EcoBiodiversity Sdn. Bhd. (private entity)	No
Japan	• Mitsui & Co. Ltd. (private entity)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Malaysia

A.4.1.2. Region/State/Province etc.:

State of Johor

A.4.1.3. City/Town/Community etc:

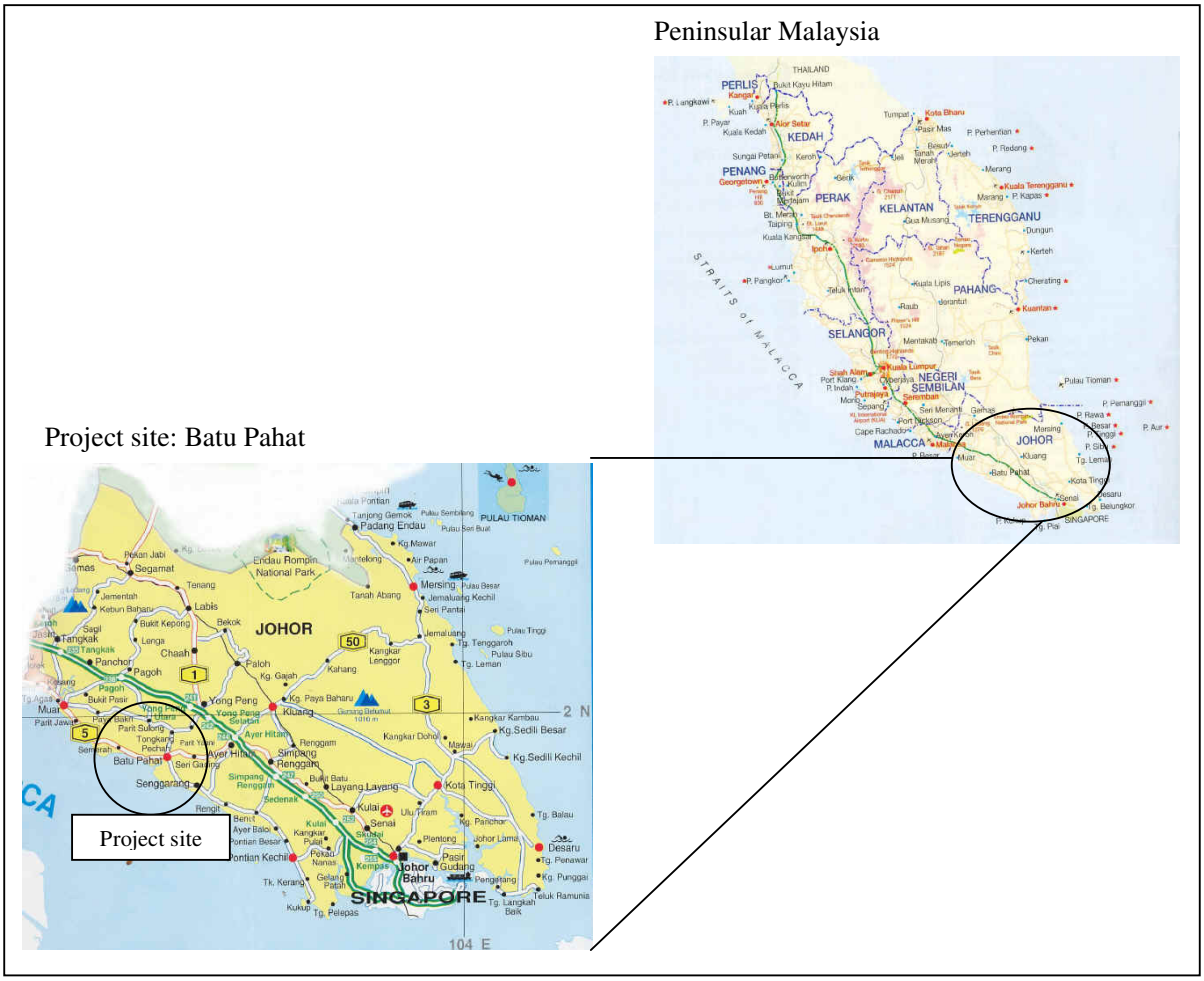
Batu Pahat

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The project activity is located in the southern part of Peninsular Malaysia (see maps below). The project will be hosted by the BPI crude palm oil mill, located at:

Bell Palm Industries Sdn. Bhd.
Lot 4909, 4910, 4911, 4960, Parit Ju, Simpang Kiri, 83007 Batu Pahat, Johor, Malaysia

The project site is 15 kilometers north of the city of Batu Pahat which is located at latitude 1^0 51' (N) and longitude 102^0 56' (E).



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

POME treatment in biogas tanks

The technology to be employed in the project activity consists of an improved version, based on German / British design, of the Completely Stirred Tank Reactor (CSTR). The conventional CSTR tanks will receive innovative improvements in terms of stirring devices inside the tanks.

At the beginning of the project, the two (2) digester tanks will be installed in series and the volume and retention time in each tank will be managed so as to maximize the anaerobic digestion of the POME and

generation of biogas. It is forecasted that the capacity of the mill will be increased from 240,000 tons of FFB per year to 350,000 tons of FFB per year within 4 years. As a result of the increased production capacity, the additional two (2) tanks will be installed in series which will be running parallel to the first series of two tanks. There will be four (4) biogas tanks installed in total.

The POME will flow from the mixing and cooling pond into the first biogas tank, where the retention time will be between 5 to 6 days, before entering the second tank, for a retention time of 5 to 6 days. Part of the biogas produced in the first tank will be directed to a compressor and injected back into the first and second tank through a suction column installed at the centre of the tanks. The stirring system, coupled with four nozzles mounted on adjustable pipe frames, will ensure a complete stirring of the POME, thereby considerably improving the anaerobic digestion and reducing the formation of deposit in the tanks. This system will ensure a reduction of at least 90% of the COD and 80% of the BOD levels. The treated POME will then enter a series of two (2) open lagoons for aerobic digestion, as a means to further reduce the COD and BOD levels below Malaysian environmental regulatory levels (100 ppm of BOD), before being released into the nearby river.

The solid sludge generated will be mixed with biomass residues from the mill and utilized as soil application in nearby oil palm plantations.

Electricity generation from biogas:

The biogas produced from the two CSTR tanks will be stored in a storage vessel, and sent to a desulphurization unit in order to remove hydrogen sulfide before being fed into the biogas engines. The electricity produced will be exported to the Malaysian grid, and partly utilized on-site for internal consumption.

Surplus biogas will be flared using a high efficiency semi-enclosed or enclosed flare system. The flare system is rated by their manufacturers at 98% combustion efficiency for biogas produced by the digester. The efficiency of the flaring process of a 90% default value will be adopted over the crediting period. For the purpose of monitoring the project's performance, electricity and flow meters will be installed. Biogas will be monitored through the use of a thermal gas flow meter.

With reference to the "Appendix B – Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activities", the project activity falls under the following types and categories:

- Scope 13, type III, AMS-III.H "Methane recovery in wastewater treatment" version 5
- Scope 1, type I, AMS-I.D "Grid connected renewable electricity generation" version 11

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Years	Estimation of annual emission reductions in tones of CO_2e
Year 1: May 2008 – April 2009	35,021
Year 2: May 2009 – April 2010	35,448
Year 3: May 2010 – April 2011	35,876
Year 4: May 2011 – April 2012	53,226
Year 5: May 2012 – April 2013	53,226

Year 6: May 2013 – April 2014	53,226
Year 7: May 2014 – April 2015	53,226
Year 8: May 2015 – April 2016	53,226
Year 9: May 2016 – April 2017	53,226
Year 10: May 2017 – April 2018	53,226
Total estimated reductions (tonnes of CO_2e)	**478,927**
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tCO_2e)	**47,893**

A.4.4. Public funding of the small-scale project activity:

No public funding has been or is being sought for this project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to Appendix C, this Project is not a debundled component of a larger project activity since the project participants have not registered nor operated another project in the region surrounding the project boundary within the previous 2 years, and because the project boundary is at least one kilometer apart from the project boundary of other proposed small-scale CDM project activities with similar characteristics.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

The project applies two approved baseline and monitoring methodologies:

- AMS-III.H "Methane recovery in wastewater treatment" version 5, for the methane recovery aspect of the project; and
- AMS-I.D "Grid connected renewable electricity generation" version 11, for the electricity generation aspect of the project

B.2 Justification of the choice of the project category:

The project meets all the applicability conditions of the methodologies, as described below.

Applicability conditions for AMS-I.D.

	Applicability condition	Project case
1	This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace	The project will generate electricity from the captured methane and use it i) for

	electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	internal purposes to displace electricity from the grid; and ii) for export to the Malaysian grid**.**
2	If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	The maximum capacity to be installed by the project over the crediting period is 3 MW, which is below 15 MW, and will remain so during the crediting period.
3	Biomass combined heat and power (co-generation) systems that supply electricity to and/or displace electricity from a grid are included in this category. To qualify under this category, the sum of all forms of energy output shall not exceed 45 MWthermal e.g. for a biomass based co-generating system the rating for all the boilers combined shall not exceed 45 MWthermal.	Not applicable
4	In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable
5	Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	Not applicable

Applicability conditions for AMS-III.H.

