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: 01
Date: 13/06/2007

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

Introduction:

The purpose of the project activity is to install two (2) 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.

The mill currently generates its own electricity and steam via a biomass-fired cogeneration system. However, diesel is used in a 175 kW generator for start-up and back-up purposes. The annual consumption of diesel in the mill is approximately 50,000 liters which generates electricity of 56 MWh for the mill. Periodic purchase of electricity from the Tenaga Nasional Berhad (TNB) grid is also used for back-up purposes.

Proposed project activity:

The project proposes to construct two (2) 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 1) be used to substitute diesel for the start-up/back-up genset system; and 2) be sold to the grid. By doing so, the project will reduce GHG emissions by an estimated 46,821 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 2 MW (4 x 500kW) (whereby the net output is estimated at 90% of 1.8MW) of electricity generation capacity at the beginning of the project; it is forecasted that the capacity will be increased to 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 diesel (currently used in the start-up/back-up system) and 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. By recovering the methane that is currently emitted by the open lagoons anaerobic treatment system, and by generating electricity from the biogas, the project will reduce emissions of GHG in the range of 46,821 tCO_2e per year.

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).

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	• Bell Eco Power Sdn. Bhd. (private entity) • EcoBiodiversity Sdn. Bhd. (private entity)	No
Netherlands (tbc.)		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:

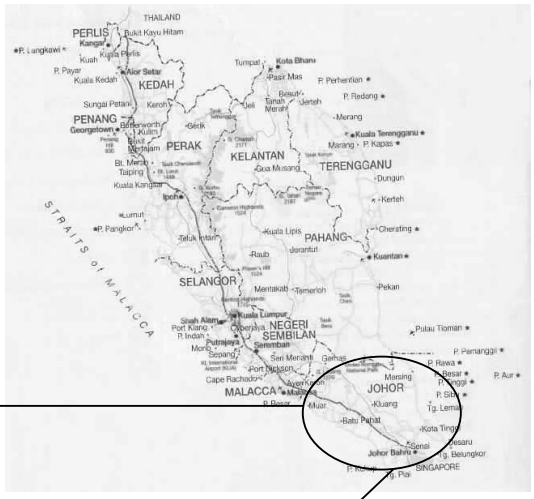
Batu Pahat

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

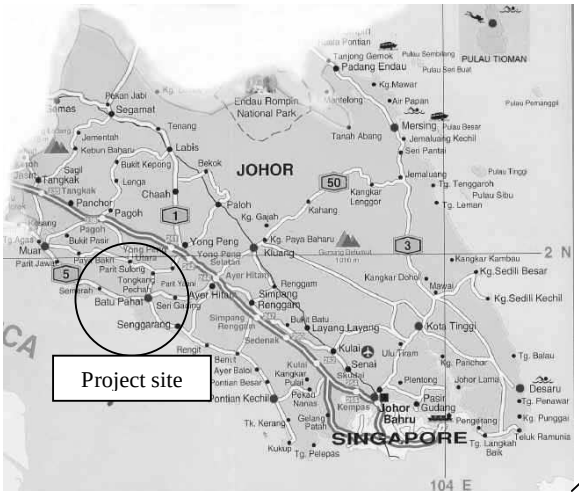
The project activity is located in the southern part of Peninsular Malaysia (see maps below). The project will be hosted by the BPI crude palm oil mill, located at:

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

Peninsular Malaysia



Project site: Batu Pahat



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. The two (2) 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. The POME will flow from the mixing and cooling pond into the first biogas tank, where the retention time will be between 8 to 10 days, before entering the second tank, for a retention time of 6 to 8 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 4 bubbling devices installed at the bottom of the tanks. The bubbling system, coupled with four stirring devices mounted on adjustable 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 back-up and start-up purposes, thereby replacing the current diesel generator.

