CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

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>.

SECTION A. General description of the small-scale project activity

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

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Golden Hope Composting Project - Merotai. . (Version 04, 10th Sept 2007)

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

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Golden Hope Plantations Bhd is one of the largest plantations companies in Malaysia. The company owns and operates 22 palm oil mills in Malaysia with a total capacity to process 878 MT Fresh Fruit Bunches (FFB)/hr. This project activity will be based in a 90t/h oil mill located near Tawau, Sabah.

There are 4 types of biomass waste from palm oil mills, namely empty fruit bunches (EFB), fibres, palm kernel shells (PKS) and the liquid waste with high COD content known as palm oil mill effluent (POME).

POME is currently, treated using a series of anaerobic and aerobic processes in open lagoons (ponds).During the anaerobic digestion in the lagoons, methane gas is generated and emitted to the atmosphere. EFB is sent back to the plantation for mulching which is considered as an aerobic process to be conservative.

This project is aimed to reduce the methane emission from anaerobic digestion of POME treatment by avoiding the current waste water treatment method and instead applying POME onto windrows of EFB in an aerobic co-composting techniques. Composting is a process of controlled biological decomposition of organic materials. POME will be sprayed on the composting windrows and will be exposed to a large surface of EFB.

The subsequent process is aerobic due to mechanical aeration as well as strict control of key parameters – oxygen levels of the compost mounds and temperature– to ensure that the process proceeds optimally. The compost product is ready in 10-12 weeks. Subsequently the compost will be used as an organic fertilizer in the plantation. As the anaerobic process is avoided in the POME treatment, methane generation is eliminated. The system will both reduce methane generation and minimize the risk of river contamination from the palm oil mill effluent. Thus the project will further minimize the air and water pollution problems exist in the baseline scenario.

The composting will reduce the negative environmental impact of POME treatment in terms of organic discharge to rivers and it will improve the fertilizer and soil conditioning value of the EFB application in the plantations. In addition, the use of compost will reduce the use of inorganic fertilizer.

The project is a waste management project that will lead to sustainable development through reduced pollution from palm oil residue and improved utilisation of the EFB as well as reduced methane emissions from anaerobic digestion of POME.

The project will fulfil the development policies of the 3rd Outlook Perspective Plan of Malaysia, where it is highlighted (item 7.69 page 187), that

> *"The major environmental and natural resource concerns during the OPP3 period, will include improving air and water quality, efficient management of solid waste and toxic and industrial waste, developing a healthy urban environment and the conservation of natural habitats and resources. ……….. In addition, zero emission technologies will be promoted to reduce energy consumption and facilitate the reuse and regeneration of new materials from waste. The industrial sector will be encouraged to adopt cleaner technology production."*

From the statement above the project satisfies the national environment sustainable policy by improving air and water quality and minimizing the waste from palm oil mills by reusing and regenerating it into an improved fertilizer product.

A.3. Project participants:

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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 participant (Yes/No)
Malaysia, (host)	Private entity: Golden Hope Plantations Berhad	No
Denmark	Danish Ministry of Foreign Affairs	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:

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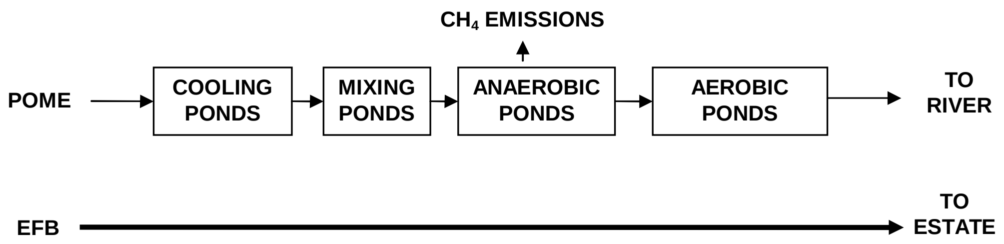
The project activity will change the conventional way of waste management for POME and EFB. The flow chart below shows the process in the baseline scenario to treat the POME and EFB. POME is treated in a series of anaerobic and aerobic ponds before discharged to the river. The emission reduction for this project comes from avoiding methane emissions from the anaerobic ponds. EFB is send back to the plantation for mulching and this process is considered dominantly aerobic. There might be some methane emissions from EFB mulching but the amount is not considered in the calculation to be conservative.

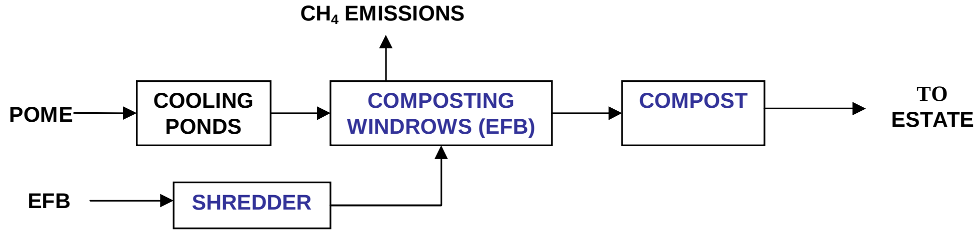
Flow Chart for Baseline Scenario



The composting system offers an improved solution to the oil palm industry's waste management. The composting system utilises the POME and EFB and uses a technically advanced method to convert these waste matters into organic fertiliser. EFB are firstly shredded using a high speed hammer mill and then stacked into windrows of 1.5 meter high by 45 meter length in a confined composting site. POME with COD levels of approximately 50-60 kg COD/m^3 is then pumped from the outlet of cooling ponds and sprayed onto these windrows periodically. The windrows are turned regularly using a windrow-turner for better mixing, aeration and temperature control.

The compost is mature after approximately 2.5 months and is ready for use. The compost, being an organic fertiliser, is capable of replacing a major portion of the inorganic fertilisers. In addition it makes it possible to use the organic fertiliser in areas where EFB are difficult to transport and apply for mulching in the baseline.

Flow Chart for Project Scenario



Baseline and Project Scenario

Characteristics	Baseline Scenario	CDM Project Scenario
POME Treatment System	Anaerobic process - a series of anaerobic open lagoons emitting methane to the atmosphere.	Aerobic process – where POME is exposed on a large fibrous surface area on EFB in the composting windrows.
EFB Handling	Mulching in the plantation	Aerobic Composting - to be applied in the plantation as organic fertilizer displacing non-organic fertilizers

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

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The project location is shown in the Malaysia map given below.

A.4.1.1. Host Party(ies):

>>
The host country is Malaysia.

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

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Sabah / Malaysia

A.4.1.3. City/Town/Community etc:

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Tawau/Merotai

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

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Golden Hope Plantation Bhd operates from its Head Quarters in Kuala Lumpur, Malaysia. Palm oil mills are located all over Malaysia.

Head Quarters Address :

Golden Hope Plantation Bhd
13th Floor, Menara PNB
No. 201-A, Jalan Tun Razak
50400 Kuala Lumpur
Malaysia

The name and address of the palm oil mill involved in this project is given below.

Merotai Oil Mill
Golden Hope Plantation Bhd
Merotai Estate, 89908 Tawau, Sabah
Malaysia

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

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The project is a small scale project activity and falls under the category **III.F** according to the Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities. It is a "***Avoidance of methane production from biomass decay through composting***" project, diverting POME from anaerobic open ponds without methane recovery to composting site for co-composting with solid biomass waste in the form of EFB. The compost windrows will be turned periodically with a mechanical turner to ensure good aeration and temperature control.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

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Palm oil mills produce palm oil mill effluent, POME and Empty Fruit Bunches, EFB in the process of producing crude palm oil from oil palm fruit bunches. POME contains a very high level of COD level, which need to be reduced before discharging to the local drain ways.

The baseline scenario is to treat the POME in anaerobic open lagoons or tanks to digest the high amount of COD and later further reduce the COD in a series of aerobic ponds to a level acceptable to the local environmental regulations before final discharge. The source of anthropogenic emission is the anaerobic open ponds/tanks installed in Golden Hope palm oil mill selected for this project.

The project will divert the POME from the anaerobic ponds to the EFB composting site. POME will be sprayed on the EFB windrows to increase the nutrient content of the final compost and digested aerobically.

With CDM support Golden Hope will be able to use the income from CER's sales to finance the project. Golden Hope management would not have invested in the project if no revenue from CDM contributed to the project. The baseline scenario of open lagoons and tanks would have continued.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

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Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
1st Aug 2007-31st July 2008	30,449
1st Aug 2008-31st July 2009	30,449
1st Aug 2009-31st July 20010	30,449
1st Aug 2010-31st July 2011	30,449
1st Aug 2011-31st July 2012	30,449
1st Aug 2012-31st July 2013	30,449
1st Aug 2013-31st July 2014	30,449
Total estimated reductions (tonnes of CO_2 e)	214,143
Total number of crediting years	7 Years
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	30,449

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Details calculation is given in the Annex 3.

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

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There is no Public Funding involved in this project.

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

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The project activity is not a debundled component of a larger project activity and there is no registered small-scale CDM project activity and will not be applied to register another small-scale CDM project activity:

- With the same project participants; and
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point of a larger project activity.

SECTION B. Application of a baseline methodology:

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

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Title of baseline methodology: "***Avoidance of methane production from decay of biomass through composting***", **Type III.F, Version 03,** in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities.

B.2 Project category applicable to the small-scale project activity:

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Small-scale methodology III.F is applicable to this project activity as it is co-composting waste-water and solid biomass in the form of EFB and avoids the generation of methane from waste water (POME) treated in anaerobic lagoons without methane recovery. The characteristic of the anaerobic lagoons in the palm oil mills satisfies the following applicability criteria;

Methodology	Project
Co-composting waste water and solid biomass waste	Co-composting POME (waste water) and EFB (solid biomass waste) from palm oil mill.
Waste water would have been treated anaerobic waste water treatment system without methane recovery.	POME would have been treated in a series of anaerobic and aerobic ponds without methane recovery in the palm oil mill.