	Applicability condition	**Project case**
1	This project category comprises measures that recover methane from biogenic organic matter in wastewaters by means of one of the following options: … (vi) Introduction of a sequential stage of wastewater treatment with methane recovery and combustion, with or without sludge treatment, to an existing wastewater treatment system without methane recovery (e.g. introduction of treatment in an anaerobic reactor with methane recovery as a sequential treatment step for the wastewater that is presently being treated in an anaerobic lagoon without methane recovery).	The project will install biogas tanks to capture the methane that is currently emitted to the atmosphere through anaerobic digestion in open lagoons of the palm oil mill wastewater.
2	If the recovered methane is used for heat and or electricity generation that component of the project activity can use a	The approved baseline and monitoring methodology AMS-

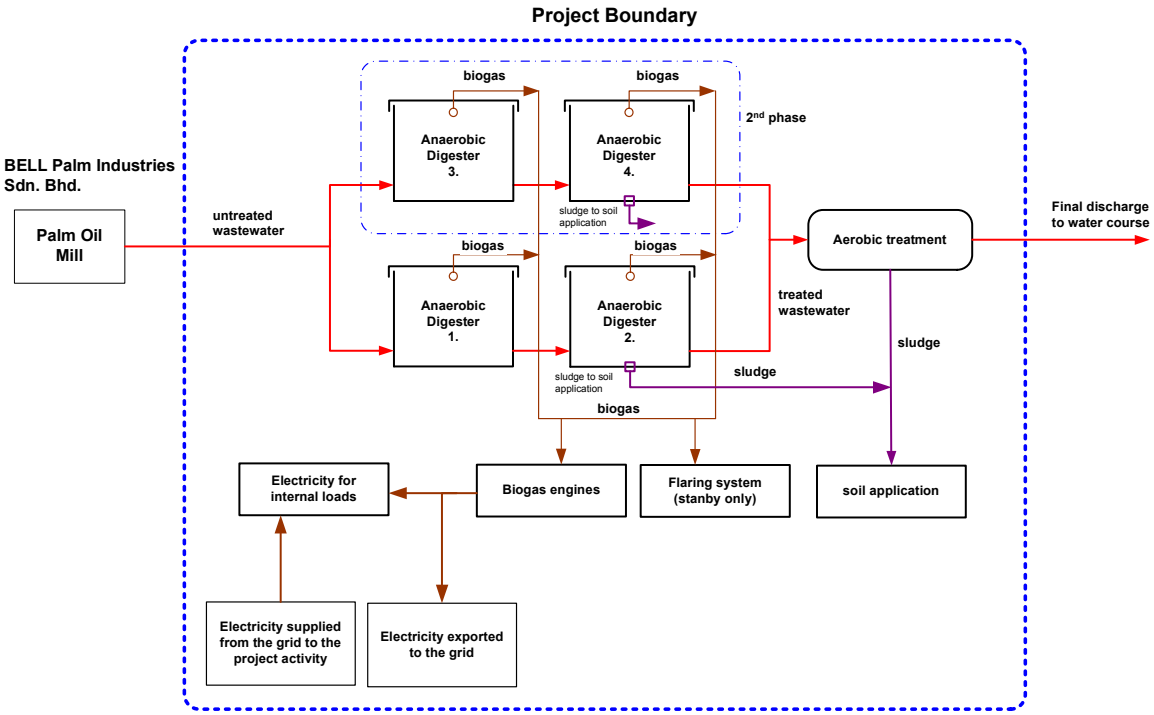
	corresponding category under type I.	I.D. is used for the electricity generation component of the project activity.
3	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO2 equivalent annually.	The emission reductions to be achieved by the project activity are estimated as follow: Year 1: 35,021 tCO_2e/y Year 2: 35,448 tCO_2e/y Year 3: 35,876 tCO_2e/y Year 4: 53,226 tCO_2e/y Year 5: 53,226 tCO_2e/y Year 6: 53,226 tCO_2e/y Year 7: 53,226 tCO_2e/y Year 8: 53,226 tCO_2e/y Year 9: 53,226 tCO_2e/y Year 10: 53,226 tCO_2e/y Which are lower than 60 $ktCO_2e$ per year over the crediting period.

B.3. Description of the project boundary:

With reference to Appendix B for small-scale project activities, the project boundary is defined as follows:

- For the methane capture part of the project, with reference to AMS III.H., the project boundary is the physical, geographical site where the wastewater and sludge treatment takes place. The project boundary therefore comprises of the methane recovery facility, as opposed to the current anaerobic treatment system using open lagoons (boundary of the baseline). It includes the biogas tanks, the biogas storage vessel, the methane flaring system, the aeration ponds (aerobic treatment where emissions of methane still occur), and the usage of solid sludge for soil application.
- For the electricity generation, utilization and export to the grid, with reference to AMS I.D, the project boundary encompasses the physical, geographical site of the renewable generation source. The project boundary therefore comprises of the electricity generation system using the biogas. It includes the biogas engines and internal electrical loads (such as desulphurization units, pumps, compressors). Grid electricity for plant maintenance during no electricity from biogas is also included in the project boundary.

The diagram below provides an illustrative description of the project boundary:



B.4. Description of baseline and its development:

The baseline for the project activity has been developed by using two categories listed in the simplified modalities and procedure for small-scale CDM project activity:

1. Type III – Other project activities, Category III.H – Methane recovery in wastewater treatment, Version 5 (AMS III.H.)

   The baseline scenario is the case 6 (vi) of AMS III.H./Version 5 which states: "The existing anaerobic wastewater treatment system without methane recovery for the case of introduction of a sequential anaerobic wastewater treatment system with methane recovery". For the project, the existing system is a series of five (5) open lagoons with 3 meters depth.

2. Type I – Renewable energy projects, Category I.D – Grid connected renewable electricity generation, Version 11 (AMS I.D.)

   For electricity displaced from and exported to Malaysian grid, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in $kgCO_2e/kWh$).

   The emission coefficient is calculated as per paragraph 9. (a), as a combined margin (CM), consisting of the combination of operation margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM 0002.

For Peninsular Malaysia, the emission coefficient is 0.631 $kgCO_2/kWh$[2] in accordance with the national power sector baseline study undertaken by Pusat Tenaga Malaysia (PTM).

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities requires project participants to provide an explanation to show that the project activity would not have occurred in the absence of the CDM due to the following barriers: (a) investment barrier, (b) barrier due to prevailing practice, and (c) other barriers. The tool for demonstration and assessment of additionality (version 03) is used.

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

Proposed CDM activity: The project activity is to install a biogas recovery system using tanks (CSTR). This system will replace the existing system where the wastewater (Palm Oil Mill Effluent – POME) is treated via open lagoons. The proposed project activity is in accordance with the current applicable laws and regulations, does not fall under the Prescribed Activities listed under the Environmental Quality (Prescribed Activities) (EIA) Order 1987.

The biogas produced will be used to generate electricity which will be sold to the grid.

Alternative scenario 1: continuation of the current situation (no project activity or other alternatives undertaken)

For methane emissions: the CPO mill will continue to treat its POME via open lagoons, with emissions of methane into the atmosphere. This way of treating POME is in accordance with all Malaysian laws and regulations, and the treated wastewater at the end of the process complies with Malaysian standards. No further investment is needed.

For the electricity generation part: the CPO mill does not produce electricity for selling to the grid.

This scenario is credible and realistic.

Other alternative scenarios: there is no other credible and realistic alternative scenario, apart from using different methane recovery technologies.

With reference to the above, the only realistic and credible alternative to the proposed project activity is the continuation of the current situation. The additionality testing is therefore limited to the financial analysis, to see whether the proposed activity could be implemented without the additional revenues from the selling of CERs.

(a) Investment analysis

[2] Study on Grid Connected Electricity Baselines in Malaysia, Pusat Tenaga Malaysia, April 2006 (http://www.ptm.org.my)

There are presently more than 380 palm oil mills in Malaysia in operations, and more than 85% of palm oil mills are utilizing open based lagoons, with direct emissions of methane into the atmosphere (as per above described as Alternative Scenario 1) [3]. The open lagoons system is an effective low-tech solution that can be easily applied to meet the Malaysian Standards relating to the treatment and discharge of wastewater in the palm oil industry. There is also an abundance of local labour with experience in this open lagoons technology in Malaysia.

Since the continuation of the current practice (anaerobic treatment of POME through open lagoons) does not pose any financial or economical problem to the project host (BPI mill) and it requires no further investment, there is no financial incentive for the owner to invest into the capture of biogas project with absence of CERs revenue. In addition, there is no requirement under the existing Malaysian Laws for the palm oil industry to compulsory undertakes the methane capture project.

The proposed CDM activity requires an investment of approximately RM10 million for the methane recovery system. The methane recovery system will be built, own and operated by the project participants. The project participants will retain the income from the selling of electricity and CERs, and pay the project host (CPO mill) for the POME to be used.

The financial details of the proposed project are summarized hereafter:

Item	Amount (RM)
1. Investment and development cost	
Machinery and equipment	6,500,000
Other	5,760
Total	**6,505,760**
2. Additional investment in year 3	**3,500,000**
3. Average annual cost (over 10 years)	
Cost of sales	1,016,067
Other operating expenses	846,790
Total	**1,862,857**
4. Average annual income	
Electricity	2,956,262
Project IRR (10 years) without CERs revenue	1.65%
Project IRR (10 years) with CERs revenue	15.47%

IRR analysis:

The Internal Rate of Return (IRR) had been chosen as calculation and comparison of financial indicators. The Project IRR is calculated based on key assumptions as follows:

1. Feed in tariff (electricity sell price) is 0.21 RM/kWh.
2. Depreciation is calculated on plant and machinery at 10% straight line method.
3. The margin of financing for the project is 70% at an interest rate of 8.0% per annum on monthly rest.