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. (A conservative combustion efficiency of 90% will be applied ex-ante, but actual measurements of efficiency will be attempted ex-post.) 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: 2008	35,645
Year 2: 2009	36,117
Year 3: 2010	36,589
Year 4: 2011	51,409
Year 5: 2012	51,409
Year 6: 2013	51,409
Year 7: 2014	51,409

Year 8: 2015	51,409
Year 9: 2016	51,409
Year 10: 2017	51,409
Total estimated reductions (tonnes of CO_2e)	**468,214**
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tCO_2e)	46,821

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 electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	The project will generate electricity from the captured methane and use it i) for internal purposes to displace electricity produced by diesel generator and 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	Not applicable

	qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15 MW.	

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 corresponding category under type I.	The approved baseline and monitoring methodology AMS-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 methane capture part of the project are estimated as follow: Year 1 – 3 : 29,470 tCO2e/y Year 4 – 10 : 42,976 tCO2e/y which is lower than 60 ktCO2e per year over the crediting period.

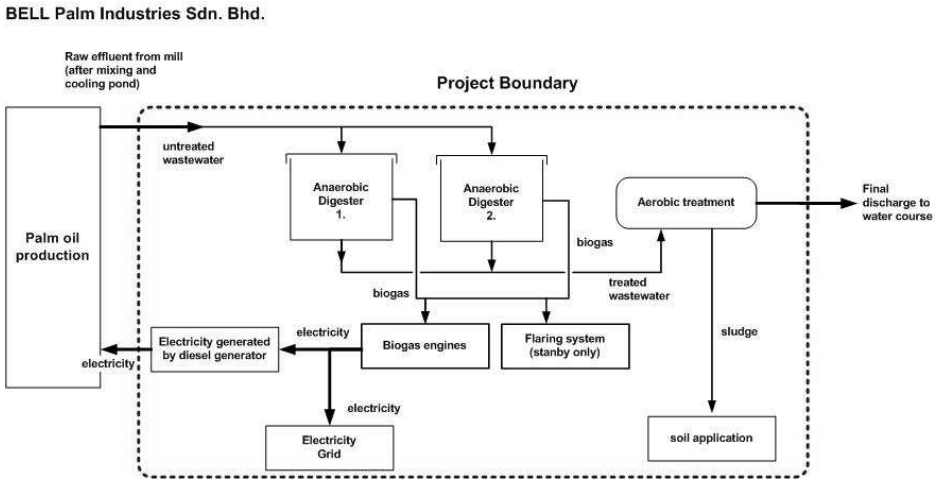
B.3. Description of the project boundary:

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, as opposed to the current system that is based on diesel generator (for start-up and back-up purposes) and electricity from the grid (boundary of the baseline). It includes the compressor, the desulphurization unit, and the biogas engines.

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 CO_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 electricity displaced from diesel generator, the baseline is the annual kWh generated by the renewable unit times an emission coefficient for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.D.1 of AMS I.D.

The emission coefficient for the case of Productive applications, capacity of 175 kW is 0.8 $kgCO_2e/kWh$.

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 at least one of the following barriers: (a) investment barrier, (b) technological barrier, (c) barrier due to prevailing practice, and (d) 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.

Investment analysis

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). It requires no further investment.

The methane recovery system will be built, own and operated by the project participants. The project participants will retain the incomes 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	
Plant & Equipment	4,500,000
Development cost	2,000,000
Other	5,760
Total	**6,505,760**
2. Average annual cost (over 10 years)	
Cost of sales	
Case of including CDM implementation	997,730
Case of excluding CDM implementation	974,524
Operating expenses	465,183
3. Average annual income	
Electricity	2,106,720
Project IRR (10 years) without CER revenue	0.41%
Project IRR (10 years) with CER revenue	22.32%

The IRR of the project, without the revenues from the selling of CERs is 0.41%, which is deemed not financially feasible. Taking into consideration the additional revenues from the selling of CERs, the project IRR is 22.32%.

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

The detailed financial model is provided in Annex 3

Prevailing practices

There are close to 400 CPO mills in Malaysia. As of June 2007, based on general knowledge, no CPO mill has implemented a biogas recovery system on a commercial basis. The proposed project can therefore be considered as innovative.