All anaerobic ponds are without aeration system and the depths of the open lagoons are greater than 2 m. Malaysian ambient temperature is always higher than 15°C which makes the anaerobic lagoons active throughout the year.

Key information, assumptions and data to determine the baseline scenario and the project scenario are presented in the table below.

Assumptions and Source of Values Used in the Baseline Estimation

No	Parameters	Value	Unit	Source	Justification
1	Mill Operation	4800	hr/yr	Golden	Only used in the PDD for estimation of

				Hope	waste water from palm oil mill.
2	Pome generation	0.6	m3/tFFB	PTM Study (pg 32)	Only used in the PDD for estimation of waste water from palm oil mill.
3	$COD_{ww,untreated}$	53.6	kgCOD/m3	PTM Study (pg 25)	Only used in the PDD for emission reduction estimation. The actual lab measurement value from respective mills will be used during monitoring and verification of CER's.
4	Methane generation, $B_{o,ww}$	0.21	kgCH4/kgCOD	A.M.S III.F Ver. 03	IPCC default value for domestic waste water
5	GHG factor	21	-	IPCC	
6	$MCF_{ww,treatment}$	1.0		A.M.S III.F Ver. 03	MCF higher value as per table III.H.1 in A.M.S III.H Ver. 03

*A.M.S III.H is the Approved Methodology for Small Scale Type III.H

B.3. 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:

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This section describes how the emissions are reduced below those that would have occurred in the absence of the project activity using the "Tool for the demonstration and assessment of additionality" to define the baseline scenario and the project activity.

Step 0: Preliminary screening based on the starting date of the project activity

The evidence to indicate the initiatives to develop a CDM Composting project can be clearly seen in a document called "Letter of Intent" (LoI) which was signed between Danish Government and the project developer, Golden Hope.

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

Sub-step 1a. Define alternatives to the project activity:
If the composting project is not undertaken as CDM project activity, it could be a realistic alternative. Besides reducing methane emission, the composting project will be able to provide a better use for the abundantly available EFB. The Malaysian law banned open burning and the best way to dispose EFB would be composting it in windrows with POME. Even though the project involves some capital investment, but it is can be easily shown feasible with its CDM contribution in financial analysis.

An alternative that would deliver approximately the same services as the proposed project activity is to install closed digester tanks to collect the generated biogas (methane) and flare it. However this is not a likely scenario as, there are no rules or regulations to direct palm oil mills to capture the gas and flare it. This alternative could be another CDM project if financial analysis shows positive results.

Another alternative is to erect aerobic ponds to avoid methane generations from anaerobic ponds in the baseline. Again this is not a likely scenario as this would require large land area and energy consumption for aeration etc., which would be more feasible to plant palm trees rather than treating POME.

The continuation of current situation is to treat POME in open lagoons or tanks. Most of the palm oil mills in Malaysia are treating POME in open lagoons or tanks. In the absence of the CDM project activity, the current situation will continue as this is an effective way of treating the POME and there are no rules or regulation opposing anaerobic treatment and emission of methane to the atmosphere.

Sub-step 1b. Enforcement of applicable laws and regulations:

The project activity and all the alternatives are in compliance with existing laws and regulations since both are capable of reducing environmental impacts of the baseline scenario. Even in the baseline scenario, the discharge of POME is already complying with the local environmental standards before going into the common drainage or rivers.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

A benchmark analysis has been carried out with and without CDM support to demonstrate additionallity.

Sub-step 2b. – Option I. Apply simple cost analysis

This step is not applicable.

Sub-step 2b Option III- Benchmark Analysis

A benchmark analysis was done to calculate the financial feasibility at different CER price with two financial indicators, IRR and NPV. The project proponent will only invest in a project with a positive cash flow and an IRR of more than 10% p.a. The justification was based on idea that the investment return should be higher than the countries commercial base lending rate, BLR adopted from Malaysian Central Bank, Bank Negara Malaysia. The yearly BLR from year 1998 to 2006 is shown in the table below.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
BLR	8.04	6.79	6.78	6.39	6.39	6.00	5.98	6.20	6.60

Source: http://www.bnm.gov.my/files/publication/ar/en/2006/zcp07_table_A.26.pdf

The benchmark used for the calculation is also based on the expected return on investment by the Golden Hope Plantations Berhad. The 10% benchmark is in accordance with the average return on assets (ROA) for the Group as a whole. This benchmark is verified by the Financial Reports of the Group, where the ROA was 11.1% in 2005 and has been 9.5% for the 3-years period 2003-2005. The financial highlight can be found on Golden Hope Plantations Berhad's web site: http://www.ghope.biz/financial_highlights.htm.

Deleted: Some of the palm oil industries in Malaysia is using a benchmark of 15%p.a but to be conservative the project proponent selected a lower value of 10%p.a.¶

Sub Step 2c. Calculation and Comparison of Financial Indicators

The summary of the feasibility study results are tabulated below.

CER Price (USD)	0	3	7

IRR (%)	4.0	10.6	19
NPV	(843,309)	83,389	1,376,383

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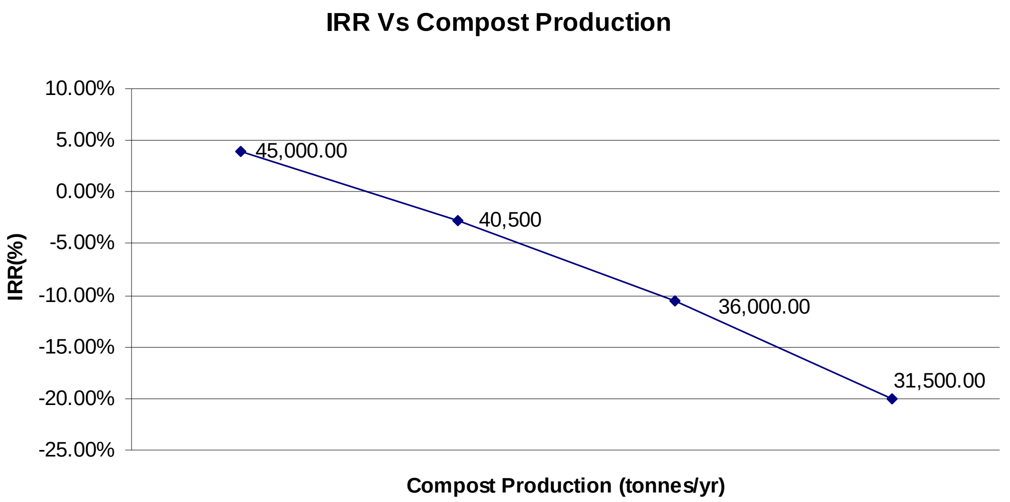
The results from the table above indicate that without CDM the project has a negative NPV and low IRR of 4.0 %. To meet the investment criteria of the project proponent, the CER price must be above USD 3.

The detailed financial analysis spreadsheet without CDM is attached in Annex 4.

Sub Step 2d. Sensitivity Analysis

The project is sensitive to the amount of compost produced. The IRR calculation in the baseline uses an ideal compost amount produced in a year. However the sensitivity analysis below shows that the project will become less feasible if the amount of compost produced is reduced.



The sensitivity analysis begins with an ideal value of compost production capacity per year and gradually reduces the amount by 10% every time to look into the corresponding IRR values. It is very prominent that the project is very sensitive to amount of compost produced and requires CDM to make it feasible even for the ideal case.

Note: The ideal compost production is calculated based on mill FFB processing capacity, typical mill operation hours of 300 days/year and 16 hours a day.

Step 3. Barrier analys;is

This step will not be described as Step 2 is considered for additionality justification.

Step 4. Common practice analysis

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

The common practice in the industry is to send the EFB back to the plantation for mulching or left to decay in piles. Recently there are some similar composting activities started to take place in a number of palm oil mills in Malaysia with CDM concept in mind or as the only way to reduce the amount of EFB waste, if they do not posses plantations where the EFB can be mulched. As the project proponent has been mulching the EFB it could have continued this practice instead of implementing the composting project.

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

A few palm oil mills which have executed composting projects, as they have no other better option to dispose their EFBs as open burning is banned in Malaysia. Palm oil mills with plantations could easily send their waste EFBs for mulching in their own land but it is not possible for millers without plantations to do so. Palm oil mills with plantation will only opt for composting only if the project becomes feasible with CDM contribution.

There are a number of palm oil mills doing composting in Malaysia   One of the technology providers owns a full scale composting plant in Sedenak, Johor as a demonstration site to promote their technology, conduct R & D and provide training to his customers.

Furtehrmore, there are 4 composting sites where the technology provider own 1/3rd of the share in the plantation company. All the palm oil mills below owns plantation and decided to go for composting as the technology provider has some share in the company and could provided the technology cheaper than the market price. The 4 locations of composting sites are;

a) Lambir (10t/h), Miri, Sarawak
b) Tereh (60t/h), Kulang, Johor
c) Sindora (60t/h), Kluang,Johor
d) Palong Cocoa (40t/h), Segamat, Johor.

Golden Hope owns 22 palm oil mills with plantation in Malaysia and has only decided to conduct composting in 5 of the mills with CDM. Golden Hope might opt for composting in the rest of the mills if CDM becomes a reality for these initial 5 mills.
The above arguments indicate that composting is not conducted extensively at mills with or without plantations.

