CDM – Executive Board

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 of the project	:	Co-composting of Palm Oil Mill Waste at Keratong
Version	:	4.0
Date	:	15/02/2013

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

The 'co-composting of palm oil mill waste project at Keratong', (hereafter referred as "project activity") will implement a composting facility for palm oil mill waste in Keratong, Malaysia. The Tee Teh Palm Oil Mill has a processing capacity of 20 tonnes of fresh fruit bunches (FFB) an hour and proposes to increase the processing capacity to 45 tonnes of fresh fruit bunches per hour. Two major waste streams originate from the FFB processing: namely Empty Fruit Bunches (EFB) and Palm Oil Mill Effluent (POME). As it is not economical to dispose of EFB in other means, it is currently deposited at an unmanaged dump site (solid waste disposal site- SWDS) near the mill, where it is left to decompose. Daily unloading of EFB using trucks at the SWDS eventually leads to accumulation of EFB which causes anaerobic degradation and consequent release of methane emissions to the atmosphere. It is common practice in Malaysian palm oil mills to dispose of EFB in unmanaged dump sites since incineration is prohibited[1] and other means of disposal are too expensive[2].

On the other hand, POME is treated in open anaerobic ponds or lagoons where it oxidizes anaerobically before the effluent is allowed to be discharged into nearby river. The treatment of POME in open ponds is a standard practice currently implemented by most palm oil mills in Malaysia. The discharged effluents meet the relevant regulatory requirements[3]. However such practice generates several environmental problems, including foul odour and free emissions of methane (a Green House Gas (GHG)) into the atmosphere.

The proposed project activity site is located in a remote area - 15 km from the main Keratong- Mersing road. The composting facility is expected to treat both EFB and POME aerobically thus reducing free emissions of methane into atmosphere. Furthermore the usage of the produced compost in palm oil plantations will reduce the application of chemical fertilizers which in turn release nitrous oxide into the atmosphere as well as cause pollution of waterways.

In the proposed project activity, EFB will be sent to a pressing machine to remove any remaining oil from the fruits. After this EFB will be shredded to fibres of length around 5 to 10 cm and transported to

[1] Refer to Lim, KC and Zaharah, A R '*Decomposition and N & K release by Oil Palm Empty Fruit Bunches Applied under Mature Palms', Journal of Oil Palm Research Vol. 12 No.2, December 200, p 56.*

[2] There is official recommendation to use the EFB as mulching material to be arranged between rows of the palm trees. However the cost of employing additional manpower to put in the inter-rows is among the reasons identified for mulching practice to be unattractive. Refer to Chow Mee Chin from Malaysian Palm Oil Board (Page 35 -36, n.d.) '*An Assessment of Potential and Availability of Palm Biomass for Bioconversion to Biomethanol',* a report prepared under the Malaysian-Danish Environmental Cooperation Programme for Renewable Energy and Energy Efficiency Component.

[3] Standard B of the Environmental Quality Act 1974 set by Department of Environment Malaysia according to which effluents with COD less than 100 ppm are allowed.

the composting plant and laid in rows. Trichoderma F1132 microbes[4] will be added to the windrows to accelerate the composting process. Each windrow will be covered by specially designed windrow cover permeable to air to facilitate aeration. The cover also allows rainwater to run off smoothly thus preventing leaching and consequent production of waste water. A drain is provided around the perimeter of the compost yard and the run off water, if any, flows to a sump from where it is pumped to existing anaerobic lagoons. Such run-off is expected only when there is high rainfall. Since covers are provided, there is no leachate from the composting material. POME is sprayed over shredded EFBs to maintain adequate moisture levels throughout the process cycle. Nearly 56,716 m^3 and 127,611 m^3 of POME shall be composted per year in the first year and the subsequent years respectively. The windrows will be periodically turned for aeration using a tractor fitted with mechanical turner. The composting process will take 8 to10 weeks and the end product is a dark brown porous substance with earthly smell: the organic compost. The bioorganic compost will be used in the surrounding palm oil estates or sold locally.

Reduction of Green House Gases (GHG) by the project activity

The project activity reduces GHG emissions in two ways as follows:

(i.) The EFB to be consumed in the project activity is currently disposed in dumpsite and left to decay anaerobically causing methane emissions to the atmosphere. The project activity will subject EFB to aerobic decomposition to produce organic compost; preventing methane emissions to the atmosphere. Thus, the project activity reduces GHG emissions.

(ii.) The organic wastewater is at present treated in open anaerobic lagoons. Methane, a strong GHG, rich biogas formed due to anaerobic degradation of organics in open anaerobic lagoons is emitted to the atmosphere. The project activity involves construction of closed anaerobic digesters wherein methane gas formed would be captured and utilised for energy generation thereby preventing methane emissions to the atmosphere.