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 0.41%;
3. The proposed project activity is not a prevailing practice.

As result, the proposed project activity is additional.

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"
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.

$PE_{y,fugitive}$ emissions from methane release in capture and flare systems in year "y"

$PE_{y,dissolved}$ emissions from dissolved methane in treated wastewater in year "y"

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

Where:

EF_{grid} Emission coefficient of the grid
(Calculated combined margin (CM) of 0.655 tCO_2/MWh is used.)

$MWh_{\_grid,cons}$ Grid electricity consumed by the project activity in the year "y"

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

Where:

$Q_{y,ww}$ volume of wastewater treated in the year "y" (m^3)

$COD_{y,ww,treated}$ chemical oxygen demand of the treated wastewater in the year "y" (tonnes/m^3)

$B_{o,ww}$ methane producing capacity of the wastewater
(IPCC default value for domestic wastewater is 0.21 kg CH_4/kg.COD)

$MCF_{ww,final}$ 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

$\mathbf{BE_y = BE_{y\_ww} + BE_{y\_electricity}}$
Where:
Where:
$\mathbf{BE_{y\_ww}}$ Baseline emissions of wastewater treatment system
$\mathbf{BE_{y\_electricity}}$ Baseline emissions of displaced electricity

(A) Formula used to calculate $\mathbf{BE_{y\_ww}}$

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 $\mathbf{BE_{y\_electricity}}$

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:

$\mathbf{BE_{y\_electricity} = MWh\_{grid} * EF_{grid} + MWh\_{diesel} * EF_{diesel\_generator}}$

Where:
$\mathbf{BE_{y\_electricity}}$ Baseline emissions of displaced electricity

MWh_{grid}	Amount of electricity produced by renewable generating unit that is exported to the grid in the year "y"
MWh_{diesel}	Amount of electricity produced by renewable generating unit that displaces electricity formerly produced by diesel generator in the year "y"
EF_{grid}	Emission coefficient of the grid *(Calculated combined margin (CM) of 0.655 tCO_2/MWh is used.)*
$EF_{diesel\_generator}$	Emission factor for diesel generator systems *(According to AMS I.D., default value of 0.8 tCO_2e/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 :	As per AMS III.H.
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 :	As per AMS III.H.
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 :	As per AMS III.H.
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:	0.655 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.

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									
			2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
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	9,360	10,080	10,800	12,806	12,806	12,806	12,806	12,806	12,806	12,806
Displaced diesel generating electricity	MWh_diesel	MWh	56	56	56	56	56	56	56	56	56	56

* $Q_{y,ww}$ 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} = 0.655 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 * 10.266 kg.COD/m^3 * 10e-3 tonnes/kg * 0.21 $kgCH_4$/kg.COD * 0.1 * 21
= 652 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.

$PE_{y,fugitive}$

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

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

$PE_{y,fugitive,ww}$ $= (1 - 0.9) * 2{,}070\ tCH_4/y * 21$
$= 4{,}346\ tCO_2/y$

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

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

$MEP_{y,ww,treatment}$ $= 144{,}000\ m^3/y * 68.441\ kg.COD/m^3 * 10e\text{-}3\ tonnes/kg * 0.21\ kg\ CH_4/kg.COD * 1.0$
$= 2{,}070\ tCH_4/y$

$PE_{y,fugitive,s}$

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

Therefore;

$PE_{y,fugitive}$ $= 4{,}346\ tCO_2/y + 0\ tCO_2/y$
$= 4{,}346\ tCO_2/y$

$PE_{y,dissolved}$

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

$PE_{y,dissolved}$ $= 144{,}000\ m^3/y * 0.0001\ tonnes/m^3 * 21$
$= 302\ tCO_2/y$

The project emissions, PE_y is:

PE_y $= 0\ tCO_2/y + 652\ tCO_2/y + 0\ tCO_2/y + 4{,}346\ tCO_2/y + 302\ tCO_2/y$
$= 5{,}300\ tCO_2/y$