[3] Economics and Industry Development Division, Malaysian Palm Oil Board (MPOB), August 2007 (http://www.mpob.gov.my)

4. For income tax, pioneer status for first 5 years, the amount abated is 70% of statutory income.

The IRR of the project, without the revenues from the selling of CERs is 1.65%, which is below the borrowing cost of 8% and thus is deemed not financially feasible. Taking into consideration the additional revenues from the selling of CERs, the project IRR is 15.47% and thus making it financially feasible. The borrowing cost of 8.0% is based on the existing available interest rate offered by the financial institution in Malaysia to Bell Palm Industries Sdn Bhd.

Sensitivity analysis on the Project IRR for project activity without CERs revenue is also performed: i) if the project investment cost fluctuates between -20% to +20%; or ii) if the total cash operating outflows fluctuate between -20% to +20%. The range considered for the sensitivity analysis is based on the reasonable variations / fluctuations in the above critical variables (i.e. potential fluctuations in construction materials and operational cost due to changes in the price of global commodities such as fuels and steel). The summary of the sensitivity analysis is set out as follows:

Sensitivity Analysis for Project Activity Without CERs revenue:

Factor	**Project IRR (10 years)**				
	-20%	**-10%**	**No Change**	**+10%**	**+20%**
Fluctuation in investment cost	5.65%	3.52%	1.65%	0.00%	-1.47%
Fluctuation in operating cash outflows	7.46%	4.61%	1.65%	-1.46%	-4.77%

The investment cost comprises mainly the capital expenditure (CAPEX) for the methane recovery system of approximately RM10 million. The investment cost is estimated based on the quotation from BPI mill's technologies supplier.

If the investment cost increased by just 10%, a Project IRR of zero would be the result. Even the decrease in investment cost by 20%, the Project IRR of 5.65% is still below the borrowing cost of 8.00% and is not financial feasible.

The cash operating outflows comprises mainly the cost of sales (i.e. mainly raw material, direct overhead, repairs and maintenance, overhauls, etc) and other operating expenses (i.e. indirect operating overheads, professionals, consultancy, etc). POME would be the only raw material required for the project activity. In order to minimize the risk of non-stable supplies of raw material, Bell Eco Power Sdn Bhd had agreed to purchase the POME from BPI mill on willing seller and willing buyer basis. BPI owns only 30% interest in Bell Eco Power Sdn Bhd. The average annual purchase of POME for the project activity would be approximately RM54,000, which represents only 3% of its annual average operating expenses amounting to RM2 million a year.

Therefore, if the operating cash outflows increased by 10%, a Project IRR of -1.46% would be the result. Similarly, if the operating cash outflows decreased by 20%, the Project IRR would still below the borrowing cost of 8%.

Based on the above sensitivity analysis of Project IRR, it has demonstrated that the project activity would not be financially attractive if without CERs revenue.

The project developer will not invest without the additional revenues from the CDM.

The detailed financial model and its assumptions are provided in Appendix 1.

(b) Prevailing practices

Currently, the majority of palm oil mills have adopted conventional biological treatment of anaerobic or facultative digestions which large treatment area and long treatment period[4]. As of June 2007, there is no similar CDM project (methane gas recovery system for electricity generation) registered in Malaysia.. The proposed project can therefore be considered as innovative.

(c) Other Barriers:

Presently, no regulations and laws in Malaysia are in place to govern the capture of biogas emissions in the palm oil industry.

Conclusion

According to the above, it is clearly demonstrated that:

1. The only plausible and realistic scenario is the continuation of the current situation, which requires no further investment;
2. On the contrary, the proposed project faces significant financial barriers as the project IRR is 1.65%;
3. The proposed project activity is not a prevailing practice.

Based on the above analysis, it can be concluded that the proposed project activity would not have occurred without the incentive from CDM and the additional income from the issuance of CERs. The proposed activity goes beyond the applicable legislation and the prevailing practices in the palm oil industry in Malaysia. As such, the proposed project activity is additional and not a baseline scenario.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to baseline methodologies listed in section B.4, formulas to calculate the project emissions, baseline emissions, leakage and emission reductions are expressed as follows:

Emission reductions

The emission reduction for the project activity is calculated by using the formula:

$ER_y = BE_y – PE_y – Leakage$

Where:
ER_y = Emission reductions in the year "y"

[4] Research Abstract, Prof. Abdul Latif Ahmad (http://www.psipw.org/abdulahmadabstracts.html)

BE_y = Baseline emissions
PE_y = Project activity emissions in the year "y"

Project Activity Emissions

Formula used to calculate PE_y

Project activity emissions consist of:

(i) CO_2 emissions on account of power used by the project activity facilities. Emission factors for grid electricity or diesel fuel use, as the case may be, shall be calculated as described in category AMS I.D;

(ii) Methane emissions on account of inefficiency of the wastewater treatment and presence of degradable organic carbon in treated wastewater;

(iii) Methane emissions from the decay of the final sludge generated by the treatment systems;

(iv) Methane fugitive emissions on account of inefficiencies in capture and flare systems;

(v) Methane emissions resulting from dissolved methane in the treated wastewater effluent.

$$\mathbf{PE_y = PE_{y,\,power} + PE_{y,ww,treated} + PE_{y,s,final} + PE_{y,fugitive} + PE_{y,dissolved}}$$

Where:

$\mathbf{PE_y}$	project activity emissions in the year "y" (tCO_2e)
$\mathbf{PE_{y,power}}$	emissions from electricity or diesel consumption in the year "y"
$\mathbf{PE_{y,ww,treated}}$	emissions from degradable organic carbon in treated wastewater in year "y"
$\mathbf{PE_{y,s,final}}$	emissions from anaerobic decay of the final sludge produced in the year "y". If the sludge is controlled combusted, disposed in a landfill with methane recovery, or used for soil application, this term can be neglected, and the final disposal of the sludge shall be monitored during the crediting period.
$\mathbf{PE_{y,fugitive}}$	emissions from methane release in capture and flare systems in year "y"
$\mathbf{PE_{y,dissolved}}$	emissions from dissolved methane in treated wastewater in year "y"

$$\mathbf{PE_{y,power} = EF_{grid} * MWh_{\_grid,p}}$$

Where:

$\mathbf{EF_{grid}}$	Emission coefficient of the grid *(Calculated combined margin (CM) of 0.631 tCO_2/MWh is used.)*
$\mathbf{MWh_{\_grid,p}}$	Grid electricity consumed by the project activity in the year "y"

$$\mathbf{PE_{y,ww,treated} = Q_{y,ww} * COD_{y,ww,treated} * B_{o,ww} * MCF_{ww,final} * GWP\_CH_4}$$

Where:

$\mathbf{Q_{y,ww}}$	volume of wastewater treated in the year "y" (m^3)
$\mathbf{COD_{y,ww,treated}}$	chemical oxygen demand of the treated wastewater in the year "y" (tonnes/m^3)
$\mathbf{B_{o,ww}}$	methane producing capacity of the wastewater *(IPCC default value for domestic wastewater is 0.21 kg CH_4/kg.COD)*
$\mathbf{MCF_{ww,final}}$	methane correction factor based on type of treatment and discharge pathway of the wastewater (fraction) *(According to table AMS III.H.1, MCF Higher Value for aerobic treatment, well managed, is 0.1.)*
GWP_CH4	Global Warming Potential for methane

(value of 21 is used)

$$PE_{y,s,final} = S_{y,final} * DOC_{y,s,final} * MCF_{s,final} * DOC_F * F * 16/12 * GWP\_CH_4$$

Where:

$PE_{y,s,final}$	Methane emissions from the anaerobic decay of the final sludge generated in the wastewater system in the year "y" (tCO_2e)
$S_{y,final}$	Amount of final sludge generated by the wastewater treatment in the year y (tonnes)
$DOC_{y,s,final}$	Degradable organic content of the final sludge generated by the wastewater treatment in the year "y" (fraction). It shall be measured by sampling and analysis of the sludge produced, and estimated ex-ante using the IPCC default values of 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10 percent) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent).
$MCF_{s,final}$	Methane correction factor of the landfill that receives the final sludge, estimated as described in category AMS III.G.
DOC_F	Fraction of DOC dissimilated to biogas (IPCC default value of 0.5)
F	Fraction of CH_4 in landfill gas (IPCC default of 0.5).