Contribution by the project activity to sustainable development:

The proposed project activity will contribute to overall sustainable development in the region and globally by promoting reuse of wastes from palm oil processing in Malaysia in the following ways:

a. It reduces air pollution from the anaerobic decay of EFB and POME. The emissions to air include methane, ammonia and hydrogen sulphide (H_2S). These emissions contribute to global climate change, local acid rain and offensive smell in the local area.

b. It produces organic fertilizer (compost) from biomass waste that will partly replace the existing use of chemical fertilizer (it is a common practice in palm oil plantations to use large quantities of inorganic fertilizer as a supplement source of nitrogen, phosphorus & potassium (NPK) to boost the production of FFB) and/or increase the harvest of FFB from the palm plantations. The compost is rich in both micro and macronutrients and will condition the soil to promote better quality and quantity of yields in agricultural crops.

c. The project activity reduces the risk of methane ignited fires at the waste disposal site.

[4] Trichoderma F1132 is a patented microbe for composting. Patent owned by Putra University Malaysia. When the compost is ready for application, the presence of Trichoderma F1132 in the compost provides additional benefits as it will assist the oil palm overcoming a pathogen which causes stem rot problem.

d. It initializes a clean technology on solid biomass waste management.

e. It improves the ambient air quality around the SWDS and the project activity.

f. It improves the environmental performance of the palm oil mills.

g. It will create new job opportunities for local residents during construction and operation of the compost plant.

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 participant (Yes/No)
Malaysia (Host Party)	Hi-Tech Activated Carbon Sdn. Bhd. (private entity)	No
United Kingdom of Great Britain and Northern Ireland **(Annex I Party)**	Belektron d.o.o. (private entity)	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

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

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

A.4.1.1. Host Party(ies):

Malaysia

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

State of Pahang

A.4.1.3. City/Town/Community etc:

Rompin

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 at (see Figure 2):
Lot PT 324,
Keratong (see **Figure 1**),
District of Rompin, Pahang
Malaysia.

The coordinates of the project location are :
2 50' 24.3"N, 102 51' 55.6"E

Figure 1: Keratong in peninsular Malaysia

Keratong

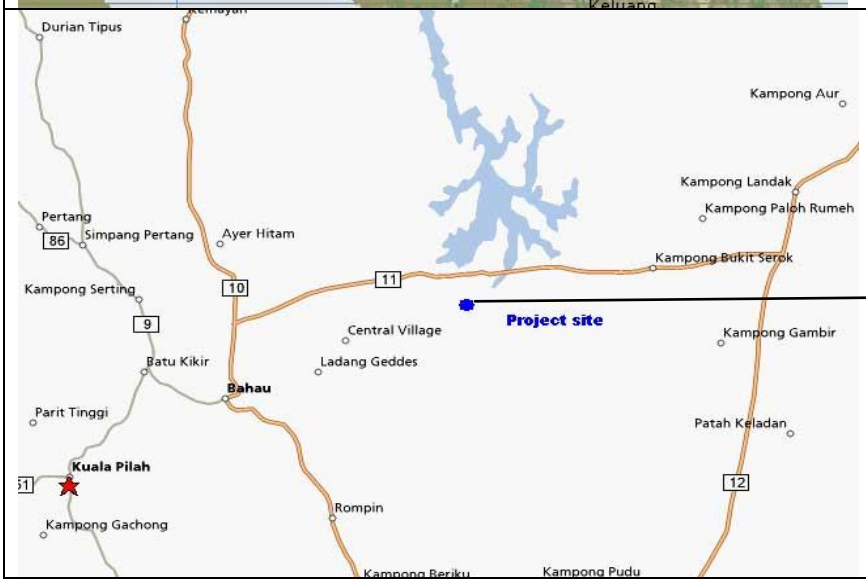

Figure 2: Location of the project site.

Project activity

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

In accordance to Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities, the proposed CDM project is a small scale project and it falls under the following category:

Scope Number : 13
Sectoral Scope : Waste handling and disposal
Type : III - Other Project Activities
Category : M - Methane Recovery
Approved small scale methodology **AMS III.F (version 10),** "***Avoidance of methane emissions through composting***" is applied.

Technology employed in the project activity

The composting technology is developed in USA. It uses a mechanical turner that ensures aeration of the EFB to enhance the composting process. Also, the windrows cover sheets from Denmark are specifically designed to allow rainwater runoff and hence minimize leaching from the EFB under composting. The permeable cover allows free flow of air for composting activities.