Step 5. Impact of CDM registration

CDM registration will benefit the project. The expected impact of CDM registration are;

- The project will be able to reduce anthropogenic GHG emission reductions,
- Revenue from the sale of CER will be able to make the project more feasible.(IRR>10 % at CER price of above USD 3)

Based on the step by step additionality analysis above the project is proven to be additional.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

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The project boundary is confined to the project site where the composting is taking place. The project emission is considered insignificant for this project activity. The GHG and their sources as related to the baseline methodology are:

	Source	Gas	Comment
Baseline emissions	Anaerobic open ponds	CH_4	Methane generated from the open ponds
Project emissions	Transportation	CO_2	The composting site is within the palm oil mill and both co-composting waste comes from palm oil mill. Thus there will be no incremental transportation for waste. The compost weight will be reduced to half of the original waste and improved nutrient value. This will reduce the transportation of both EFB for mulching and in-organic fertiliser to the plantation . To be conservative emission reductions from reduced transportation is not considered in this project activity.
	Power	CO_2	The power is generated using a biomass fuel in the palm oil mill. Thus, the electricity consumption for the additional machineries used in the project activity is carbon neutral. There is will be some project emissions from diesel consumption at the composting site for compost turners and front loaders. The emissions from this source will be monitored..
	Run-off Water	CH_4	The run-off water will be contained in a well managed aerobic treatment system before discharged to the river. The project emissions from this source will be monitored.

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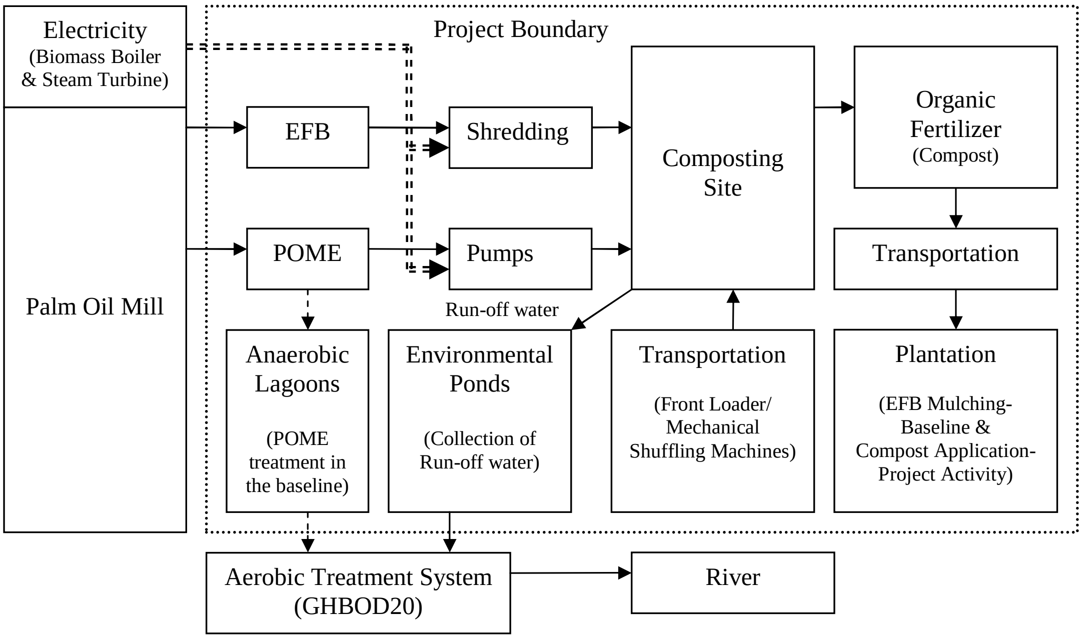

Emission Reduction
The projects boundary is the physical composting site. Waste products such as POME and EFB generated from palm oil mills will be sent to composting sites located within the palm oil mill. Emission reductions are achieved by avoiding anaerobic digestion of POME in open lagoons. The POME will be sprayed on a large surface are of EFB windrows. The composting process will be aerobic. The windrows will be turned periodically to ensure high oxygen levels in the windrows to promote aerobic decomposition.

Project Emissions

<u>Project emissions from composting process.</u>

The composting process is a controlled process, where mechanical aeration is carried out to ensure aerobic digestion and optimum composting conditions. Anaerobic digestion is avoided as this will reduce the quality of the final compost e.g. reduced PH-level.

Furthermore some of the EFB would have been sent for mulching in the baseline scenario. It is possible that there would have been some methane emissions from anaerobic decomposition during mulching process. To be conservative emission from mulching was not considered in the project baseline. Any possible amount of methane emissions from composting windrows in the project activity is none or less than what would have occurred in the baseline. Thus, project emission due to anaerobic decomposition in the windrows is considered zero for this project activity.

Project emissions from transportation.

1) The collection point of EFB and the composting site as compared to the baseline.
As described earlier, the composting site is within palm oil mill compound and there is no significant increment in distance and emissions compared to the baseline.

2) The collection point of POME and the composting site as compared to the baseline of anaerobic ponds.
The POME is transported using a piping system both in the baseline and project activity, which is within the palm oil mill compound .The pumps for the piping system are powered by biomass boiler and steam turbine which is carbon neutral. Thus, there is no increased emissions due transportation due to pumping project activity.

3) Transportation of compost to the soil application site. The compost will be used in the plantation and replace both mulching of whole EFB and in-organic fertilisers. In the baseline whole EFB and in-organic fertilisers are transported on small vehicles such as tractors and lorries to the plantation, which incur emissions from combustion of diesel. In the project activity the compost will be transported in a similar manner, but as the compost is reduced to about half the volume and weight compared to whole EFB and the nutrient value is increased the amount of transport is reduced and thus the emissions are reduced. To be conservative the reduced emissions from transportation of compost compared to EFB is not included in the emissions reductions from the project activity compared to the baseline.

Project emissions from power consumption.

The EFB need to be shredded into small pieces before it can be used for composting using an electrical powered shredding machine. The power is supplied from the palm oil mill's existing biomass boiler and steam turbine. This power source is considered carbon neutral and is not leading to any increase in emissions.

Mechanical aeration of compost is done by turning the windrows periodically with compost shuffling machines and front loaders powered by diesel fuel. The project emissions from diesel will be monitored in this project activity.

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Project emissions from run-off water.

The composting site will have a perimeter drain to collect leachate and rain water. The water from the perimeter drain is defined as run-off water. The project is located in a high rainfall area. Thus the runoff water consists of mainly rainwater and obviously the runoff water in the environmental pond is very much diluted. The run-off water will be directed into a polishing plant designed by Golden Hope named GHBOD20 to ensure well-managed aerobic treatment condition before discharged to the river. However, the project emission from the runoff water will be monitored for this project activity.

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Leakage

The technology and machinery for the project activity is not transferred from another activity and thus no leakage is considered to take place.

B.5. Details of the baseline and its development:

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The baseline study was done on 23rd December 2006 by;

1) Mr. Henrik Rytter Jensen
Danish Energy Management A/S
Vestre Kongevej 4-6
DK-8260 Viby J, Denmark
Tel: +45 8734 0600
Fax: +45 8734 0601
E-mail: henrik.rytter.jensen@dem.dk

2) Mr. Thirupathi Rao
Danish Energy Management
36th Floor, Menara Maxis,
Kuala Lumpur City Centre
50088 Kuala Lumpur, Malaysia
Tel : +603 2615 0014
Fax : +603 2615 0088
E-mail: rao@dem.dk

Danish Energy Management is a CDM consultant to the Project and is not a project participant.

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

>>

C.1.1. Starting date of the small-scale project activity:

>>

28/02/06

C.1.2. Expected operational lifetime of the small-scale project activity:

>>

30 years.

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

>>

C.2.1. Renewable crediting period:

>>

21 years

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

>>

01/08/07

C.2.1.2. Length of the first crediting period:
>>

7 years.

C.2.2. Fixed crediting period:
>>

Not applicable.

C.2.2.1. Starting date:
>>
Not applicable.

C.2.2.2. Length:
>>
Not applicable.

SECTION D. Application of a monitoring methodology and plan:
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D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:
>>
Title of the approved monitoring methodology is : "***Avoidance of methane production from decay of biomass through composting*** ", **Type III.F, Version 03,** in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities.

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:
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The justification of the applicability of this methodology has been discussed in section B.2.

D.3 Data to be monitored:

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ID number *(Please use numbers to ease cross-referencing to table D.6)*	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
M1	*Monthly Chemical Oxygen Demand*	$COD_{monthly}$	$kgCOD/m^3$	*m and c*	*monthly*	*100%*	*Electronic*	*2 Years after the Crediting period*	*This is a monthly COD value used to calculate the yearly average of COD entering the anaerobic lagoons in the baseline emissions. The monthly COD value is an average value from 4 samples of COD analysis from in-house laboratory and 1 sample of COD analysis from third-party accredited laboratory every month.*
M2	*Monthly Flow Rate*	Q_{ww}	$m^3/month$	*m and c*	*monthly*	*100%*	*Electronic*	*2 Years after the Crediting period*	*1) Measurement will be taken from installed flow meter at the POME discharge point.* *2) The flow meter will be calibrated as required by the manufacturer's recommendations.*
M3	*Yearly Chemical Oxygen Demand*	$COD_{ww,untreated}$	*kg COD/yr*	*c*	*yearly*	*100%*	*Electronic*	*2 Years after the Crediting period*	*This value is used to calculate the baseline emissions.* *Total COD for a particular year can be calculated by averaging the monthly* $COD_{monthly}$ *for 12 months.*
M4	*Quantity of*	*Compost*	*tonnes*	*m and c*	*daily*	*100%*	*Electronic*	*2 Years*	*This value is not used in any*