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} $= 144{,}000\ m^3/y * 68.441\ kg.COD/m^3 * 10e\text{-}3\ tonnes/kg * 0.21\ kgCH_4/kg.COD * 0.8 * 21$
$= 34{,}770\ tCO_2/y$

$BE_{y\_electricity}$

$BE_{y\_electricity} = MWh_{\_grid} * EF_{grid} + MWh_{\_diesel} * EF_{diesel\_generator}$

$BE_{y\_electricity}$ = 9,360 MWh/y * 0.655 tCO_2/MWh + 56 MWh/y * 0.8 tCO_2/MWh
= 6,175 tCO_2/y

Baseline emissions, BE_y is:

BE_y = 34,770 tCO_2/y + 6,175 tCO_2/y
= 40,945 tCO_2/y

Emission reductions

$ER_y = BE_y – PE_y – Leakage$

ER_y = 40,945 tCO_2/y – 5,300 tCO_2/y – 0 tCO_2/y
= 35,645 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)
Year 1: 2008	5,300	40,945	0	35,645
Year 2: 2009	5,300	41,417	0	36,117
Year 3: 2010	5,300	41,889	0	36,589
Year 4: 2011	7,730	59,139	0	51,409
Year 5: 2012	7,730	59,139	0	51,409
Year 6: 2013	7,730	59,139	0	51,409
Year 7: 2014	7,730	59,139	0	51,409
Year 8: 2015	7,730	59,139	0	51,409
Year 9: 2016	7,730	59,139	0	51,409
Year 10: 2017	7,730	59,139	0	51,409
Total (tonnes of CO_2e)	**70,010**	**538,224**	**0**	**468,214**

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:	kg.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	68.441 kg.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:	kg.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	10.266 kg.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:	$MWh_{grid,cons}$
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 : 9,360 MWh/y Year 2 : 10,080 MWh/y Year 3 : 10,800 MWh/y Every year from 4 to 10 : 12,806 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_{diesel}
Data unit:	MWh
Description:	Amount of electricity produced by the renewable generating unit that displaces electricity formerly produced by diesel generator in the year "y"
Source of data to be used:	Bell Eco Power Sdn. Bhd.
Value of data	56 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 Eco Bio Power Sdn. Bhd. This metering standard will be same standard of Tenaga Nasional Berhad (TNB).
Any comment:	-

Data / Parameter:	BE_y
Data unit:	tCO_2/y
Description:	Baseline emission from wastewater in the year "y"
Source of data to be	Bell Eco Power Sdn. Bhd.

used:	
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 applied:	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 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:	^0C
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	Bell Eco Power Sdn. Bhd.

used:	
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:	-

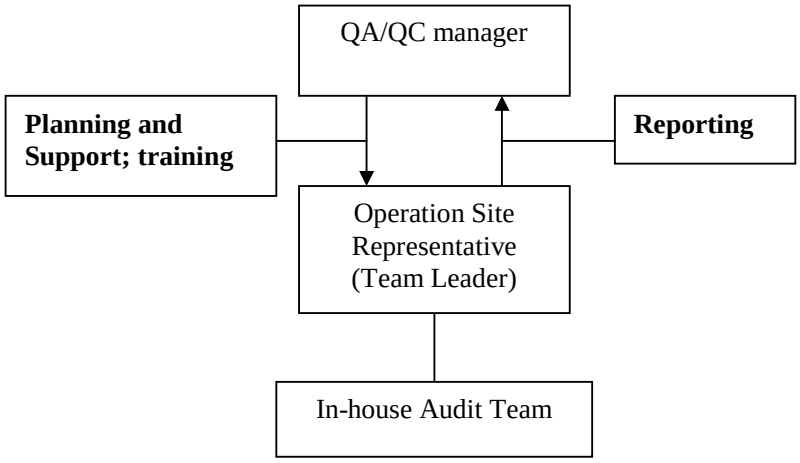
B.7.2 Description of the monitoring plan:

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.