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

A fixed crediting period of 10 years is chosen for the project activity. The total emissions reductions resulting from the project activity are estimated to be approximately **371,696** tCO_2 e over the 10 year crediting period. An annual average of **37,170** t CO_2 e will be reduced as a consequence of the project activity.

Year	Annual estimation of emission reductions in tonnes of CO_2e
Year 1	15,282
Year 2	35,055
Year 3	36,659
Year 4	38,012
Year 5	39,154
Year 6	40,117
Year 7	40,929
Year 8	41,615
Year 9	42,193
Year 10	42,681
Total estimated reductions (tonnes of CO_2e)	**371,696**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tCO_2e)	**37,170**

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

No public funding from Annex I Parties is involved in the project activity.

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

A proposed small-scale project activity shall be deemed to be a de-bundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

a) With the same project participants;

b) In the same project category and technology/measure; and
c) Registered within the previous 2 years; and
d) Whose project boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point

None of the above applies to the proposed project activity; therefore, the project activity is not a de-bundled component of a large scale project activity.

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 activity would apply approved small scale methodology as follows:

Title of the approved baseline methodology:		Avoidance of methane emissions through composting
Reference of the approved methodology	:	AMS III.F. /Version 10
Scope number	:	13
Sectoral scope	:	Waste handling and disposal

These methodologies are used in conjunction with the following tools:

- Methodological tool "Emissions from solid waste disposal sites" / Version 06.0.1
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion / Version 02

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

The proposed project activity qualifies as small scale project as the emission reductions from the project activity will be less than 60,000 tCO_2e/year over its crediting period.

The table below shows that the proposed project activity meets each of the applicability conditions of the approved small scale methodology AMS III.F. / Version 10:

Table 1 – Justification for choice of the methodology

S.No.	Applicability criteria set by AMS IIIF / version 10	Conditions of proposed project activity
1	This methodology comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS) without methane recovery or in an animal waste management system (AWMS), or in a wastewater treatment system (WWTS). In the project activity, controlled aerobic treatment by composting of biomass is introduced	Without the project activity, the EFB would be left to decay anaerobically at an unmanaged solid waste disposal site without any methane recovery. The Keratong composting project proposes to implement a co-composting plant for aerobically treating the wastes (EFB and POME) from the palm oil mill. The composting process is a controlled biological treatment of biomass through aerobic treatment. *Hence, meets the criterion.*

2	The project activity does not recover or combust landfill gas from the disposal site (unlike AMS III.G "Landfill methane recovery"), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS IIIE "Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical / thermal treatment").	The project activity does not recover landfill gas from dump site and it does not carry out any combustion of waste that is not treated biologically. *Hence, meets the criterion.*
3	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2equivalent annually	The estimated annual emission reduction from the proposed project activity will not exceed 60ktCO_2·e during the crediting period. The highest emission that is expected from the project activity is 42. 681 kt CO_2 e / year. *Hence, meets the criterion.*
4	This methodology is applicable to the composting of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure.	The project activity will treat EFB and waste water (biomass waste) from the palm oil mill which is an agro industry, into organic compost. *Hence, meets the criterion.*
5	This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility. For project activities that increase capacity utilization at existing facilities, project participant(s) shall demonstrate that special efforts are made to increase the capacity utilization, that the existing facility meets all applicable laws and regulations and that the existing facility is not included in a separate CDM project activity. The special efforts should be identified and described	This project activity involves construction of a new co-composting plant. *Hence, this clause is not applicable to the project activity.*
6	This methodology is also applicable for co-composting wastewater and solid biomass waste, where wastewater would otherwise have been treated in an anaerobic wastewater treatment system without biogas recovery. The wastewater in the project scenario is used as a source of moisture and/or nutrients to the biological treatment process e.g. composting of empty fruit bunches (EFB), a residue from palm oil production, with the addition of palm oil mill effluent (POME) which is the wastewater co-produced from palm oil production.	The project activity is a co –composting facility EFB and POME; In the absence of the project activity, POME would be treated in open anaerobic lagoons without biogas recovery. The wastewater (POME) will be used as a source of moisture and nutrient to the co-composting process. *Hence, meets the criterion.*
7	In case of co-composting, if it cannot be demonstrated that the organic matter would	The EFB is dumped in solid waste disposal site and POME is treated in

	otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero, where as project emissions shall be calculated according to the procedures presented in this methodology for all co-composted substrates.	open anaerobic lagoons where organic matter in both these wastes are left to decay anaerobically. This has been clearly demonstrated to DOE during site validation. *Hence, meets the criterion*.
8	The location and characteristics of the disposal site of the biomass, animal manure and co-composting wastewater in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions, using the provisions of AMS III.G, AMS III.E (concerning stockpile), AMS III.D "Methane recovery in animal manure management systems" or AMS – IIIH respectively.	The location and characteristics of the dumpsite where EFB are currently being dumped and POME (co-composting wastewater) is left to decay are well known and has been validated by DOE. *Hence, meets the criterion.*
9	The project participants shall clearly define the geographical boundary of the region referred in paragraph 8 (b), and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the source of the waste i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. Once defined, the region should not be changed during the crediting period(s).	The geographical boundary of the project activity has been defined in section B.3. The compost will be used in the plantations that are located at a distance of approximately 5kms (10kms round trip) which is less than 200kms. Also, the EFB is transported from distance less than 1.5kms. *Hence, meets the criterion.*
10	In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.	Proper measures shall be taken to ensure that there are no methane emissions while handling the produced compost aerobically and submitting it to soil application. *Hence, meets the criterion.*
11	In case produced compost is treated thermally/ mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.	The produced compost will not be treated thermally / mechanically. *Hence this condition is not applicable.*
12	In case produced compost is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual organic content shall to be taken into account and calculated as per the latest version	The compost will be handled aerobically and used for soil application. Hence, no emissions are expected from storage of compost under anaerobic conditions.

	of the "Emissions from solid waste disposal sites".	*Hence, meets the criterion.*

Since all the applicability criteria of the approved small scale methodology AMS III.F. / Version 10 are satisfactorily met by the project activity, the chosen methodology is appropriate for the project activity.

B.3. Description of the project boundary:

The project boundary is the physical, geographical site where:

- The solid waste would have been disposed of and the methane emission occurs in the absence of the proposed project activity: dumping site for EFB;
- The co-composting wastewater would have been treated anaerobically in the absence of the project activity (the anaerobic pond);
- The treatment of biomass through composting takes place;
- The residual waste from biological treatment (organic compost) are submitted to soil application;
- The transportation of waste, wastewater, compost occur (itineraries between all locations mentioned above).

The co-composting plant is located next to the existing palm oil mill. The EFB will be shredded and loaded into windrows. The compost produced will be applied in the palm oil plantation. Therefore, the project boundary includes the oil palm plantation in which the compost is applied.