	Compost							*after the Crediting period*	*calculations but to justify that the compost is used for soil application in aerobic manner which is the interest of the estates to have high yield of palm fruits with high quality organic compost.*
M5	*Temperature*	*T*	*Celsius*	*m*	*Before and after turning of windrows*	*10%*	*Electronic*	*2 Years after the Crediting period*	*This value is not used in the calculations but to have a quality control of the aerobic process in the windrows. Temperature above ambient will indicate aerobic process which releases heat. A temperature probe will be used and will be calibrated according to the manufacturers recommendation.*
M6	*Oxygen*	O_2	*%*	*m*	*Before and after turning of windrows*	*10%*	*Electronic*	*2 Years after the Crediting period*	*This value is not used in the calculations but to have a quality control of the aerobic process in the windrows. Presence of oxygen indicates aerobic process. An oxygen probe will be used and will be calibrated according to the manufacturers recommendation.*
M7	*Monthly Chemical Oxygen Demand of runoff water*	$COD_{monhtly, run-off}$	*kgCOD/m*^{3}	*m and c*	*monthly*	*100%*	*Electronic*	*2 Years after the Crediting period*	*This is a monthly COD value used to calculate the yearly average of COD of run off water.The monthly COD value is an average value from 4 samples of COD analysis from in-house laboratory and 1 sample of COD analysis from third-party accredited laboratory every month.*
M8	*Monthly Flow Rate of Runoff*	$Q_{ww,runoff}$	*m*^{3}*/month*	*m and c*	*monthly*	*100%*	*Electronic*	*2 Years after the Crediting*	*1) Measurement will be taken from a flow meter installed at the environmental pond runoff water*

Deleted: -monthly

	Water							period	pump . 2) The flow meter will be calibrated as required by the manufacturer's recommendations.
M9	Yearly Chemical Oxygen Demand of runoff water	$COD_{ww,run-off}$	kg COD/yr	c	yearly	100%	Electronic	2 Years after the Crediting period	This value is used to calculate the project emissions from runoff water. Total COD for a particular year can be calculated by averaging the monthly $COD_{monhtly,run-off}$ for 12 months.
M10	Diesel	Q_{diesel}	Liters	m	monthly	100%	Electronic	2 Years after the Crediting period	Data can be obtained from the diesel supply invoices between the composting plant and the palm oil mill store/diesel supplier. Major consumption is for the compost turners and front loaders.

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D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

>>

The flow meter will monitor the volume of POME that would have been treated in the anaerobic ponds. Volume of POME in every month will be recorded and summarised at the end of the year to get the yearly flow rate as described in the monitoring methodology. The flow meters will be calibrated according to manufacturers' recommendation to have a high accuracy in measurement.

COD sampling will be done monthly together with the monthly environmental monitoring required by the Malaysian Department of Environment.

The POME volume measurement is done continuously and the flow meter will be read monthly. COD measurements will be done monthly. All data will be recorded electronically.

It has been the normal practice in palm oil mills to take records of the volume of POME and EFB generated every month. All the relevant parameters can be easily extracted from the existing data sheets to calculate the emission reductions. The original data sheets will be recorded by the mill technician and verified by the mill engineer. The data from the mill will be verified by the mill manager before submission every year. The records will be then sent to the Golden Hope head quarters every year for compilation for the monitoring reports.

The compost is used for soil application in Golden Hope's own palm oil plantations. It is desirous for the estates to have high quality compost and good nutrients absorption after soil application. This can only be achieved if the soil application is done by spreading the compost evenly between the palm trees which is consequently ensures aerobic conditions. The estate manager will ensure the compost is properly applied. Thus, sufficient monitoring is already in place for monitoring soil application.

The quality control to ensure aerobic conditions is achieved by monitoring the temperature and oxygen levels in the compost windrows with a representative random sampling of 10% of the windrows before and after turning. Temperature above ambient will indicate aerobic process which releases heat and presence of oxygen indicates the high possibility of aerobic process. An oxygen and temperature probe will be used to monitor the above parameters. The monitoring point should be preferably in the centre of the compost windrow cross section.

The validity of baseline can be monitored by checking the approval from department of environment to operate the palm oil mill and anaerobic lagoons in other Golden Hope or neighbouring palm oil mills. As long as there is no objection to operate anaerobic lagoons without methane recovery, Golden Hope will continue the current practice of anaerobic lagoons. Golden Hope owns 22 palm oil mills in Malaysia and this government approval to operate the anaerobic treatment system can be easily verified.

A standardise monitoring protocol will be prepared by Golden Hope Plantation Engineering Services to specify the procedures for monitoring of CDM composting projects.

Procedures will be developed and implemented before the start of the project activity. A summary of the monitoring protocol is attached in Annex 5.

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

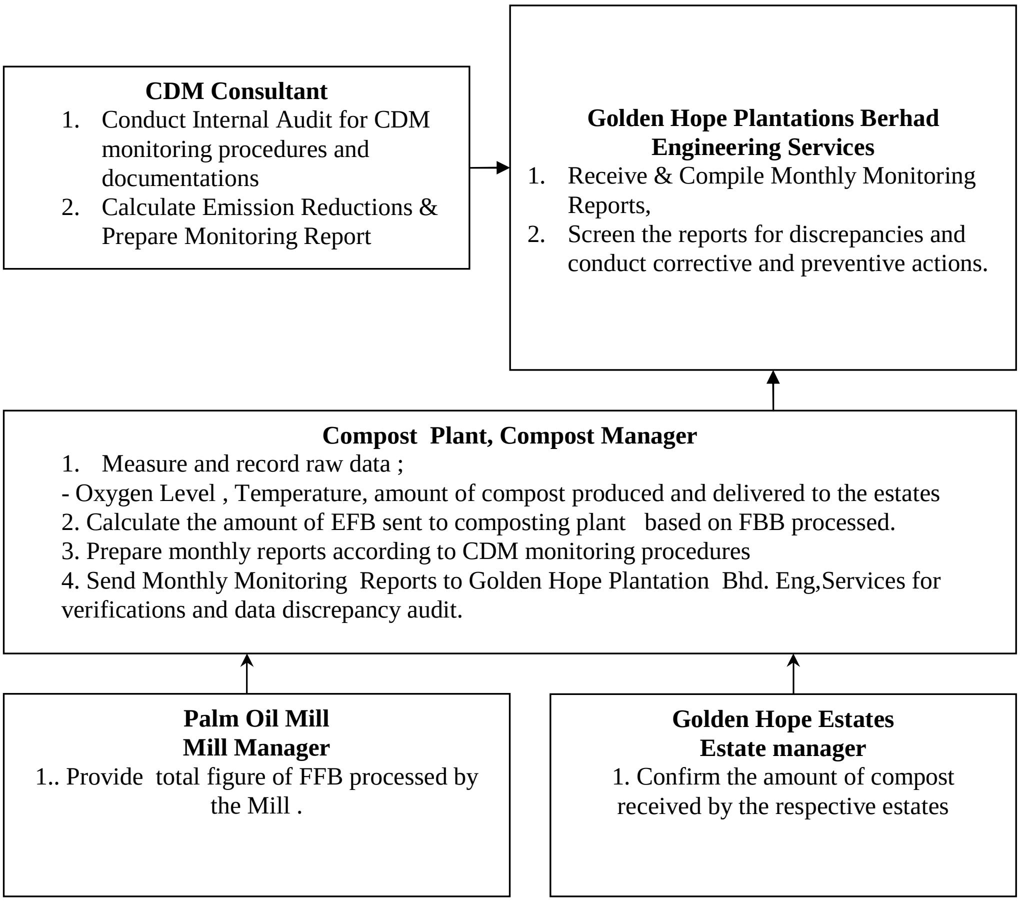
>>

Golden Hope Plantation Berhad has an operational and management structure in place to monitor emission reductions from the project activity.

Each composting site will appoint a composting team to run the composting plant efficiently. A compost plant manager will be responsible to assign his subordinates to collect and record the monitoring parameters and verify them monthly. All the date will be kept in both hard copy and soft copy.

The Golden Hope Engineering Services Department will receive data from the palm oil mill and assign a third party consultant or in-house expertise to calculate the emission reduction and prepare a monitoring report. All the raw data available at palm oil mill will also be available at the head quarters.

The flowchart below describes the operational structure of the data collection and compilation.


CDM Consultant
1. Conduct Internal Audit for CDM monitoring procedures and documentations
2. Calculate Emission Reductions & Prepare Monitoring Report
Golden Hope Plantations Berhad Engineering Services
1. Receive & Compile Monthly Monitoring Reports,
2. Screen the reports for discrepancies and conduct corrective and preventive actions.
Compost Plant, Compost Manager
1. Measure and record raw data ;
- Oxygen Level , Temperature, amount of compost produced and delivered to the estates
2. Calculate the amount of EFB sent to composting plant based on FBB processed.
3. Prepare monthly reports according to CDM monitoring procedures
4. Send Monthly Monitoring Reports to Golden Hope Plantation Bhd. Eng,Services for verifications and data discrepancy audit.
Palm Oil Mill
Mill Manager
1.. Provide total figure of FFB processed by the Mill .
Golden Hope Estates
Estate manager
1. Confirm the amount of compost received by the respective estates

D.6. Name of person/entity determining the monitoring methodology:

>>

1) Mr. Henrik Rytter Jensen
Danish Energy Management A/S
Vestre Kongevej 4-6
DK-8260 Viby J, Denmark
Tel: +45 8734 0600
Fax: +45 8734 0601
E-mail: henrik.rytter.jensen@dem.dk

2) Mr.Thirupathi Rao
Danish Energy Management
36th Floor, Menara Maxis
Kuala Lumpur City Centre
50088 Kuala Lumpur
Malaysia
Tel : +6 03 2615 0014
Fax : +6 03 2615 0088
E-mail : rao@dem.dk

Danish Energy Management is a CDM consultant to the Project and is not a project participant.

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

>>

The formula applied to estimate the emission reduction is obtained from description on paragraph 4, 5, 6, 8 and 9 in Appendix B of category III.F, "***Avoidance of methane production from biomass decay through composting***".