This term is neglected because the sludge generated by the project is used for soil application. The final disposal of the sludge shall be monitored during the crediting period.

$$PE_{y,fugitive} = PE_{y,fugitive,ww} + PE_{y,fugitive,s}$$

Where:

$PE_{y,fugitive,ww}$	Fugitive emissions through capture and flare inefficiencies in the anaerobic wastewater treatment in the year "y" (tCO_2e)
$PE_{y,fugitive,s}$	Fugitive emissions through capture and flare inefficiencies in the anaerobic sludge treatment in the year "y" (tCO_2e)

$$PE_{y,fugitive,ww} = (1 - CFE_{ww}) * MEP_{y,ww,treatment} * GWP\_CH_4$$

Where:

CFE_{ww}	capture and flare efficiency of the methane recovery and combustion equipment in the wastewater treatment *(a default value of 0.9 is used)*
$MEP_{y,ww,treatment}$	methane emission potential of wastewater treatment plant in the year "y" (tonnes)

$$MEP_{y,ww,treatment} = Q_{y,ww} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,treatment}$$

Where:

$COD_{y,ww,untreated}$	Chemical Oxygen Demand of the wastewater entering the anaerobic treatment reactor/system with methane capture in the year "y" (tonnes/m^3)
$MCF_{ww,\ treatment}$	methane correction factor for the wastewater treatment system that will be equipped with methane recovery and combustion. *(According to table AMS III.H.1, MCF Higher Value for anaerobic deep lagoon [depth more than 2 meters] is 1.0.)*

$$PE_{y,fugitive,s} = (1 - CFE_s) * MEP_{y,s,treatment} * GWP\_CH_4$$

Where:

CFE_s	capture and flare efficiency of the methane recovery and combustion equipment in the sludge treatment (a default value of 0.9 is used)
$MEP_{y,s,treatment}$	methane emission potential of the sludge treatment system in the year "y" (tonnes)

This term is not applicable as the project will use sludge for soil application. There will therefore be no sludge treatment.

$$MEP_{y,s,treatment} = S_{y,untreated} * DOC_{y,s,untreated} * DOC_F * F * 16/12 * MCF_{s,treatment}$$

Where:

$S_{y,untreated}$	amount of untreated sludge generated in the year "y" (tonnes)
$DOC_{y,s,untreated}$	Degradable organic content of the untreated sludge generated in the year "y" (fraction). It shall be measured by sampling and analysis of the sludge produced, and estimated ex-ante using the IPCC default values of 0.05 for domestic sludge (wet basis, considering a default dry matter content of 10 percent) or 0.09 for industrial sludge (wet basis, assuming dry matter content of 35 percent)
$MCF_{s,treatment}$	methane correction factor for the sludge treatment system that will be equipped with methane recovery and combustion (MCF Higher value of 1.0 as per table III.H.1).

This term is not applicable as the project will use sludge for soil application. There will therefore be no sludge treatment.

$$PE_{y,dissolved} = Q_{y,ww} * [CH_4]_{y,ww,treated} * GWP\_CH_4$$

Where:

$[CH_4]_{y,ww,treated}$	dissolved methane content in the treated wastewater (tonnes/m^3). For the aerobic wastewater treatment, the default value is zero; for anaerobic treatment it can be measured, or a default value of 10e-4 tonnes/m^3 can be used. *(A default value of 10e-4 tonnes/m^3 is used.)*

Baseline Emissions

$$BE_y = BE_{y\_ww} + BE_{y\_electricity}$$

Where:

BE_{y_ww}	Baseline emissions of wastewater treatment system
$BE_{y\_electricity}$	Baseline emissions of displaced electricity

(A) Formula used to calculate BE_{y_ww}

According to AMS III.H., the baseline scenario will be one of the following situations:

(i) The existing aerobic wastewater or sludge treatment system, in the case of substitution of one or both of these systems for anaerobic ones with methane recovery and combustion.
(ii) The existing sludge disposal system, in the case of introduction of anaerobic sludge treatment system with methane recovery and combustion to an existing wastewater treatment plant.
(iii) The existing sludge treatment system without methane recovery and combustion.
(iv) The existing anaerobic wastewater treatment system without methane recovery and combustion.
(v) The untreated wastewater being discharged into sea, river, lake, stagnant sewer or flowing sewer, in the case of introducing the anaerobic treatment to an untreated wastewater stream.

(vi) The existing anaerobic wastewater treatment system without methane recovery for the case of introduction of a sequential anaerobic wastewater treatment system with methane recovery.

The baseline scenario for this project is the case 6 (vi); therefore, the baseline emissions are calculated by using the following formulas:

$$\mathbf{BE_{y\_ww} = Q_{y,ww} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,treatment} * GWP\_CH_4}$$

Where:

$\mathbf{BE_{y\_ww}}$	Baseline emissions of wastewater treatment system
$\mathbf{B_{o,ww}}$	the methane generation capacity of the treated wastewater *(IPCC lower value of 0.21 kg CH_4/kg .COD)*
$\mathbf{MCF_{ww,treatment}}$	Methane correction factor for the existing wastewater treatment system to which the sequential anaerobic treatment step is being introduced *(According to table AMS III.H.1, MCF Lower Value for anaerobic deep lagoon [depth more than 2 meters] is 0.8.)*

(B) Formula used to calculate $BE_{y\_electricity}$

The baseline is the amount of electricity produced by the renewable generating unit, i.e. biogas internal combustion engine coupled with generator, multiplied by an emission coefficient ($kgCO_2e/kWh$) as follows:

$$\mathbf{BE_{y\_electricity} = MWh_{\_grid} * EF_{grid}}$$

Where:

$\mathbf{BE_{y\_electricity}}$	Baseline emissions of displaced electricity
$\mathbf{MWh_{\_grid}}$	Amount of electricity produced by renewable generating unit that is exported to the grid in the year "y"
$\mathbf{EF_{grid}}$	Emission coefficient of the grid *(Calculated combined margin (CM) of 0.631 tCO_2/MWh is used.)*

Leakage

According to AMS III.H., "if the used technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects at the site of the other activity are to be considered."

For AMS I.A. and AMS I.D., **"**If the energy generating equipment is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered."

For the project,

- The used technology is not equipment transferred from another activity. The equipments installed in the project are brand new.
- The existing equipment is not transferred to another activity.

According to the criteria mentioned, leakage of the project is considered to be zero; Leakage = 0 tCO_2/y.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**$MCF_{ww,treatment}$**
Data unit:	Fraction
Description:	Methane correction factor for the wastewater treatment system that will be equipped with methane recovery and combustion
Source of data used:	AMS III.H.
Value applied:	1.0 (MCF higher value of Table III.H.1 is used for calculation of $PE_{y,fugitive}$)
Justification of the choice of data or description of measurement methods and procedures actually applied :	From the mill's design data, depth of anaerobic lagoon is 3 meters which falls into the type of anaerobic deep lagoon (depth more than 2 meters) as per AMS III.H, Table III.H.1.
Any comment:	-

Data / Parameter:	**$MCF_{ww,treatment}$**
Data unit:	Fraction
Description:	Methane correction factor for the existing wastewater treatment system to which the sequential anaerobic treatment step is being introduced.
Source of data used:	AMS III.H.
Value applied:	0.8 (MCF lower value in Table III.H.1 is used for calculation of $BE_{y,ww}$)
Justification of the choice of data or description of measurement methods and procedures actually applied :	From the mill's design data, depth of anaerobic lagoon is 3 meters which falls into the type of anaerobic deep lagoon (depth more than 2 meters) as per AMS III.H, Table III.H.1.
Any comment:	-

Data / Parameter:	**$MCF_{ww,final}$**
Data unit:	Fraction
Description:	Methane correction factor based on type of treatment and discharge pathway of the wastewater
Source of data used:	AMS III.H.
Value applied:	0.1 (MCF higher value in Table III.H.1 for aerobic treatment, well managed is used for calculation of $PE_{y,ww,treated}$.)
Justification of the choice of data or description of measurement methods and procedures actually applied :	After treated in anaerobic digester tanks, the treated POME will enter a series of two (2) open lagoons for aerobic digestion.
Any comment:	-

Data / Parameter:	EF_{grid}
Data unit:	tCO_2/MWh
Description:	Emission coefficient of the grid (Peninsular Malaysia)
Source of data used:	Pusat Tenaga Malaysia (PTM): Study on grid connected electricity sector baselines in Malaysia, April 2006
Value applied:	0.631 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data used for the calculation come from the PTM (www.ptm.org.my). The main reasons of using these data sources are to reduce the data inconsistency, uncertainly and to obtain realistic baseline results.
Any comment:	See Annex 3 for details.

Data / Parameter:	Efficiency of the flaring process
Data unit:	%
Description:	The efficiency of the flaring process in an enclosed flare
Source of data used:	AMS III.H.
Value applied:	90%
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to paragraph 12 of AMS III.H./Version 5, option (a) is used to determine the efficiency of the flaring process in an enclosed flare.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

From the CPO mill historical records, average capacity of the mill is about 40 tFFB/h (tonnes of Fresh Fruit Bunch per hour) with an operational time of 6,000 hours a year resulting total FFB processed by the mill of 240,000 tFFB/y. The mill has planned to increase its capacity to 350,000 tFFB/y by 2011.

For ex-ante calculation, the following parameters are used:

Parameter		unit	10 years – Crediting period									
			Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Fresh fruit bunch processed	-	tonnes	240,000	240,000	240,000	350,000	350,000	350,000	350,000	350,000	350,000	350,000
Volume of wastewater treated*	Qy,ww	m^3	144,000	144,000	144,000	210,000	210,000	210,000	210,000	210,000	210,000	210,000
COD of the wastewater entering the anaerobic treatment system**	CODy,ww,untreated	$kgCOD/m^3$	68.441	68.441	68.441	68.441	68.441	68.441	68.441	68.441	68.441	68.441
COD of the treated wastewater***	CODy,ww,treated	$kgCOD/m^3$	10.266	10.266	10.266	10.266	10.266	10.266	10.266	10.266	10.266	10.266
Displaced grid electricity	MWh_grid	MWh	8,798.4	9,475.2	10,152.0	16,243.2	16,243.2	16,243.2	16,243.2	16,243.2	16,243.2	16,243.2

* $Q_{y,ww}$ is estimated by using the mill's historical records which is 0.6 m^3/ton of FFB.
** $COD_{y,ww,untreated}$ is an average value for the COD, obtained from the results of sample testing by an external accredited laboratory.
*** $COD_{y,ww,treated}$ is estimated by using anaerobic digester efficiency of 85% (COD removal in the digester) provided by the technology supplier.