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

QA/QC and monitoring organization



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 Management Consulting Co., Ltd.
No.1 Fortune Town bldg, 15th floor
Ratchadaphisek Rd.
Dindaeng, Bangkok 10400
Thailand

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:

01/01/08

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

21 years

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:

n/a

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/08

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:	
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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:	EcoBiodiversity Sdn. Bhd.
Street/P.O.Box:	11-1, Block C (1st Floor), Dataran Ara Damansara, Jalan PJU 1A/20B
Building:	
City:	Petaling Jaya
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Telephone:	+603 7846 8509
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E-Mail:	ksooi@ecobiodiversity.com
URL:	
Represented by:	
Title:	
Salutation:	Mr.

Last Name:	Soon
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First Name:	Ooi
Department:	
Mobile:	+6019 631 7086
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project has not received and will not receive 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, 0.655 (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.* 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 latest year is the years 2004 and 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

Source: Energy Commission (2004)

The "Simple Operation Margin" has been calculated based on the year of 2004 data and is 0.629 $kgCO_2/kWh$.

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 (0.629 + 0.681)/2 or 0.655 $kgCO_2/kWh$.

Project Financial Analysis

Summary

BELL ECO POWER SDN BHD **PIN Copy**
(FORMERLY KNOWN AS BELL THERMAL POWER SDN BHD)

Biogas Project Financial model

Project Cost:

Plant & Equipment	4,500,000.00
Development Cost	2,000,000.00
Total	6,500,000.00 (As per the Cost of investments in the Cashflow Statements)

Operating Costs and Depreciation will commence only upon completion of the construction of the plant in Year 1.
There are no operating costs in Year 0, the year of construction of the plant.

Project Cashflow with CER Income
Discounted Cash Flows for IRR

Year	Net Cash Flows	Discounting Rate = 22.32% Discounting factor	Discounted Cash Flows
0	(6,505,760.00)	1.00	(6,505,760.00)
1	46,683.40	0.82	38,165.24
2	2,186,350.76	0.67	1,461,271.72
3	2,252,758.00	0.55	1,230,924.04
4	2,251,583.78	0.45	1,005,797.13
5	2,267,693.73	0.37	828,156.19
6	1,941,077.97	0.30	579,530.64
7	1,928,643.17	0.24	470,750.59
8	1,908,617.22	0.20	380,858.28
9	1,727,223.64	0.16	281,772.57
10	1,713,540.44	0.13	228,533.60
			0.00

Project Cashflow without CER Income
Discounted Cash Flows for IRR

Year	Project Cash Flows	Discounting Rate = 0.41% Discounting factor	Discounted Cash Flows
0	-6,505,760.00	1.00	(6,505,760.00)
1	66,683.40	1.00	66,408.17
2	568,615.76	0.99	563,931.65
3	719,177.47	0.99	710,309.18
4	768,278.24	0.98	755,672.60
5	788,140.94	0.98	772,009.82
6	777,278.21	0.98	758,226.94
7	766,005.52	0.97	744,146.44
8	744,301.57	0.97	720,077.48
9	742,143.70	0.96	715,026.41
10	729,507.85	0.96	699,951.31
			0.00

Cash flow statement (with CER revenue)