E.1.1 Selected formulae as provided in appendix B:

>>

Below are the formulae extracted from the Appendix B of category III.F;

From paragraph 4

$$\underset{(t\ CO_2)}{PE_y} = \underset{(t\ CO_2)}{PE_{y,transp}} + \underset{(t\ CO_2)}{PE_{y,power}} + \underset{(t\ CO_2)}{PE_{y,runoff}}$$

Where;

PE_y is the total project emission in the year “y”
$PE_{y,transp}$ is the emission from incremental transportation in the year “y”,
$PE_{y,power}$ is the project emission from electricity or diesel consumption in the year “y”,
$PE_{y,runoff}$ is the methane emissions potential from anaerobic digestion of the run-off water in the year “y”, which is considered to be zero as described in section B.4.

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The formulae for project emission from power (diesel) consumption will be as shown below:

$$\underset{(t\ CO_2)}{PE_{y,power}} = \underset{(t\ CO_2/yr)}{PE_{diesel,}} = \underset{(liters/yr)}{Q_{diesel}} \times \underset{(kg/liter)}{D_{Density}} \times \underset{(g\ CO_2/kg)}{EF_{Heavy\ Duty}} \div 10^6$$

Where;
Q_{diesel} is the amount of diesel used at the composting site
$PE_{diesel,}$ is the project emission from diesel consumption
$D_{Density}$ is the diesel density at standard temperature and pressure.
$EF_{Heavy\ Duty}$ is the CO_2 emission factor for diesel engines

From paragraph 9

The project emission from run-off water can be calculated as shown below:

$$\underset{(t\ CO_2)}{PE_{y,run\text{-}off}} = \underset{(m^3)}{Q_{y,ww,run\text{-}off}} \times \underset{(t\ COD/m3)}{COD_{y,run\text{-}off}} \times \underset{(kg\ CH_4/kg\ COD)}{B_{o,ww}} \times MCF_{run\text{-}off} \times GWP\_CH_4$$

Where;
$Q_{y,ww,run\text{-}off}$ is the volume of the run-off water treated in the year “y”
$COD_{y,run\text{-}off}$ is Chemical Oxygen Demand of runoff water in the year “y”
$B_{o,ww}$ is maximum methane producing capacity of the run-off water
$MCF_{run\text{-}off}$ is methane correction factor for the run-off water treatment system
GWP_CH_4 is the global warming potential (GWP) for CH_4

From paragraph 5

$$\underset{(t\ CO_2)}{BE_{y,}} = \underset{(t\ CO_2)}{BE_{CH4,SWDS,y}} - \underset{(t\ CH_4)}{MD_{y,reg}} \times GWP\_CH_4 + \underset{(t\ CO_2)}{MEP_{y,ww}}$$

Where;
BE_y is the baseline emission in the year “y”
$BE_{CH4,SWDS,y}$ is the yearly methane generation potential of the EFB composted by the project activity in the year “y”
$MD_{y,reg}$ is the amount of methane that would have to be captured and combusted in the year “y” to comply with prevailing regulations
$MEP_{y,ww}$ methane emission potential in the year “y” of the POME.

From paragraph 6

$$\underset{(t\ CO_2)}{MEP_{y,ww}} = \underset{(m^3)}{Q_{y,ww}} \times \underset{(tonnes/\ m^3)}{COD_{y,ww,untreated}} \times \underset{(kg\ CH_4/kg\ COD)}{B_{o,ww}} \times MCF_{ww,treatment} \times GWP\_CH_4$$

Where;
$Q_{y,ww}$ is the volume of the POME co-composted in the year "y"
$COD_{y,ww,untreated}$ is Chemical Oxygen Demand of POME in the year "y"
$B_{o,ww}$ is maximum methane producing capacity of the POME
$MCF_{ww,treatment}$ is methane correction factor for the wastewater treatment system
GWP_CH_4 is the global warming potential (GWP) for CH_4

From paragraph 9

$$\underset{(t\ CO_2/yr)}{ER_y} = \underset{(t\ CO_2/yr)}{BE_y} - \underset{(t\ CO_2/yr)}{PE_y} - \underset{(t\ CO_2/yr)}{Leakage_y}$$

Where;
ER_y is the emission reduction in the year "y"

E.1.2 Description of formulae when not provided in appendix B:

>>

Additional formula for Baseline Emissions

The quantity of waste water, COD will be measured monthly and a yearly average COD value will be calculated before applied in the formula in paragraph 6.

The average chemical oxygen demand of POME is calculated as shown in the formula below.

$$\underset{(tonnes/\ m^3)}{COD_{y,ww,untreated}} = \underset{(kg\ /\ m^3)}{\sum COD_{monthly}} \div 12 \div 1000$$

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Additional formula for Project Emissions

The average chemical oxygen demand of the run-off water is calculated as shown in the formula below.

$$\underset{(tonnes/\ m^3)}{COD_{y,run\text{-}off}} = \underset{(kg\ /\ m^3)}{\sum COD_{monthly,un\text{-}off}} \div 12 \div 1000$$

Deleted: ¶
$PE_{y,runoff}$¶
(kg CO_2) ... [1]

The project emissions from diesel consumption is calculated as shown below:

Deleted: Where;¶
$Q_{y,ww,runoff}$ is the volume of the runoff water treated in the year "y"¶
$COD_{y,runoff}$ is Chemical Oxygen Demand of runoff water in the year "y"¶
$B_{o,ww}$ is maximum methane producing capacity of the POME¶
$MCF_{ww,runoff}$ is methane correction factor for the runoff water treatment system ¶
GWP_CH_4 is the global warming potential (GWP) for CH_4 ¶

No other additional formula used for calculating emission reduction other than those provided in this section.

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

>>

There are no significant project emissions according to the formulae given in appendix B of category I.III, Version 03. The justification is given below;

a) $PE_{y,transp}$ = Project emission from transportation
The project emissions from mechanical aeration process and transportation of compost back to the plantation will be lower than the emissions from baseline transportation. The baseline transportation is from inorganic fertiliser and raw EFB application for mulching. There will be less transportation after the project activity as consumption of organic fertilizer will be reduced and volume of compost will reduce to half of the original raw EFB volume. More justification is given in the section B.4. To be conservative the emission reduction from transportation is considered insignificant for this project activity.

b) $PE_{y,power}$ = Project emission from power consumption (electricity/diesel)
The power supplied to the EFB shredding equipments and POME spraying pumps is carbon neutral as it is generated from a biomass boiler and steam turbine. There will be some diesel consumption at the compost site from machineries, e.g. compost turners and front loaders. Detail calculations are given in Annex 3.

Deleted: The table below calculates the project emissions from diesel source.

Deleted: ¶ **Project Emissions from Compost Turners** ... [2]

The formulae for project emission from diesel consumption is as shown below:

$$\underset{(t\ CO_2)}{PE_{y,power}} = \underset{(t\ CO_2/yr)}{PE_{diesel}} = \underset{(liters/yr)}{Q_{diesel}} \times \underset{(kg/liter)}{D_{Density}} \times \underset{(g\ CO_2/kg)}{EF_{Heavy\ Duty}} \div 10^6$$

The project emissions for power consumption will be mainly from project emission from diesel consumption at the composting site. There will be no significant project emissions from electricity consumption as the electricity generation is from biomass source at the palm oil mill.

Q_{diesel} is the amount of diesel used at the composting site and this value will be monitored from actual diesel consumption data recorded at the composting site.

$D_{Density}$ is the diesel density in kg/liter. Diesel density is obtained from the MSDS of "Caltex Oil Malaysia Limited" who is one of the major diesel supplier in Malaysia. The value to be used in the CER calculations during crediting period will be 0.85 kg/liter at 15 °C. (https://www.cbest.chevron.com/msdsServer/controller?module=com.chevron.lubes.msds.bus.BusMSDSList). A conservative value of 1 kg/liter is used for PDD calculation purposes. This conservative value will be used if no other documented values available during the crediting period.

$EF_{Heavy\ Duty}$ is the CO2 emission factor for heavy duty diesel engines obtained from IPCC : 3,172.31 gCO2/kg. IPCC Source :TABLE 1.32) Estimated emission factor for US heavy-duty diesel vehicles, uncontrolled and assumed fuel economy of 2.2 km/l. Source: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference

c) $PE_{y,runoff}$ = Project emission from runoff water
The run-off water is treated in a well-managed aerobic system before discraged to the water ways.
The project emission from run-off water can be calculated as shown below:

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Deleted: The table below shows the assessment of the worst case scenario for calculating the project emission from the run off water.¶ ¶ ... [3]

$$\underset{(t\ CO_2)}{PE_{y,run\text{-}off}} = \underset{(m^3)}{Q_{y,ww,run\text{-}off}} \times \underset{(tonnes\ COD/m3)}{COD_{y,run\text{-}off}} \times \underset{(kg\ CH_4/kg\ COD)}{B_{o,ww}} \times MCF_{run\text{-}off} \times GWP\_CH_4$$

Where;

$Q_{y,ww,run\text{-}off}$
Is the volume of the run-off water collected in environmental pond during the during year "y". A flow meter will be installed at the environmental pond and the data (m^3) will be recorded monthly from the totaliser meter. The yearly flow of run-off water will be based on the sum of the monthly recorded value. The value used in the PDD was estimated based on the rainfall data and composting hectares at the project location. It is assumed that the volume of run-off water will be mainly constitutes of rainwater. Actual run-off water volume will be measured during the crediting period or the rainfall volume on the composting area will be used as the total run-off water volume if no actual data is available.

$COD_{y,run\text{-}off}$
Is Chemical Oxygen Demand of run-off water in the year "y". A monthly measurement will be taken to measure the COD (tonnes/m^3) content and will be recorded electronically. The yearly COD value will be the average of the monthly COD value recorded. The value applied in the PDD is based from an actual COD sampling at the environmental pond.

$B_{o,ww}$
Is the maximum methane producing capacity of the run-off water. A value of 0.21 kg CH_4/kg COD is used according to ASM III.F.