The following calculation is based on the first year of operation of the project.

Project Activity Emissions

$PE_y = PE_{y,\ power} + PE_{y,ww,treated} + PE_{y,s,final} + PE_{y,fugitive} + PE_{y,dissolved}$

PE_{power}

$PE_{y,power} = EF_{grid} * MWh_{\_grid,p}$

PE_{power} = 0.631 tCO_2/MWh * 0 MWh/y
= 0 tCO_2/y,
(as ex-ante estimation, the project does not consume any grid electricity or diesel)

$PE_{y,ww,treated}$

$PE_{y,ww,treated} = Q_{y,ww} * COD_{y,ww,treated} * B_{o,ww} * MCF_{ww,final} * GWP\_CH_4$

$PE_{y,ww,treated}$ = 144,000 m^3/y * 0.010266 tonnes COD/m^3 * 0.21 kgCH_4/kg.COD * 0.1 * 21
= 651.9 tCO_2/y

$PE_{y,s,final}$

$PE_{y,s,final}$ = 0 tCO_2/y

This term is neglected because the sludge generated by the project is used for soil application.

$PE_{y,fugitive}$

$PE_{y,fugitive} = PE_{y,fugitive,ww} + PE_{y,fugitive,s}$

$PE_{y,fugitive,ww} = (1 - CFE_{ww}) * MEP_{y,ww,treatment} * GWP\_CH_4$

$PE_{y,fugitive,ww}$ = (1 – 0.9) * 2,069.7 tCH_4/y * 21
= 4,346.3 tCO_2/y

Where $MEP_{y,ww,treatment}$ is calculated as follows;

$MEP_{y,ww,treatment} = Q_{y,ww} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,treatment}$

$MEP_{y,ww,treatment}$ = 144,000 m^3/y * 0.068441 tonnes COD/m^3 * 0.21 kg CH_4/kg.COD * 1.0
= 2,069.7 tCH_4/y

$PE_{y,fugitive,s}$

$PE_{y,fugitive,s}$ = 0 tCO_2/y, as this parameter is not applicable

Therefore;

$PE_{y,fugitive}$ = 4,346.3 tCO_2/y + 0 tCO_2/y
= 4,346.3 tCO_2/y

$PE_{y,dissolved}$

$PE_{y,dissolved} = Q_{y,ww} * [CH_4]_{y,ww,treated} * GWP\_CH_4$

$PE_{y,dissolved}$ = 144,000 m^3/y * 0.0001 tonnes/m^3 * 21
= 302.4 tCO_2/y

The project emissions, PE_y is:

PE_y = 0 tCO_2/y + 651.9 tCO_2/y + 0 tCO_2/y + 4,346.3 tCO_2/y + 302.4 tCO_2/y
= 5,300.6 tCO_2/y

Baseline Emissions

$BE_y = BE_{y\_ww} + BE_{y\_electricity}$

BE_{y_ww}

$BE_{y\_ww} = Q_{y,ww} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,treatment} * GWP\_CH_4$

BE_{y_ww} = 144,000 m^3/y * 0.068441 tonnes COD/m^3 * 0.21 $kgCH_4$/kg.COD * 0.8 * 21
= 34,770.2 tCO_2/y

$BE_{y\_electricity}$

$BE_{y\_electricity} = MWh_{\_grid} * EF_{grid}$

$BE_{y\_electricity}$ = 8,798.4 MWh/y * 0.631 tCO_2/MWh
= 5,551.8 tCO_2/y

Baseline emissions, BE_y is:

BE_y = 34,770.2 tCO_2/y + 5,551.8 tCO_2/y
= 40,322.0 tCO_2/y

Emission reductions

$ER_y = BE_y – PE_y – Leakage$

ER_y = 40,322.0 tCO_2/y – 5,300.6 tCO_2/y – 0 tCO_2/y
= 35,021.4 tCO_2/y

By using the information given in the above table in this section, emission reductions for other years during the crediting period are expressed in the section B.6.4.

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)		Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
		methane capture part	displace grid electricity part		
Year 1: May 08 – Apr 09	5,301	34,770	5,552	0	35,021
Year 2: May 09 – Apr 10	5,301	34,770	5,979	0	35,448
Year 3: May 10 – Apr 11	5,301	34,770	6,406	0	35,875
Year 4: May11 – Apr 12	7,730	50,707	10,249	0	53,266
Year 5: May 12 – Apr 13	7,730	50,707	10,249	0	53,266
Year 6: May 13 – Apr 14	7,730	50,707	10,249	0	53,266
Year 7: May 14 – Apr 15	7,730	50,707	10,249	0	53,266
Year 8: May 15 – Apr 16	7,730	50,707	10,249	0	53,266
Year 9: May 16 – Apr 17	7,730	50,707	10,649	0	53,266
Year 10: May 17 – Apr 18	7,730	50,707	10,649	0	53,266
Total (tonnes of CO_2e)	**70,012**	**459,257**	**89,683**	**0**	**478,927**

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	$Q_{y,ww}$
Data unit:	M^3/y
Description:	volume of wastewater treated in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	144,000 m^3/year for the year 1 – 3, 210,000 m^3/year for the year 4 – 10
Description of measurement methods and procedures to be applied:	The effluent inflow will be monitored continuously by cumulative volumetric flow measuring meters. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
QA/QC procedures to be applied:	Flow meters will be calibrated according to manufacturer recommended standards.

Any comment:	-

Data / Parameter:	$COD_{y,ww,untreated}$
Data unit:	tonnes COD/m^3
Description:	Chemical oxygen demand of the wastewater entering the anaerobic treatment reactor/system with methane capture in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd
Value of data	0.068441 tonnes COD/m^3
Description of measurement methods and procedures to be applied:	Daily analysis of samples is conducted at in-house laboratory and observations are recorded. Monthly samples will be sent to an external accredited analytical laboratory.
QA/QC procedures to be applied:	COD will be tested by sample on a daily basis. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
Any comment:	-

Data / Parameter:	$COD_{y,ww,treated}$
Data unit:	tonnes COD/m^3
Description:	Chemical oxygen demand of the treated wastewater in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd
Value of data	0.010266 tonnes COD/m^3
Description of measurement methods and procedures to be applied:	Daily analysis of samples is conducted at in-house laboratory and observations are recorded. Monthly samples will be sent to an external accredited analytical laboratory.
QA/QC procedures to be applied:	COD will be tested by sample on daily basis. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
Any comment:	-

Data / Parameter:	$MWh_{\_grid,p}$
Data unit:	MWh/y
Description:	Grid electricity consumed by the project activity in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	0 MWh/y
Description of measurement methods and procedures to be applied:	This parameter will be measured continuously by electricity meters. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
QA/QC procedures to be applied:	This parameter will be monitored by electricity meters which will be calibrated in accordance with the standards set by Tenaga Nasional Berhad (TNB).
Any comment:	-

Data / Parameter:	MWh_{grid}
Data unit:	MWh
Description:	Amount of electricity produced by the renewable generating unit that is exported to the grid in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	Year 1 : 8,798 MWh/y Year 2 : 9,475 MWh/y Year 3 : 10,152 MWh/y Every year from year 4 to year 10 : 16,243 MWh/y
Description of measurement methods and procedures to be applied:	This parameter will be measured continuously by electricity meters. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
QA/QC procedures to be applied:	This parameter will be monitored by electricity meters which will be calibrated in accordance with the standards set by Tenaga Nasional Berhad (TNB). The data will be checked against purchase receipts.
Any comment:	-

Data / Parameter:	MWh_{gross}
Data unit:	MWh
Description:	Gross electricity produced by the renewable generating unit in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	Year 1 : 9,360 MWh/y Year 2 : 10,080 MWh/y Year 3 : 10,800 MWh/y Every year from year 4 to year 10 : 17,280 MWh/y
Description of measurement methods and procedures to be applied:	This parameter will be measured continuously by electricity meters. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
QA/QC procedures to be applied:	This parameter will be monitored by electricity meters which will be calibrated in accordance with the standards set by Tenaga Nasional Berhad (TNB).
Any comment:	This parameter (MWh_{gross}) and MWh_{grid} will be used to calculated internal electricity consumption.