CASH FLOW STATEMENT

	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		1,778,400	1,915,200	2,052,000	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800
CER Revenues		-	1,638,735	1,638,735	1,638,735	1,638,735	1,638,735	1,638,735	1,638,735	1,638,735	1,638,735
	-	1,778,400	3,553,935	3,690,735	3,827,535	3,827,535	3,827,535	3,827,535	3,827,535	3,827,535	3,827,535
OUTFLOWS											
Cost of Sales											
Salary		296,400	302,328	308,375	314,542	320,833	327,250	333,795	340,470	347,280	354,225
EPF & SOCSO		38,027	40,689	43,537	46,584	49,845	53,335	57,068	61,063	65,337	69,911
Electricity		106,704	114,912	123,120	131,328	131,328	131,328	131,328	131,328	131,328	131,328
Insurance		100,000	105,000	110,250	115,763	121,551	121,551	121,551	121,551	121,551	121,551
Repairs & maintenance		295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000
Major repairs (overhauling)		-	-	-	50,000	-	-	-	10,000	-	-
Supervision & inspection		20,000	21,000	22,050	23,153	24,310	24,310	24,310	24,310	24,310	24,310
Raw Materials		54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
	-	910,131	932,929	956,331	1,030,370	996,867	1,006,773	1,017,051	1,037,722	1,038,806	1,050,325
Operating Expenses											
Accommodation , travelling etc		20,000	21,000	22,050	23,153	24,310	24,310	24,310	24,310	24,310	24,310
Audit fee		8,000	8,400	8,820	9,261	9,724	9,724	9,724	9,724	9,724	9,724
Bonus		38,850	42,735	47,009	51,709	56,880	56,880	56,880	56,880	56,880	56,880
EPF on bonus		4,662	5,128	5,641	6,205	6,826	6,826	6,826	6,826	6,826	6,826
Salary		14,400	14,688	14,982	15,281	15,587	15,899	16,217	16,541	16,872	17,209
EPF & SOCSO		2,138	2,172	2,208	2,244	2,280	2,318	2,356	2,395	2,434	2,475
Insurance		300	315	331	347	365	365	365	365	365	365
Staff insurance		3,100	3,255	3,418	3,589	3,768	3,768	3,768	3,768	3,768	3,768
Licence fee		66,000	69,300	72,765	76,403	80,223	80,223	80,223	80,223	80,223	80,223
Medical expenses		2,880	3,024	3,175	3,334	3,501	3,501	3,501	3,501	3,501	3,501
Office expenses, stationery etc.		6,000	6,300	6,615	6,946	7,293	7,293	7,293	7,293	7,293	7,293
Office maintenance		6,000	6,300	6,615	6,946	7,293	7,293	7,293	7,293	7,293	7,293
Professional & advisory fee		600,000	200,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Quit rent & assessment		3,000	3,150	3,308	3,473	3,647	3,647	3,647	3,647	3,647	3,647
Security		5,000	5,250	5,513	5,788	6,078	6,078	6,078	6,078	6,078	6,078
Staff amenities & welfare		4,000	4,200	4,410	4,631	4,862	4,862	4,862	4,862	4,862	4,862