$MCF_{,run\text{-}off}$
Is methane correction factor for the run-off water treatment system. A value of 0.1 is used as the run-off water is treated aerobically. This default value is used as per the table III.H.1 mentioned in AMSIII.F paragraph 9.

GWP_CH_4

Is the global warming potential (GWP) for CH_4. An IPCC value of 21 is used.

Detail calculations are given in Annex 3.

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

>>

There will be no leakage in composting project as all the equipments used in the project activity are brand new and bought for the purpose of the project activity. No equipments or treatment technology transferred from another activity.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

>>

There are no significant leakage or project emission from transportation as described in section E.1.2.1.a for this project activity.

Deleted: * Based on average rainfall data for the past 3 years.¶
** Based on the COD sampling of the environmental pond runoff water¶
¶
To be conservative, the higher MCF value of 0.1 is selected as the water is treated in aerobic manner. The total project emission from run off water is considered insignificant as it is only approximately 0.19% of the baseline emissions. Thus project emission from this source is excluded from the CER calculations.¶
¶
Project emission from the runoff water may be significant if the runoff water is not treated aerobically which will cause the MCF to 1.0. In such case project emissions will be calculated as specified in the monitoring plan.

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¶
PE_y¶
(t CO_2) ... [4]

Thus the total project emissions for this project activity will be the sum of project emission from power(diesel) and run-off water.

$$\underset{(t\ CO_2)}{PE_y} = \underset{(t\ CO_2)}{PE_{y,power}} + \underset{(t\ CO_2)}{PE_{y,runoff}}$$

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E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

>>

The baseline emissions come from methane emissions from anaerobic treatment of POME. Baseline emission from EFB mulching is not considered in the project activity as a conservative approach. The applicable formula is extracted from paragraph 5 of ASM III.F, as given below.

$$\underset{(t\ CO_2)}{BE_{y,}} = \underset{(t\ CO_2)}{BE_{CH4,SWDS,y}} - \underset{(t\ CH_4)}{MD_{y,reg}} \times GWP\_CH_4 + \underset{(t\ CO_2)}{MEP_{y,ww}} \times GWP\_CH_4$$

And as methane emissions from solid waste disposal in the baseline is not considered in this project the formula can be reduced to

$$\underset{(t\ CO_2)}{BE_{y,}} = \underset{(t\ CO_2)}{MEP_{y,ww}} \times GWP\_CH_4$$

In order to calculate $MEP_{y,ww,}$ the following formula is given by ASM III.F:

$$\underset{(t\ CO_2)}{MEP_{y,ww}} = \underset{(m^3)}{Q_{y,ww}} \times \underset{(tonnes/\ m^3)}{COD_{y,ww,untreated}} \times \underset{(kg\ CH_4/kg\ COD)}{B_{o,ww}} \times MCF_{ww,treatment} \times GWP\_CH_4$$

Where,

$Q_{y,ww}$

Is the volume of the POME treated during the during year "y". A flow meter will be installed and the data (m^3) will be recorded monthly. The yearly flow will be based on the sum of the monthly recorded value. This value is estimated based on project proponent estimation in the PDD. Actual values will be measured during the crediting period.

$COD_{y,ww,untreated}$

Is Chemical Oxygen Demand of POME entering the open lagoon in the year "y". A monthly measurement will be taken to measure the COD (tonnes/m^3) content and will be recorded electronically. The yearly COD value will be the average of the monthly COD value recorded.

The value used in this PDD is extracted from " *Feasibility Study On Grid Connected Power Generation Using Biomass Cogeneration Technology*", 2000,PTM, p.25 and is for PDD calculation purposes only. Actual value will be measured during the crediting period.

B_o

Is the maximum methane producing capacity of the inlet POME. A value of 0.21 kg CH_4/kg COD is used according to ASM III.F.

$MCF_{ww,treatment}$
Is the methane correction factor for the waste water treatment system in the baseline scenario. A default MCF higher value of 1.0 is used according to ASM III.F.

GWP_CH_4
Is the global warming potential (GWP) for CH_4. An IPCC value of 21 is used.

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

>>
Since there are no significant leakage associated with this project activity the emission reduction is will be the baseline emissions minus the total project emissions as given in the formula below.

ER_y (t CO_2)	=	BE_y (t CO_2)	-	PE_y (t CO_2)

Deleted: project emissions and

Deleted: ER_y¶ (t CO_2/yr) ... [5]

E.2 Table providing values obtained when applying formulae above:

>>

The *ex post* calculation of baseline emission rates may only be used if proper justification is provided. Notwithstanding, the baseline emission rates shall also be calculated *ex ante* and reported in the CDM-PDD. The result of the application of the formulae above shall be indicated using the following tabular format.

Year	Estimation of project activity emission reductions (tonnes of $CO_{2\,e}$)	Estimation of baseline emission reductions (tonnes of $CO_{2\,e}$)	Estimation of leakage (tonnes of $CO_{2\,e}$)	Estimation of emission reductions (tonnes of $CO_{2\,e}$)
1st Aug 2007-31st July 2008	185	30,634	0	30,449
1st Aug 2008-31st July 2009	185	30,634	0	30,449
1st Aug 2009-31st July 20010	185	30,634	0	30,449
1st Aug 2010-31st July 2011	185	30,634	0	30,449
1st Aug 2011-31st July 2012	185	30,634	0	30,449
1st Aug 2012-31st July 2013	185	30,634	0	30,449
1st Aug 2013-31st July 2014	185	30,634	0	30,449
Total (tones of CO_2 e)	1,293	**214,438**	0	**213,143**

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Detailed calculation is given in the Annex 3.

SECTION F.: Environmental impacts:

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

>>

The Malaysian Authorities does not require an Environmental Impact Analysis for this project activity and the environmental impacts are considered insignificant. The project complies with all regulations related to establishment and operation of composting sites and solid waste and waste-water treatment.

The site has been prepared with a suitable drainage system for collection and treatment of rainwater and leachate.

SECTION G. Stakeholders' comments:

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

>>
This project activity is within the existing compound of the palm oil mill. As mentioned in the previous section the environmental impact of the project is insignificant and it improves the water quality in the surrounding environment. Furthermore this mill is located deep inside the plantations to avoid any form of discomfort to the local community. Thus the project has minimal involvement from the local stakeholders.

However, the management of Golden Hope Plantation decided to invite local stakeholders for a presentation on the CDM composting project and to receive constructive comments and suggestions. An advertisement was placed two local newspapers "Daily Express" and "Sabah Times" on 15th November 2006 which was approximately two weeks before the stakeholder's consultation meeting to provide sufficient time for the related parties to attend the meeting.

The meeting was held in Merotai Palm Oil Mill, Tenom, Sabah on 1st December 2006. The meeting started at 9.30 a.m with a welcoming speech by the mill manager, followed by a presentation on CDM and the project activity. A site visit was arranged subsequently to the composting site. Below is the list of parties attended the meeting and the site visit.

No:	Department/Organization	No of Representatives
1	Town Office, Tawau	1
2	Department of Environment (DOE), Tawau	1
3	Public Works Department (JKR), Tawau	1
4	Drainage and Irrigation Department (JPS), Tawau	2
5	Man Power Office, Tawau	1
6	Agricultural Department, Tawau	1
7	Sabah Plantation Industry	1
8	Fire Works Department, Tawau	1
9	Special Issues Department, (JASA)	2
10	Syarikat Wawasan Merotai	1
11	Syarikat Tawau Plywood	1
12	Local Village, Kg.Sg. Haji Matahir,	1
13	Local School, Sekolah Kebangsaan Abaka	2
14	Local School, Sekolah Kebnagsaan Ladang Tiger	1
15	Local Village, Kg.Kelapa,	1
16	Local Village, Kg.Melati	2
17	Local Village, Kg.Asli	1
18	Local Village, Kg.Pinang	1
19	Local Village, Kg.Pisang	1
20	Local Village, Kg.Pertama	1
21	Incorporated Society of Planters	1
22	Golden Hope Plantation (Sabah) Sdn. Bhd	6
23	Golden Hope Berhad, Kuala Lumpur	2
24	Danish Energy Management	1

25	Local School, Sekolah Kebangsaan Bombalai	1
26	Asia Green Sdn Bhd	2
27	Public	4
28	Local Political Party, UMNO	1
29	Local School, Sek.Men Kebangsaan Merotai Besar	1
30	Local Village, Kg. Simpang 3	1

G.2. Summary of the comments received:

>>

There were a number of comments received from the stakeholders attended the meeting. Below are the summary of the comments received presented in a table format.

ID	Comments	From
1	Why only methane gas is considered for this project activity and what is the justification of not considering CO_2 emissions from aerobic process.	UMNO Kalabakan
2	Originally the anaerobic lagoons produce bad smell in the baseline scenario. Will there be such bad smell produced in composting project site?	UMNO Kalabakan
3	What sort of monetary benefits received from this composting project.	UMNO Kalabakan
4	Can the small scale plantation owners buy the fertilizer?	Asian and company, FRAT
5	EFB mulching in the baseline scenario attracts flies and this was a nuisance to the neighbouring villages. Clarification is required if the similar problem will persist in the composting and compost land application process.	JKK Tanah Merah
6	What is the scenario if continuous rain and what are the contingency measures	Sabah Plantation Industry

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

>>

ID	Response to comments received
1	Anaerobic treatment of POME in the open lagoons produces methane gas which is listed as one of the GHG contributing to climate change according to UNFCCC definitions. The release of CO_2 from biomass sources is considered carbon neutral as the amount of carbon consumed during the growth of the biomass is the same with the amount of carbon released to the atmosphere during degradation process.
2	The bad smell in the anaerobic lagoons in the baseline scenario cause discomfort to the local villages. After the composting project implementation, the bad smell is reduced dramatically as there is not much POME is treated in the anaerobic ponds. Some of the stakeholders verify this statement during the site visit. Even the final compost product does not have any bad smell which could cause discomfort to the neighbouring villages.