Data / Parameter:	BE_y
Data unit:	tCO_2/y
Description:	Baseline emission from wastewater in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	Year 1 – 3: 34,770 tCO_2/y Year 4 – 10: 50,707 tCO_2/y
Description of measurement methods and procedures to be	The amount of methane recovered, fuelled or flared will be monitored, using continuous flow meter. The fraction of methane in the gas will be measured with continuous analyzer or with periodical measurement at a 95% confidence

applied:	level. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
QA/QC procedures to be applied:	The flow meters will be calibrated in accordance with the manufacturer standards or appropriate industry standards.
Any comment:	-

Data / Parameter:	Fraction of methane
Data unit:	Fraction (volumetric basis)
Description:	Fraction of methane in the recovered biogas
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	n/a – this parameter is not relevant to the purpose of the ex-ante estimation
Description of measurement methods and procedures to be applied:	The fraction of methane in the gas will be measured with continuous analyzer or with periodical measurement at a 95% confidence level. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
QA/QC procedures to be applied:	The analyser will be calibrated in accordance with the manufacturer standards or appropriate industry standards.
Any comment:	-

Data / Parameter:	Temperature of biogas
Data unit:	^{0}C
Description:	Temperature of biogas combusted
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	n/a – this parameters is not relevant to the purpose of the ex-ante estimation
Description of measurement methods and procedures to be applied:	Temperature of the biogas will be measured by continuous temperature sensor or with periodical measurement at a 95% confidence level. This parameter is required to determine the density of methane combusted. Data will be kept electronically in a systematic and transparent manner during the crediting period and two years after the end of the crediting period.
QA/QC procedures to be applied:	The temperature sensor will be calibrated in accordance with the manufacturer standards or appropriate industry standards.
Any comment:	-

Data / Parameter:	Pressure of biogas
Data unit:	Bar
Description:	Pressure of biogas combusted
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	n/a – this parameter is not relevant to the purpose of the ex-ante estimation
Description of measurement methods and procedures to be applied:	Pressure of the biogas will be measured by continuous pressure transducer or with periodical measurement at a 95% confidence level. This parameter is required to determine the density of methane combusted. Data will be kept electronically in a systematic and transparent manner during the crediting

	period and two years after the end of the crediting period.
QA/QC procedures to be applied:	The pressure transducer will be calibrated in accordance with the manufacturer standards or appropriate industry standards.
Any comment:	-

Data / Parameter:	End-use of the final sludge
Data unit:	-
Description:	End-use of the final sludge; for the project, the final sludge will be used for soil application.
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	Negligible
Description of measurement methods and procedures to be applied:	The final disposal of the sludge will be monitored during the crediting period. For each disposal of the sludge, the following will be recorded; end-use, disposal site and date of disposal.
QA/QC procedures to be applied:	-
Any comment:	-

B.7.2 Description of the monitoring plan:

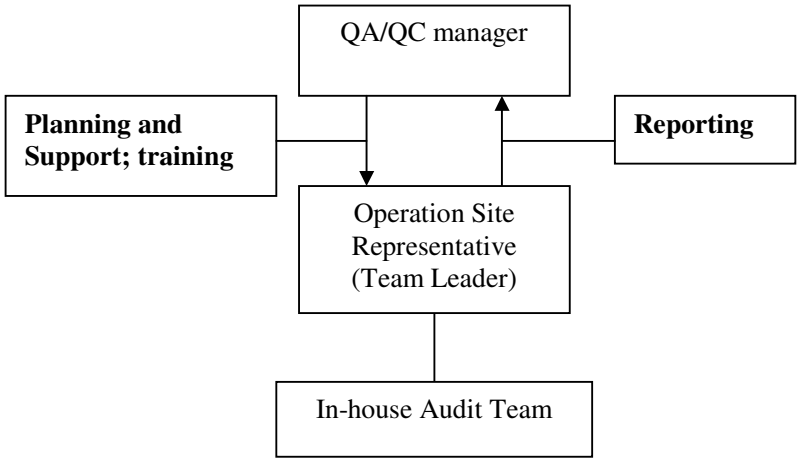
In order to monitor the project emission reductions, the biogas plant staff will receive appropriate training based on the monitoring equipment to be installed, the data to be monitored, and the related monitoring and quality control procedures.

The technology supplier will conduct the training. As it is a project participant, the technology supplier will be responsible for the implementation of quality control and quality assurance procedures at the project site. He will act as QC/QA manager.

The QA/QC manager will nominate the internal audit team members and also approve the training programs. The team leader will consolidate all the data and input the data in a monitoring workbook.

Monitoring procedures and QA/QC activities will be implemented under the structure described below:

QA/QC and monitoring organization



QA/QC will ensure accuracy and reliability of the collected through:

1. Measurement Control
2. Document Control
3. Management Review

Position

QA/QC Manager Plant manager

Team Leader Plant engineer

Audit team Plant technicians

Responsibility

QA/QC manager Review all the reported results and measurements submitted by the team leader

Team Leader Conforming, all instruments such as waste water flow meter, gas flow meter, and temperature meter will be calibrated as per manufacturing recommended standard.

Arrange with the technology supplier in order to train the audit team. The audit team shall be trained in operation, maintenance, trouble shooting, analysis of operating parameters and other safety procedures of the new installed technology. Beside, the team leader will aggregate all the recorded data in to electronic database a well as review the detail of any breakdown of equipments.

Audit team The team will be trained not only about the biogas tank digester technology and its system but also the electricity generation technology and the grid connection system in operation, trouble shooting, maintenance, analysis of operating parameter and other safety procedures from the technology supplier.

The team will responsible for maintenance of equipment and record of the breakdown with details. Importantly, the team will record the data, according to the PDD, such as COD, gas flow rate, temperature of flare and etc, accurately.

Beside, the team must be able to deal with the emergency situations. The emergencies can be leakage of biogas from gas holders, others gas handling. Although all the equipment, piping and instruments are as per explosion proof and gas tight, emergencies and immediately rectify the leakage areas.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

Date: 15 June 2007

Person/Entity responsible:
Bright Carbon & Energy Consulting Sdn Bhd
Suite 3A01, Level 3A, Block E, Phileo Damansara 1
Off Jalan Damansara
46350 Petaling Jaya
Selangor, Malaysia

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

13th June 2007

C.1.2. Expected operational lifetime of the project activity:

21 years
(Based on the standard terms of Renewable Energy Power Purchase Agreement expected to be entered between Tenaga Nasional Bhd and Bell Eco Power Sdn Bhd)

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

n/a

C.2.1.2. Length of the first crediting period:

CDM – Executive Board

n/a

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

1st May 2008 or date of registration with CDM-EB whichever is later

C.2.2.2. Length:

10 years 0 month

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

As the project does not fall under the Prescribed Activities listed under the Environmental Quality (Prescribed Activities) (EIA) Order 1987, no Environmental Impact Assessment was required.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

n/a

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

A workshop was organized on 31 May 2007 at the project host's premises (CPO mill - future project site) to conduct the stakeholders' consultation. It assembled representatives from the project host, the project participants, the Malaysian Palm Oil Board, the Malaysian Department of Environment, the CDM consultants and local communities. The agenda of the meeting was as follows:

- Registration
- Introduction to the project host (CPO mill) activities
- The objectives of the project
- Explanation of the global warming and climate change causes and consequences
- Explanation of the CDM objective and process
- Detailed description of the proposed project
- Walk-through visit of the CPO mill and the open lagoon
- Questions and answer

The list of participants who attended the stakeholders' consultation meeting is given below:

No.	Name	Organization
1.	En. Anuar Bin Ismail	Department of Environment
2.	Dr. Chow Mee Chin	Malaysia Palm Oil Board (MPOB)
3.	Mr. Vijayan	Malaysia Palm Oil Board (MPOB)
4.	Hj. Mohd Khalid Bin Ismail	Village Head, Kampung Parit Ju
5.	Pn. Sharifah Binti Amin	Parit Ju School
6.	Hj. Bohari Bin Shafie	Deputy Chairman, Committee on Village Security & Development, Parit Ju
7.	Mr. Lau Choon Wah	Batu Pahat Plantation
8.	En. Ayob Bin Mustafa	FFB Supplier
9.	Mr. Andrew Chiew	Highland Palm Produce
10.	Mr. Jason Gan	Cemerlang Sawit
11.	Mr. Goh Soon Hoe	Eng Hup Soon
12.	En. Kamarul Akmal Arif	Joda
13.	En. Ismudin Manap	Joda
14.	En. Md Isa Hussain	local resident
15.	Mr. Kho Chee Peng	local resident
16.	En. Ishak Bin Mohd Som	local resident
17.	Mr. Chen Soo Kim	local resident
18.	Mr. Muthiah A/L Doraisamy	local resident
19.	En. Yazid Bib Tuziman	local resident
20.	Mr. Lim Tiok Yong	local resident
21.	Mr. Teo Hwee Hong	local resident
22.	Mr. Teow Wee San	local resident
23.	Mr. Yeo Thian Guan	Bell Palm Industries
24.	En. Effendy Bin Khairuddin	Bell Palm Industries
25.	En. Asri	Bell Palm Industries
26.	Dato' Low Boon Eng	Bell Group (HQ)
27.	Mr. Jeffrey Khoo	Bell Group (HQ)
28.	Ms. Celine	Bell Group (HQ)
29.	Mr. C.C.Lee	Bell Group (HQ)
30.	Mr. Tan Bee Wah	Eco Biodiversity S/B
31.	Mr. Ooi Kah Soon	Eco Biodiversity S/B
32.	Mr. William Kho	Bright Carbon & Energy Consulting S/B
33.	Mr. Kittisak Sukvivatn	Bright Carbon & Energy Consulting S/B
34.	Mr. Pierre Cazelles	Bright Carbon & Energy Consulting S/B

E.2. Summary of the comments received

The stakeholders who attended the meeting did not raise any objections to the project and showed general agreement with few comments received:

No	Comments	Representative From
1	Is there risks of explosion of the biogas tanks	Resident from local communities

2	Could the project supply the generated electricity to local communities at a reduced price?	Resident from local communities

In addition, all participants expressed their satisfaction towards the implementation of the proposed project because it will eliminate the foul odor from the open lagoons that is currently a serious inconvenience to surrounding communities.