Staff refreshment		2,000	2,100	2,205	2,315	2,431	2,431	2,431	2,431	2,431	2,431
Telephone		11,400	11,970	12,569	13,197	13,857	13,857	13,857	13,857	13,857	13,857
Training & seminar		2,000	2,100	2,205	2,315	2,431	2,431	2,431	2,431	2,431	2,431
Bank charges		10,000	10,500	11,025	11,576	12,155	12,763	13,401	14,071	14,775	15,513
Bank overdraft interest		11,856	12,768	13,680	14,592	14,592	14,592	14,592	14,592	14,592	14,592
	-	821,586	434,656	398,541	413,305	428,102	429,059	430,053	431,087	432,161	433,277
Total Outflows	-	1,731,717	1,367,584	1,354,873	1,443,674	1,424,969	1,435,832	1,447,105	1,468,809	1,470,966	1,483,602
Net Operating Cashflow	-	46,683	2,186,351	2,335,862	2,383,861	2,402,566	2,391,703	2,380,430	2,358,726	2,356,569	2,343,933
Investment Cashflow											
Power Plant											
Machinery & equipments	(6,500,000)										
Office											
Furniture & office equipments	(5,760)										
	(6,505,760)	-	-	-	-	-	-	-	-	-	-
Taxation	-	-	-	(83,104)	(132,277)	(134,872)	(450,625)	(451,787)	(450,109)	(629,345)	(630,392)
Net Project Cashflow	(6,505,760)	46,683	2,186,351	2,252,758	2,251,584	2,267,694	1,941,078	1,928,643	1,908,617	1,727,224	1,713,540
Funding											
Equity	1,950,000										
Debt	4,550,000										
Total	6,500,000	-	-	-	-	-	-	-	-	-	-
Debt Service											
Principal Repayment		(392,204)	(404,983)	(418,178)	(431,802)	(445,871)	(460,398)	(475,399)	(490,888)	(506,882)	(523,396)
Interest Payment		(140,339)	(127,560)	(114,365)	(100,741)	(86,672)	(72,145)	(57,144)	(41,655)	(25,661)	(9,146)
	-	(532,543)	(532,543)	(532,543)	(532,543)	(532,543)	(532,543)	(532,543)	(532,543)	(532,543)	(532,543)
Net Cashflow	(5,760)	(485,860)	1,653,808	1,720,215	1,719,041	1,735,151	1,408,535	1,396,100	1,376,074	1,194,681	1,180,997
Net Cashflow b/fwd	-	(5,760)	(491,620)	1,162,188	2,882,403	4,601,444	6,336,595	7,745,130	9,141,230	10,517,304	11,711,985
Net Cashflow c/fwd	(5,760)	(491,620)	1,162,188	2,882,403	4,601,444	6,336,595	7,745,130	9,141,230	10,517,304	11,711,985	12,892,983
RESULTS											
Net Project Cashflow (after tax)	(6,505,760)	46,683	2,186,351	2,252,758	2,251,584	2,267,694	1,941,078	1,928,643	1,908,617	1,727,224	1,713,540
Net Project Cashflow (before tax)	(6,505,760)	46,683	2,186,351	2,335,862	2,383,861	2,402,566	2,391,703	2,380,430	2,358,726	2,356,569	2,343,933
Equity Cashflow	(1,950,000)	(485,860)	1,653,808	1,886,424	1,983,595	2,004,895	2,309,785	2,299,675	2,276,293	2,453,371	2,441,782