3	As per the Malaysian government requirement, all CDM projects should be bilateral and thus Danish Government is buying the carbon credits(CER's) from Golden Hope Composting project and making this project more feasible. Besides that the Danish Government also provide technical assistance in developing the PDD via Danish Energy Management A/S.
4	The final product of compost is not for sale as it is not even enough for own consumption in Golden Hope estates.
5	It was true that EFB mulching attracts flies to lay eggs in the baseline scenario. With the windrow composting technology covered with air permeable material this problem is reduced significantly. Furthermore the high temperature of the compost (approximately 40°C-70°C) and frequent shuffling of compost will drive away the flies problem. Nevertheless, there will be still a small percentage of approximately 10% of EFB will be sent back for plantation for mulching. The aim of the plantation management team is to use 100% of the EFB for composting.
6	The compost cover is air permeable but avoids rain water to sip into the compost windrows, thus the process is maintained aerobic even after rain. Furthermore there is perimeter drain routing all the rain water and leachate to an environmental pond. The leachate and rain water will be treated to meet local authority requirement before discharging to the Closed-End Furrow in the estate. The plantation management has also established an emergency response team to monitor any unforeseen circumstances.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY
Project Owner :

Organization:	Golden Hope Plantations Berhad
Street/P.O.Box:	P.O. Box 207
Building:	
City:	Banting
State/Region:	Selangor
Postfix/ZIP:	42700
Country:	Malaysia
Telephone:	03-3120 2311
FAX:	03-3120 1197
E-Mail:	
URL:	www.goldenhope.com
Represented by:	
Title:	
Salutation:	
Last Name:	Wok
Middle Name:	-
First Name:	Kamal
Department:	Process Engineering & Design, GHRSB
Mobile:	-
Direct FAX:	Cf. above
Direct tel:	Cf. above
Personal E-Mail:	kamalwok@goldenhope.com

CER Buyer :

Organization:	Royal Danish Ministry of Foreign Affairs
Street/P.O.Box:	Asiatisk Plads 2
Building:	
City:	Copenhagen K
State/Region:	
Postfix/ZIP:	DK 1448
Country:	Denmark
Telephone:	+45 33 92 00 00
FAX:	+45 32 54 05 33
E-Mail:	um@um.dk
URL:	
Represented by:	
Title:	Counsellor
Salutation:	Mr.
Last Name:	Bo Monsted
Middle Name:	
First Name:	
Department:	Embassy of Denmark, 22nd floor Wisma Denmark, 86 Jalan Ampang, 50450 Kuala Lumpur, Malaysia
Mobile:	+60193876622
Direct FAX:	+603 20322015
Direct tel:	+60320322001
Personal E-Mail:	bomons@um.dk

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for this project activity.

Annex 3

Baseline Emissions

The key assumption figures are presented in section B.2 of this PDD.

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STEP 1 : Baseline Emissions

Year	A*	B**	C	D	E	F= A x B x C x D x E /1000
	Q_{ww} m^3/yr	$COD_{ww,untreated}$ kgCOD/ m^3	$B_{o,ww}$ $kgCH_4$/ kgCOD	$MCF_{ww,treatment}$	GWP_ CH4	MEP_{ww} = BE
1st Aug 2007-31st July 2008	129,600	53.60	0.21	1.0	21	30,634
1st Aug 2008-31st July 2009	129,600	53.60	0.21	1.0	21	30,634
1st Aug 2009-31st July 20010	129,600	53.60	0.21	1.0	21	30,634
1st Aug 2010-31st July 2011	129,600	53.60	0.21	1.0	21	30,634
1st Aug 2011-31st July 2012	129,600	53.60	0.21	1.0	21	30,634
1st Aug 2012-31st July 2013	129,600	53.60	0.21	1.0	21	30,634
1st Aug 2013-31st July 2014	129,600	53.60	0.21	1.0	21	30,634
Total Estimated Baseline Emissions /yr						**214,438**

* Volume of POME was based on Golden Hope conservative assumption. Actual volume may vary according to the tones of fresh fruit bunches processed .

** Feasibility Study On Grid Connected Power Generation Using Biomass Cogeneration Technology,2000,PTM, p.g25.

Project Emissions

STEP 1: Project Emissions from Diesel Consumption

Year	A*	B**	C***	E = A/C x B x D/10^6
	Q_{diesel} liters/yr	$D_{Density}$ kg/liter	$EF_{Heavy\ Duty}$ g C02/kg	PE_{diesel} t CO_2/yr
1st Aug 2007-31st July 2008	39,563	1	3,172.31	126
1st Aug 2008-31st July 2009	39,563	1	3,172.31	126
1st Aug 2009-31st July 20010	39,563	1	3,172.31	126
1st Aug 2010-31st July 2011	39,563	1	3,172.31	126
1st Aug 2011-31st July 2012	39,563	1	3,172.31	126
1st Aug 2012-31st July 2013	39,563	1	3,172.31	126
1st Aug 2013-31st July 2014	39,563	1	3,172.31	126

*Historical data was used only for PDD estimation purposes. Actual data will be measured during the crediting period

**Actual Diesel Density value will be used during the crediting period. A conservative estimate of 1 kg/liter is used only for PDD calculation purposes.

*** IPCC Source :TABLE 1.32) Estimated emission factor for US heavy-duty diesel vehicles, uncontrolled and assumed fuel economy of 2.2 km/l. Source: Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference

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STEP 2 : Emissions from Aerobic Waste Water Treatment (Environmental Ponds)

	A	**B**	**C**	**D**	**E**	**F= A x B x C x D x E/1000**
Year	$Q_{ww,runoff}$ (m^3)	$COD_{run-off}$ (kgCOD/m^3)	Bo ($kgCH_4$/ kgCOD)	MCF $_{run-off}$	GWP CH4	PE_{runoff}
1st Aug 2007-31st July 2008	133276	1.0	0.21	0.1	21	59
1st Aug 2008-31st July 2009	133276	1.0	0.21	0.1	21	59
1st Aug 2009-31st July 20010	133276	1.0	0.21	0.1	21	59
1st Aug 2010-31st July 2011	133276	1.0	0.21	0.1	21	59
1st Aug 2011-31st July 2012	133276	1.0	0.21	0.1	21	59
1st Aug 2012-31st July 2013	133276	1.0	0.21	0.1	21	59
1st Aug 2013-31st July 2014	133276	1.0	0.21	0.1	21	59
Total Estimated Baseline Emissions /yr						**411**

STEP 3 : Total Project Emissions

Year	**A**	**B**	**C = A + B**
	PE_{diesel} (tCO_{2e})	**PE_{runoff} (tCO_{2e})**	**PE (tCO_{2e})**
1st Aug 2007-31st July 2008	126	59	185
1st Aug 2008-31st July 2009	126	59	185
1st Aug 2009-31st July 20010	126	59	185
1st Aug 2010-31st July 2011	126	59	185
1st Aug 2011-31st July 2012	126	59	185
1st Aug 2012-31st July 2013	126	59	185
1st Aug 2013-31st July 2014	126	59	185

Annex 4

Financial Analysis without CDM

GOLDEN HOPE PLANTATIONS BERHAD

CDM - COMPOSTING **90** mt/hr FFB

SELLING PRICE OF CO2 = **0.0** USD/mt

CASHFLOW								
Income	RM / unit	Qty	**1**	**2**	**3**	**4**	**5**	**6**
Sales of Product	114	45,000	5,117,647	5,117,647	5,117,647	5,117,647	5,117,647	5,117,647
Sales of CO2	0.00	30,634	-	-	-	-	-	-
Other Income			-	-	-	-	-	-
Total sales			**5,117,647**	**5,117,647**	**5,117,647**	**5,117,647**	**5,117,647**	**5,117,647**
Variable Costs								
Empty Fruit Bunches(EFB)	0	95,040	0	0	0	0	0	0
Palm Oil Mill Effluent (POME)	0	259,200	0	0	0	0	0	0
Innoculant	19	18,000	345,600	355,968	366,647	377,646	388,976	400,645
Inorganic Addition	20	45,000	915,300	942,759	971,042	1,000,173	1,030,178	1,061,084
Application Cost	17	45,000	772,650	772,650	772,650	772,650	772,650	772,650
Electricity	0.27	672,000	181,440	181,440	181,440	181,440	181,440	181,440
Diesel		318,240	318,240	318,240	318,240	318,240	318,240	318,240
Labour & related Cost			421,200	433,836	446,851	460,257	474,064	488,286
Others Overhead			0	0	0	0	0	0
Total Variable Cost			*2,954,430*	*3,004,893*	*3,056,870*	*3,110,406*	*3,165,548*	*3,222,345*
Fixed Cost								
Salaries & related cost			90,000	92,700	98,345	107,465	120,952	140,217
Marketing Expenses			0	0	0	0	0	0
Maintenance			240,000	247,200	254,616	262,254	270,122	278,226
Office Expenses			0	0	0	0	0	0
Interest			0	0	0	0	0	0
Depreciation			944,595	944,595	944,595	944,595	944,595	944,595
Insurance			107,430	107,430	107,430	107,430	107,430	107,430
Loss of CPO Revenue		65,458	65,458	65,458	65,458	65,458	65,458	65,458
CDM Verrification/Audit		0	0	0	0	0	0	0