E.3. Report on how due account was taken of any comments received:

The project participants and consultants' responses to the comments received from the stakeholders were as follows:

No	Reponses

1	The biogas tank will use state-of-the-art technology. The pressure inside the tanks will be constantly monitored and the biogas engine will run on a 24 hour basis. During maintenance of the biogas engine, the biogas will be flared. There is no history of such accidents worldwide.
2	The Malaysian regulation does not allow this practice. All electricity produced by independent power producers must be either used on-site, or sold to TNB.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Bell Eco Power Sdn. Bhd.
Street/P.O.Box:	125, Jalan SS15/5A,
Building:	
City:	Subang Jaya
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Telephone:	+6035 634 4999
FAX:	+6035 634 0723
E-Mail:	jeffrey@bell.com.my
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	Khoo
Middle Name:	Kah Hock
First Name:	Jeffrey
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Eco Biodiversity Sdn. Bhd.
Street/P.O.Box:	11-1, Block C (1st Floor), Dataran Ara Damansara, Jalan PJU 1A/20B
Building:	
City:	Petaling Jaya
State/Region:	Selangor Darul Ehsan
Postfix/ZIP:	47301
Country:	Malaysia
Telephone:	+603 7846 8509
FAX:	+603 7842 2376
E-Mail:	ksooi@ecobiodiversity.com
URL:	
Represented by:	

Title:	
Salutation:	Mr.
Last Name:	Ooi
Middle Name:	
First Name:	Kah Soon
Department:	
Mobile:	+6019 631 7086
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Mitsui & Co., Ltd.
Street/P.O.Box:	2-1, Ohtemachi 1-chome, Chiyoda-ku
Building:	
City:	Tokyo
State/Region:	
Postfix/ZIP:	100-0004
Country:	JAPAN
Telephone:	
FAX:	
E-Mail:	
URL:	http://www.mitsui.co.jp/en/index.html
Represented by:	
Title:	Manager
Salutation:	Ms.
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Middle Name:	-
First Name:	Akiko
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Mobile:	
Direct FAX:	+81-3-3285-9515
Direct tel:	+81-3-3285-2977
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not sought any ODA or subsidy from any Annex I country.

Annex 3

BASELINE INFORMATION

Emission coefficient of the grid

According to the methodology AMS I.D, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in CO_2e/kWh) calculate in a transparent and conservative manner as:

The option (a), which is a combined margin (CM), consisting of the combination of operation margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002, is used to calculate the emission coefficient of the grid electricity which the project will displace.

As per ACM0002, the Operation Margin (OM) refers to adjustments in the existing grid mix due to the project activity. The planning horizon is rather short-term. Therefore, the short term marginal costs (the operating costs for the last unit produced by a plant to meet the demand) are relevant. The emissions produced by the plants, which are on the margin, are taken to calculate the OM. However, the "Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories" was used to determine the grid emission baseline in Malaysia. Hence, the baseline calculation, as per AMS I.D, used only one most recent year data available instead of threes years, as per ACM0002.

There are four options to calculate the Operating Margin, namely

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

Regarding to Tenaga Nasional Berhad (TNB), the option (c) was deemed not possible to be used, because the data is not readily available from the relevant authorities. Beside, option (d) is not applicable to Malaysia. Hence, the option (a) was carried out, option (b) give the same result.

For, the Build Margin (BM) calculation, the ex-ante option is selected.

The baseline is, therefore, 0.631 (kg CO_2e/kWh) in accordance with the national power sector baseline most recent study undertaken by Pusat Tenaga Malaysia (PTM), *Study on Grid Connected Electricity Baselines in Malaysia: 2006 (http://www.ptm.org.my).* The latest year of data available (2004) was used.

The calculation of "Operation Margin" is based on the generation-weighted emissions per electricity unit of all power plants generating units serving the grid system in Peninsular Malaysia. This excludes the generation from "Hydro" as a must-run/ low-costs fuel source. The data available for the recent 3 years are the years 2002, 2003, 2004 and are as illustrated in the Table below:

Table : Simple Operation Margin for Peninsular Malaysia

Years	Generation (GWh)	CO_2 Emission (tonnes)	Baselines ($kgCO_2e$/ kWh)
2004	77,566	48,808,151	0.629
2003	67,511	37,833,007	0.560
2002	62,854	34,604,511	0.551
Average Operation Margin for 3 years			0.580

Source: Energy Commission (2004)

The "Simple Operation Margin" has been calculated based on the average of 3 years (2002, 2003, 2004) of historical data and is is (0.629+0.560+0.551)/3 or 0.580 $kgCO_2$/kWh.

The calculations of "Build Margin" are based on the weighted average emissions of the 5 most recently installed power plants in Peninsular Malaysia. The total output generated by these 5 plants in 2003 is more than 20% of the total system generation in Peninsular Malaysia (20,055,350 MWh out of the total 82,550,893 MWh or 24%). The Build Margin for Peninsular Malaysia is calculated as follows

Table: Build Margin for Peninsular Malaysia

Name of Project / Fuel Types	Year Operation	Capacity, MW	Total Generation, MWh	CO_2 Emission (tonnes CO_2)
1.Janamanjung Power Plant / Coal	September 2003	2,070	12,289,662	11,299,338
2.GB3 Power Station / GAS	March 2003	654	4,246,276	1,957,087
3.Panglima Power Station / GAS	April 2003	720	5,577,858	2,758,729
4.Perlis Power Station GAS	April 2003	650	5,328,046	3,229,780
5. SKS Prai Power Station	June 2003	350	2,113,703	872,175
Total			29,555,545	20,117,109

Source: Energy Commission (2004)

CO2 Emissions divided by the total generation = 20,117,109 tCO_2/29,555,545 MWh or 0.681 $kgCO_2$/kWh.

Finally the "Combined Margin" is calculated by averaging the "Simple Operation Margin" with the "Build Margin". Therefore the "Combined Margin" is (0.580 + 0.681)/2 or 0.631 $kgCO_2$/kWh.

Annex 4

MONITORING INFORMATION

Please refer to section B.7.1 and B.7.2.

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Appendix 1

Project Financial Analysis

BASIC ASSUMPTIONS

Notes:

(1) Revenue from sale of electricity :

		RM
Year 1	2,000 kW x (100% - 6%) x 65% x 24 hours x 300days/ year x RM0.21 per kWh = RM	1,847,664.00
Year 2	2,000 kW x (100% - 6%) x 70% x 24 hours x 300days/ year x RM0.21 per kWh = RM	1,989,792.00
Year 3	2,000 kW x (100% - 6%) x 75% x 24 hours x 300days/ year x RM0.21 per kwh = RM	2,131,920.00
Year 4 to 21	3,000 kW x (100% - 6%) x 80% x 24 hours x 300days/ year x RM0.21 per kwh = RM	3,411,072.00

Revenue from sale of electricity is calculated based on the assumption of the trade debtors with 30 days credit period.

(2) Revenue from sale of CERs:

CERs revenue is calculated based on the assumption that US$10 per ton CO2. The exchange rate between USD and RM is assumed to be RM3.3660/USD based on the Bank Negara's best available quotations on 1 Oct 2007.

CERs revenue is calculated at net balance after less estimated monitoring and verification cost of RM40,000 per year.

(3) Cost of Sales and Other Operating Expenses:

(i) **Raw Materials (Effluents) - Fuel Cost:**

	RM
Year 1 to 21 42 tonnes of effluent/hour x 24 hours x 300days/year x RM0.3571 /tonnes = RM	54,000.00

Staff cost :

Production		Estimated Increment Per Year	Annual Salary RM
Salary :	2 Technicians @ RM5,000 per month x 12 months		120,000.00
	1 Chargemen @ RM4,500 per month x 12 months		54,000.00
	3 Operators @ RM1,800 per month x 12 months		64,800
	2 Skilled Fitters @ RM2,400 per month x 12 months		57,600.00
		2%	296,400.00
EPF @ 12% of salary		2%	35,568.00
SOCSO @ RM34.15 per personnel (6 staff x RM34.15 x 12 months)		nil	2,458.80
			38,026.80

Office Admin		Estimated Increment Per Year	Annual Salary RM
Salary:	1 Plant Manager @ RM10,000 per month		120,000.00
	1 Accountant @ RM5,000 per month		60,000.00
	1 Admin & HR Head @ RM5,000 per month		60,000.00
	1 Executive Supporting staff @ RM3,000 per month		36,000.00
	1 Clerk @ RM1,200 per month x 12 months		14,400.00
		2%	290,400.00
EPF @ 12% of salary		2%	34,848.00
SOCSO @ RM34.15 per personnel (6 staff x RM34.15 x 12 months)		nil	2,458.80
			37,306.80

Salary and salary related expenses(e.g. EPF and Bonuses) increments estimated to increase at rates of 2% annually. Inflation rate is assumed at 5% per annum. However, inflationary effects are mitigated against the learning curve effects after the plant has been in operation for 5 years and are not expected to rise significantly year-on-year.

(ii) **Depreciation:**

Depreciation is calculated on Plant & Machinery @ 10% straight line method.
Subsequent to the end of the depreciation period, we anticipate that a major overhaul of approximately RM300,000 to be incurred in order to maintain the plant to meet the expanding population demands and service level demands without incurring any further capital expenditure subsequent to the end of the depreciation period.

The cost of Plant & Machinery at the end of 10th year becomes nil.

(iii) **Electricity Consumption:**

Electricity consumption is 6% of the energy generated.