Cash flow statement (without CER revenue)

CASH FLOW STATEMENT

	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		1,778,400	1,915,200	2,052,000	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800
CER Revenues		-	-	-	-	-	-	-	-	-	-
	-	1,778,400	1,915,200	2,052,000	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800	2,188,800
OUTFLOWS											
Cost of Sales											
Salary		296,400	302,328	308,375	314,542	320,833	327,250	333,795	340,470	347,280	354,225
EPF & SOCSO		38,027	40,689	43,537	46,584	49,845	53,335	57,068	61,063	65,337	69,911
Electricity		106,704	114,912	123,120	131,328	131,328	131,328	131,328	131,328	131,328	131,328
Insurance		100,000	105,000	110,250	115,763	121,551	121,551	121,551	121,551	121,551	121,551
Repairs & maintenance		295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000	295,000
Major repairs (overhauling)		-	-	-	50,000	-	-	-	10,000	-	-
Supervision & inspection		-	-	-	-	-	-	-	-	-	-
Raw Materials		54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000	54,000
	-	890,131	911,929	934,281	1,007,217	972,557	982,463	992,741	1,013,412	1,014,496	1,026,015
Operating Expenses											
Accommodation , travelling etc		20,000	21,000	22,050	23,153	24,310	24,310	24,310	24,310	24,310	24,310
Audit fee		8,000	8,400	8,820	9,261	9,724	9,724	9,724	9,724	9,724	9,724
Bonus		38,850	42,735	47,009	51,709	56,880	56,880	56,880	56,880	56,880	56,880
EPF on bonus		4,662	5,128	5,641	6,205	6,826	6,826	6,826	6,826	6,826	6,826
Salary		14,400	14,688	14,982	15,281	15,587	15,899	16,217	16,541	16,872	17,209
EPF & SOCSO		2,138	2,172	2,208	2,244	2,280	2,318	2,356	2,395	2,434	2,475
Insurance		300	315	331	347	365	365	365	365	365	365
Staff insurance		3,100	3,255	3,418	3,589	3,768	3,768	3,768	3,768	3,768	3,768
Licence fee		66,000	69,300	72,765	76,403	80,223	80,223	80,223	80,223	80,223	80,223
Medical expenses		2,880	3,024	3,175	3,334	3,501	3,501	3,501	3,501	3,501	3,501
Office expenses, stationery etc.		6,000	6,300	6,615	6,946	7,293	7,293	7,293	7,293	7,293	7,293
Office maintenance		6,000	6,300	6,615	6,946	7,293	7,293	7,293	7,293	7,293	7,293
Professional & advisory fee		600,000	200,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Quit rent & assessment		3,000	3,150	3,308	3,473	3,647	3,647	3,647	3,647	3,647	3,647
Security		5,000	5,250	5,513	5,788	6,078	6,078	6,078	6,078	6,078	6,078
Staff amenities & welfare		4,000	4,200	4,410	4,631	4,862	4,862	4,862	4,862	4,862	4,862
Staff refreshment		2,000	2,100	2,205	2,315	2,431	2,431	2,431	2,431	2,431	2,431
Telephone		11,400	11,970	12,569	13,197	13,857	13,857	13,857	13,857	13,857	13,857
Training & seminar		2,000	2,100	2,205	2,315	2,431	2,431	2,431	2,431	2,431	2,431
Bank charges		10,000	10,500	11,025	11,576	12,155	12,763	13,401	14,071	14,775	15,513
Bank overdraft interest		11,856	12,768	13,680	14,592	14,592	14,592	14,592	14,592	14,592	14,592
	-	821,586	434,656	398,541	413,305	428,102	429,059	430,053	431,087	432,161	433,277
Total Outflows	-	1,711,717	1,346,584	1,332,823	1,420,522	1,400,659	1,411,522	1,422,794	1,444,498	1,446,656	1,459,292
Net Operating Cashflow	-	66,683	568,616	719,177	768,278	788,141	777,278	766,006	744,302	742,144	729,508
Investment Cashflow											
Power Plant											
Machinery & equipments	(6,500,000)										
Office											
Furniture & office equipments	(5,760)										
	(6,505,760)	-	-	-	-	-	-	-	-	-	-
Taxation		-	-	-	-	-	-	-	-	-	-
Net Project Cashflow	(6,505,760)	66,683	568,616	719,177	768,278	788,141	777,278	766,006	744,302	742,144	729,508
Funding											
Equity	1,950,000										
Debt	4,550,000										
Total	6,500,000	-	-	-	-	-	-	-	-	-	-
Debt Service											
Principal Repayment		-	-	-	-	-	-	-	-	-	-
Interest Payment		(140,339)	(127,560)	(114,365)	(100,741)	(86,672)	(72,145)	(57,144)	(41,655)	(25,661)	(9,146)
	-	(140,339)	(127,560)	(114,365)	(100,741)	(86,672)	(72,145)	(57,144)	(41,655)	(25,661)	(9,146)
Net Cashflow	(5,760)	(73,656)	441,055	604,812	667,538	701,469	705,133	708,861	702,646	716,482	720,361
Net Cashflow b/fwd	-	(5,760)	(79,416)	361,640	966,452	1,633,990	2,335,459	3,040,592	3,749,453	4,452,100	5,168,582
Net Cashflow c/fwd	(5,760)	(79,416)	361,640	966,452	1,633,990	2,335,459	3,040,592	3,749,453	4,452,100	5,168,582	5,888,943
RESULTS											
Net Project Cashflow (after tax)	(6,505,760)	66,683	568,616	719,177	768,278	788,141	777,278	766,006	744,302	742,144	729,508
Net Project Cashflow (before tax)	(6,505,760)	66,683	568,616	719,177	768,278	788,141	777,278	766,006	744,302	742,144	729,508
Equity Cashflow	(1,950,000)	(73,656)	441,055	604,812	667,538	701,469	705,133	708,861	702,646	716,482	720,361

Annex 4

MONITORING INFORMATION

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

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