CDM Adaptation Fee		0%	0	0	0	0	0	0
Miscellaneous Expenses			0	0	0	0	0	0
Total Fixed Cost			*1,447,483*	*1,457,383*	*1,470,444*	*1,487,202*	*1,508,558*	*1,535,926*
Total Cost			4,401,913	4,462,276	4,527,314	4,597,608	4,674,106	4,758,271
Pre-tax profit		547,399	715,734	655,371	590,333	520,039	443,541	359,376
Taxation			464,892	447,990	429,780	410,097	388,678	365,112
Profit after tax		156,716	250,842	207,381	160,553	109,941	54,863	-5,736
Cumulative Profit After Tax			250,842	458,222	618,775	728,717	783,580	777,844
Equity Investment Payback		-5,667,570	-5,416,728	-4,958,506	-4,339,730			
Inflation factor			1.00	1.03	1.06	1.09	1.13	1.16
Inflation rate		0.030						
Profit Before Tax			715,734	655,371	590,333	520,039	443,541	359,376
Add: Depreciation			944,595	944,595	944,595	944,595	944,595	944,595
Adjusted Profit			1,660,329	1,599,966	1,534,928	1,464,634	1,388,136	1,303,971
Less: Capital Allowance								
Investment Tax Allowance								
Taxable Income			1,660,329	1,599,966	1,534,928	1,464,634	1,388,136	1,303,971
TAX	28%		464,892	447,990	429,780	410,097	388,678	365,112
Inflow			2,004	2,005	2,006	2,007	2,008	2,009
Profit before tax		-	715,734	655,371	590,333	520,039	443,541	359,376
Depreciation		-	944,595	944,595	944,595	944,595	944,595	944,595
		0	-	-	-	-	-	-
		0	1,660,329	1,599,966	1,534,928	1,464,634	1,388,136	1,303,971
Outflow								
Capital Expenditure	5,417,570	5,417,570	0					
Fixed Assets Replacement			0	0	0	0	0	0
Working capital (Debtors)		250,000	0	0	0	0	0	0
Taxation		0	464,892	447,990	429,780	410,097	388,678	365,112
		5,667,570	464,892	447,990	429,780	410,097	388,678	365,112
Surplus/(Deficit)		-5,667,570	1,195,437	1,151,976	1,105,148	1,054,536	999,458	938,859
IRR		**4.0%**						
NPV @ 10%		-843,309						

Financial Analysis with CDM

GOLDEN HOPE PLANTATIONS BERHAD
CDM - COMPOSTING **90** mt/hr FFB
SELLING PRICE OF CO2 = **3.0** USD/mt

CASHFLOW								
Income	RM / unit	Qty	1	2	3	4	5	6
Sales of Product	114	45,000	5,117,647	5,117,647	5,117,647	5,117,647	5,117,647	5,117,647
Sales of CO2	11.40	30,449	347,119	347,119	347,119	347,119	347,119	347,119
Other Income			-	-	-	-	-	-
Total sales			**5,464,766**	**5,464,766**	**5,464,766**	**5,464,766**	**5,464,766**	**5,464,766**
Variable Costs								
Empty Fruit Bunches(EFB)	0	95,040	0	0	0	0	0	0
Palm Oil Mill Effluent (POME)	0	259,200	0	0	0	0	0	0
Innoculant	19	18,000	345,600	355,968	366,647	377,646	388,976	400,645
Inorganic Addition	20	45,000	915,300	942,759	971,042	1,000,173	1,030,178	1,061,084
Application Cost	17	45,000	772,650	772,650	772,650	772,650	772,650	772,650
Electricity	0.27	672,000	181,440	181,440	181,440	181,440	181,440	181,440
Diesel		318,240	318,240	318,240	318,240	318,240	318,240	318,240
Labour & related Cost			421,200	433,836	446,851	460,257	474,064	488,286
Others Overhead			0	0	0	0	0	0
Total Variable Cost			*2,954,430*	*3,004,893*	*3,056,870*	*3,110,406*	*3,165,548*	*3,222,345*
Fixed Cost								
Salaries & related cost			90,000	92,700	98,345	107,465	120,952	140,217
Marketing Expenses			0	0	0	0	0	0
Maintenance			240,000	247,200	254,616	262,254	270,122	278,226
Office Expenses			0	0	0	0	0	0
Interest			0	0	0	0	0	0
Depreciation			944,595	944,595	944,595	944,595	944,595	944,595
Insurance			107,430	107,430	107,430	107,430	107,430	107,430
Loss of CPO Revenue		65,458	65,458	65,458	65,458	65,458	65,458	65,458
CDM Verrification/Audit		15,101	15,101	15,101	15,101	15,101	15,101	15,101

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CDM Adaptation Fee		2%	6,942	6,942	6,942	6,942	6,942	6,942
Miscellaneous Expenses			0	0	0	0	0	0
Total Fixed Cost			*1,469,526*	*1,479,426*	*1,492,487*	*1,509,245*	*1,530,601*	*1,557,969*
Total Cost			4,423,956	4,484,319	4,549,357	4,619,651	4,696,149	4,780,314
Pre-tax profit		872,475	1,040,810	980,447	915,408	845,114	768,617	684,452
Taxation			555,913	539,012	520,801	501,119	479,699	456,133
Profit after tax		390,770	484,896	441,435	394,607	343,996	288,917	228,319
Cumulative Profit After Tax			484,896	926,331	1,320,939	1,664,934	1,953,852	2,182,171
Equity Investment Payback		-5,667,570	-5,182,674	-4,256,342	-2,935,404			
Inflation factor			1.00	1.03	1.06	1.09	1.13	1.16
Inflation rate		0.030						
Profit Before Tax			1,040,810	980,447	915,408	845,114	768,617	684,452
Add: Depreciation			944,595	944,595	944,595	944,595	944,595	944,595
Adjusted Profit			1,985,405	1,925,042	1,860,003	1,789,709	1,713,212	1,629,047
Less: Capital Allowance								
Investment Tax Allowance								
Taxable Income			1,985,405	1,925,042	1,860,003	1,789,709	1,713,212	1,629,047
TAX	28%		555,913	539,012	520,801	501,119	479,699	456,133
Inflow			2,004	2,005	2,006	2,007	2,008	2,009
Profit before tax		-	1,040,810	980,447	915,408	845,114	768,617	684,452
Depreciation		-	944,595	944,595	944,595	944,595	944,595	944,595
		0	-	-	-	-	-	-
		0	1,985,405	1,925,042	1,860,003	1,789,709	1,713,212	1,629,047
Outflow								
Capital Expenditure	5,417,570	5,417,570	0					
Fixed Assets Replacement			0	0	0	0	0	0
Working capital (Debtors)		250,000	0	0	0	0	0	0
Taxation		0	555,913	539,012	520,801	501,119	479,699	456,133
		5,667,570	555,913	539,012	520,801	501,119	479,699	456,133
Surplus/(Deficit)		-5,667,570	1,429,491	1,386,030	1,339,202	1,288,591	1,233,512	1,172,914
IRR		**10.6%**						
NPV @ 10%		83,389						

Annex 5

Monitoring & Quality Assurance Information Table

No	Parameter	Symbol	Unit	Recording Frequency	Data; measured [m], calculated [c],	Location	Method	Person Recording/ Calculating / Compiling Data	Person Verifying Data	Used For CER Calculation [CER] or Quality Assurance [QA]
1	Quantity of POME	Qww	m^3	daily	m	Flow meter at the POME outlet point for composting site from anaerobic pond	Totaliser reading from a flow meter.	Compost Technicians	Compost Manager	CER
2	COD of POME	$COD_{INHOUSE}$	kg COD/ m^3	weekly	m	Respective Golden Hope Palm Oil Mill Laboratory	Lab Analysis	Compost Technicians	Compost Manager	CER
3	COD of POME	$COD_{3rd\ PARTY}$	kg COD/ m^3	monthly	m	Accredited Laboratory	Lab Analysis	Compost Technicians	Compost Manager	CER
4	COD of POME	Average, COD_m	kg COD/ m^3	monthly	c	Compost Plant	Calculated from weekly COD readings	Compost Technician	Compost Manager	CER
5	COD of POME	$COD_{ww,untreated}$	kg COD/ m^3	y	c	Compost Plant	Average of monthly COD readings	Compost Technician	Compost Manager	CER

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6	Diesel Consumption	Q_{diesel}	liters	monthly	m	Palm Oil Mill Store	Diesel Invoices issued to the compost plant from plam oil mill/diesel supplier	Compost Technician	Compost Manager	CER
7	Oxygen Content,	O_2	%	before & after turning of windrows	m	Compost Windrows	Oxygen Probe	Compost Technician	Compost Manager	QA
8	Windrow Temperature,	T	℃	before & after turning of windrows	m	Compost Windrows	Temperature Probe	Compost Technician	Compost Manager	QA
9	Quantity of Compost generated	Q_{comp}	tonnes	monthly	m & c	Respective Palm Oil Mill	Weigh Bridge measuring tonnes of compost produced and used for land application	Compost Technician	Compost Manager	QA
11	Quantity of run-off water	$Q_{ww,run-off}$	m^3	daily	m	Flow meter at the environmental pond run-off water pump	Totaliser reading from a flow meter.	Compost Technicians	Compost Manager	CER
12	COD of run-off water	$COD_{run-off, INHOUSE}$	kg COD/ m^3	weekly	m	Sampling at the suction point of the run-off water pump	Golden Hope Lab Analysis	Compost Technicians	Compost Manager	CER

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13	COD of run-off water	$COD_{run-off,}$ 3rd PARTY	kg COD/ m^3	monthly	m	Sampling at the suction point of the run-off water pump	Accredited Lab Analysis	Compost Technicians	Compost Manager	CER
14	COD of run-off water	Average, $COD_{monthly-runoff}$	kg COD/ m^3	monthly	c	Compost Plant	Calculated from weekly run-off water COD readings	Compost Technician	Compost Manager	CER
15	COD of run-off water	$COD_{run-off}$	kg COD/ m^3	y	c	Compost Plant	Sum of monthly run-off water COD readings	Compost Technician	Compost Manager	CER

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