(iv) **Insurance:**

Insurance :

		RM
Plant :	Inclusive of Fire, Theft and Public Liability Insurances and relevant service taxes	100,000.00

		RM
Office :	Inclusive of Theft and Fire within Office Area	300.00

		No. of Staff	Estimated RM/Staff	RM
Staff insurance :	Non-technical staff @ RM250	5	250.00	1,250.00
	Technical staff @ RM356.25	8	356.25	2,850.00
		13		4,100.00

(v) **Maintenance and Repairs cost:**

	RM
Cost of spare-parts @ 3% of total Biogas System (includes electrical and control instrumentation)	195,000.00
Contract maintenance & servicing on the Biogas Generator Set @ RM20,000/visit x 5 visits per annu	100,000.00
	295,000.00

This amount increases to RM645,000 in Year 11 to Year 21 due to higher maintenance after end of depreciation lifetime

(vi) **Bonus:**

Bonus is calculated based on 1.5 months salary including 12% EPF.

(vii) **Medical Expenses:**

Medical expense is based on 6 visits per year for each personnel (13 personnel in total) and the cost per visit is RM60.

(viii) **Security Expenses:**

It is assumed the security force comprises of 4 personnel @ RM1,200 per month each.

(ix) **Plant Capacity:**

It is assumed the Plant is working at 80% capacity. (24hrs. x 300days p.a.)

(x) **Professional and Advisory Fees are as follows:**

	Year 1	Year 2	Subsequent Years
Consultancy for implementation (RM500,000)	450,000.00	50,000.00	
Inspection Fees (RM25,000/visit x 6 visits p.a.)	150,000.00	150,000.00	150,000.00
	600,000.00	200,000.00	150,000.00

(xi) **Trade Creditors:**

Credit period to Creditors is based on the assumption that expenses are paid when they accrued.

(5) Income Tax and Capital Allowance:

Income Tax: Calculation of income tax payable is based on the assumption that the company will be granted Pioneer Status for 5 years and the amount abated will 70% of the statutory income.

Capital Allowance:	Initial Allowance (IA)	20%	- for all assets
	Annual Allowance (AA)	10%	- on plant and machinery
		14%	- on office equipment

(6) Financing Costs:

It is assumed that the company would secure an overdraft facilities with credit limit of RM3.6 million for its working capital requirements at an interest rate of 8% per annum.

It is assumed that 70% of project cost to be project funded via borrowing from shareholder loan / financial institution at an interest rate of 8.0% per annum.

Cash flow statement (without CERs revenue)

Projected Cashflow Statement (Without CER Revenue)

	Note	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Cashflow												
INFLOWS												
Sale of Electricity	*(1)*	-	1,693,692	1,977,948	2,120,076	3,304,476	3,411,072	3,411,072	3,411,072	3,411,072	3,411,072	3,411,072
CER Revenues		-	-	-	-	-	-	-	-	-	-	-
		-	1,693,692	1,977,948	2,120,076	3,304,476	3,411,072	3,411,072	3,411,072	3,411,072	3,411,072	3,411,072
OUTFLOWS												
Cost of Sales	*(3)*	-	894,287	914,454	935,004	1,074,173	1,037,007	1,044,193	1,051,524	1,069,001	1,066,627	1,074,406
Other Operating Expenses	*(3)*	-	1,162,339	784,683	758,360	783,474	810,137	817,786	825,606	833,602	841,777	850,138
Total Outflows		-	2,056,625	1,699,137	1,693,363	1,857,646	1,847,143	1,861,979	1,877,130	1,902,602	1,908,404	1,924,544
NET OPEATING CASHFLOW		-	(362,933)	278,811	426,713	1,446,830	1,563,929	1,549,093	1,533,942	1,508,470	1,502,668	1,486,528
CAPEX												
Machinery & equipments		(6,500,000)	-	-	(3,500,000)	-	-	-	-	-	-	-
Furniture & office equipments		(5,760)	-	-	-	-	-	-	-	-	-	-
		(6,505,760)	-	-	(3,500,000)	-	-	-	-	-	-	-
Taxation	*(5)*	-	-	-	-	-	-	-	-	-	434,199	(358,921)
NET CASHFLOW BEFORE FINANCING		(6,505,760)	(362,933)	278,811	(3,073,287)	1,446,830	1,563,929	1,549,093	1,533,942	1,508,470	1,936,866	1,127,608
FINANCING												
Equity		1,950,000	-	-	-	-	-	-	-	-	-	-
Borrowing	*(6)*	4,560,000	1,150,000	1,650,000	6,050,000	3,500,000	3,200,000	2,900,000	2,600,000	2,300,000	1,500,000	800,000
Repayment	*(6)*	(800)	(764,449)	(1,944,449)	(2,957,152)	(4,899,152)	(4,775,152)	(4,451,152)	(4,127,152)	(3,803,152)	(3,439,152)	(1,948,538)
		6,509,200	385,551	(294,449)	3,092,848	(1,399,152)	(1,575,152)	(1,551,152)	(1,527,152)	(1,503,152)	(1,939,152)	(1,148,538)
NET CASHFLOW		3,440	22,618	(15,637)	19,561	47,678	(11,223)	(2,059)	6,791	5,318	(2,286)	(20,930)
OPENING BALANCE		-	3,440	26,058	10,421	29,981	77,659	66,436	64,377	71,168	76,486	74,200
BALANCE C/F		3,440	26,058	10,421	29,981	77,659	66,436	64,377	71,168	76,486	74,200	53,270
SUMMARY:												
NET ANNUAL CASHFLOW (BEFORE FINANCING)		(6,505,760)	(362,933)	278,811	(3,073,287)	1,446,830	1,563,929	1,549,093	1,533,942	1,508,470	1,936,866	1,127,608
NET ANNUAL CASHFLOW (POST FINANCING)		3,440	22,618	(15,637)	19,561	47,678	(11,223)	(2,059)	6,791	5,318	(2,286)	(20,930)
IRR (1st 10 Years) - Project		**1.65%**										

Cash flow statement (with CERs revenue)

Projected Cashflow Statement (With CER Revenues)

	Note	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Operating Cashflow												
INFLOWS												
Sale of Electricity	*(1)*	-	1,693,692	1,977,948	2,120,076	3,304,476	3,411,072	3,411,072	3,411,072	3,411,072	3,411,072	3,411,072
CER Revenues	*(2)*	-	-	1,145,928	1,160,849	1,175,771	1,764,708	1,764,708	1,764,708	1,764,708	1,764,708	1,764,708
		-	1,693,692	3,123,876	3,280,925	4,480,247	5,175,780	5,175,780	5,175,780	5,175,780	5,175,780	5,175,780
OUTFLOWS												
Cost of Sales	*(3)*	-	894,287	914,454	935,004	1,074,173	1,037,007	1,044,193	1,051,524	1,069,001	1,066,627	1,074,406
Other Operating Expenses	*(3)*	-	1,162,339	784,683	758,360	783,474	810,137	817,786	825,606	833,602	841,777	850,138
Total Outflows		-	2,056,625	1,699,137	1,693,363	1,857,646	1,847,143	1,861,979	1,877,130	1,902,602	1,908,404	1,924,544
NET OPEATING CASHFLOW		-	(362,933)	1,424,739	1,587,562	2,622,601	3,328,636	3,313,801	3,298,650	3,273,177	3,267,375	3,251,236
CAPEX												
Machinery & equipments		(6,500,000)	-	-	(3,500,000)	-	-	-	-	-	-	-
Furniture & office equipments		(5,760)	-	-	-	-	-	-	-	-	-	-
		(6,505,760)	-	-	(3,500,000)	-	-	-	-	-	-	-
Taxation	*(5)*	-	-	-	-	(116,304)	(216,904)	(719,071)	(715,136)	(708,258)	(882,191)	(877,834)
NET CASHFLOW BEFORE FINANCING		(6,505,760)	(362,933)	1,424,739	(1,912,438)	2,506,297	3,111,732	2,594,730	2,583,515	2,564,920	2,385,184	2,373,402
FINANCING												
Equity		1,950,000	-	-	-	-	-	-	-	-	-	-
Borrowing	*(6)*	4,560,000	1,200,000	500,000	3,450,000	-	-	-	-	-	-	-
Repayment	*(6)*	(800)	(768,449)	(1,902,449)	(1,599,152)	(2,019,152)	(1,019,152)	(1,019,152)	(1,019,152)	(1,019,152)	(1,019,152)	(384,538)
		6,509,200	431,551	(1,402,449)	1,850,848	(2,019,152)	(1,019,152)	(1,019,152)	(1,019,152)	(1,019,152)	(1,019,152)	(384,538)
NET CASHFLOW		3,440	68,618	22,290	(61,590)	487,145	2,092,580	1,575,578	1,564,363	1,545,768	1,366,032	1,988,864
OPENING BALANCE		-	3,440	72,058	94,348	32,758	519,904	2,612,484	4,188,062	5,752,425	7,298,193	8,664,225
BALANCE C/F		3,440	72,058	94,348	32,758	519,904	2,612,484	4,188,062	5,752,425	7,298,193	8,664,225	10,653,089
SUMMARY:												
NET ANNUAL CASHFLOW (BEFORE FINANCING)		(6,505,760)	(362,933)	1,424,739	(1,912,438)	2,506,297	3,111,732	2,594,730	2,583,515	2,564,920	2,385,184	2,373,402
NET ANNUAL CASHFLOW (POST FINANCING)		3,440	68,618	22,290	(61,590)	487,145	2,092,580	1,575,578	1,564,363	1,545,768	1,366,032	1,988,864
IRR (1st 10 Years) - Project		**15.47%**										