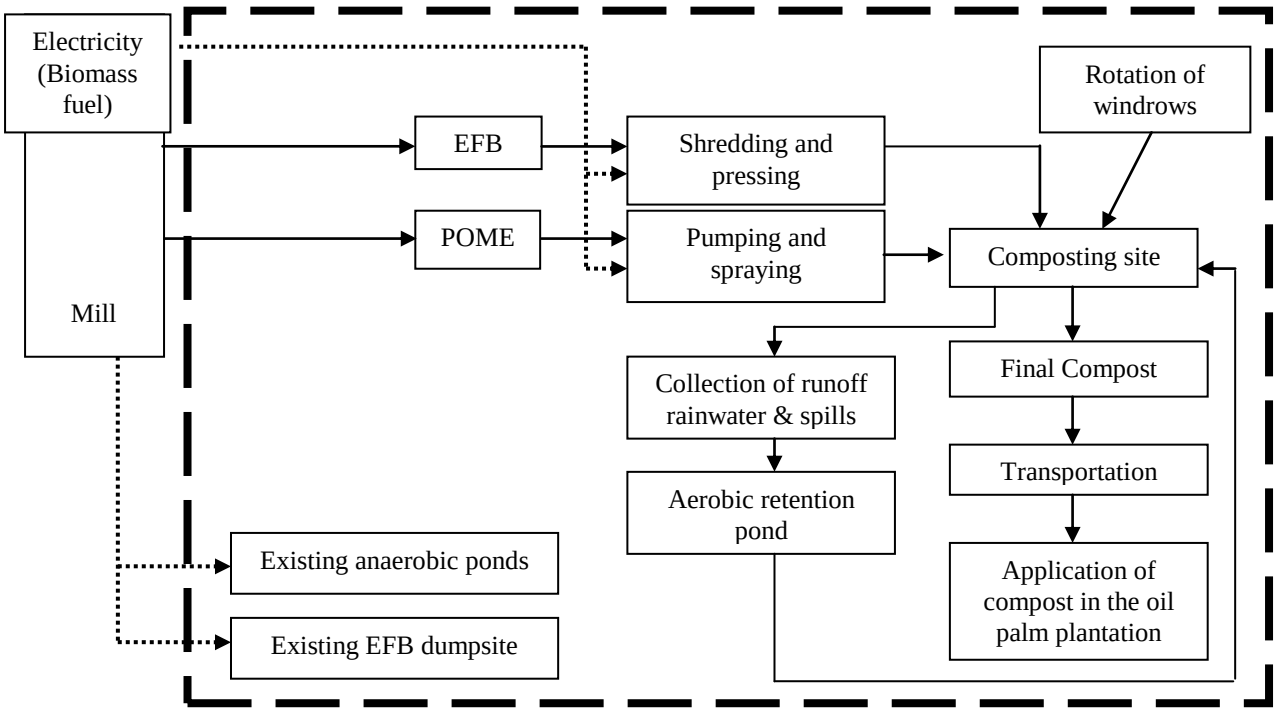

Figure 3: Project boundary and co-composting processes

The GHG and their sources as related to the baseline and project emissions are given in the table below:

Emissions	Sources	Gas	Yes/No	Comment
Baseline emissions	Anaerobic open ponds and unmanaged dumping of EFB in the dumping site	CH_4	Yes	Methane generated from the open ponds and anaerobic decay of unmanaged EFB dumping
Project emissions	Transportation	CO_2	Yes	POME will be pumped directly from the anaerobic ponds to the windrows. Thus there will be no incremental transportation for wastewater. The project emissions from the incremental CO_2 emissions due transportation by trucks of EFB and compost are considered.
	Power	CO_2	No	No project emissions are considered from the electricity used for the additional machineries in the project activity as the power is generated using biomass fuel in the palm oil mill which is considered as carbon neutral.
	Fossil Fuel	CO_2	Yes	Emissions are expected from vehicles used to turn the windrow at the composting sites. Diesel consumption for compost turners and backhoe will be monitored in the project activity.
	Composting Process	CH_4	Yes	The methane emissions from the composting will be monitored using the oxygen meter to ensure that the composting process is in aerobic conditions.
	Run-off water	CH_4	No	The run-off water will be recycled back to the composting piles for improving the moisture and nutrient. Thus, the project emission from this source is considered as zero.
	Residual waste	CH_4	No	No methane emisisons from the compost due to anaerobic storage or disposal in landfill as the final compost will be evenly applied in the palm oil plantation.

B.4. Description of baseline and its development:

The baseline scenario is identified as per Para 21 (now amended as Para 22 after EB Meeting 69) of the 'General guidelines for SSC CDM methodologies'

Para 21 suggests a 4 step approach to identify the baseline scenario.

The project activity involves co- composting EFB and POME. The project activity involves two components – EFB and POME. Therefore, the baseline scenario is identified for both the components separately.
The baseline scenario is identified as per the following steps suggested in the tool.

Step 1: Identification of various alternatives available to the project proponent for EFB

The alternatives that were available to the project proponent for disposal of EFB are listed below:

Alternative 1 **:** The proposed co-composting project using EFB undertaken without being registered as a CDM project activity.

Alternative 2 **:** Continuation of the current scenario whereby EFB is dumped in SWDS

Alternative 3 **;** EFB is burnt in uncontrolled manner without utilizing it for energy purposes

Alternative 4 : EFB is used as a fuel to produce heat and /or electricity

Alternative 5 : EFB is used for other energy purposes, such as the generation of bio-fuels

Alternative 6 : EFB used as feed stock for non-energy purposes, e.g. in the pulp and paper industry

Step 2 : Check for consistency with applicable laws and regulations

Of the identified alternatives, alternative 3 is not consistent with applicable laws and regulations as:
Open burning is prohibited in Malaysia under the Environmental Quality Act, 1974 (amended 2000)[5]. Therefore, alternative 3 is eliminated from the list of identified alternatives.

Step 3 – Barrier analysis

Step 3 of the guidelines suggests to eliminate the alternatives taking into account the barrier tests as per 'Guidelines on the demonstration of additionality of small-scale project activities'. The identified alternatives have considerable barriers which are discussed below:

*Barrier analysis for alternative 1 **:** The proposed co-composting project using EFB undertaken without being registered as a CDM project activity*
Investment analysis has been performed in next section B.5 as per the latest "Guidelines on the assessment of investment analysis" to show that alternative 1 could not be a baseline scenario.

Alternative 2 is the continuation of the current practice
Alternative 3 has been eliminated as it is not consistent with applicable laws and regulations in step 2.

[5] http://www.agc.gov.my/Akta/Vol.%203/Act%20127.pdf

Barrier analysis for alternative 4 – EFB is used as a fuel to produce heat and /or electricity

The use of EFB as a combustion fuel to produce heat and / or electricity has following barriers[6]:

- High moisture content of around 65%
- Difficulty in handling, unhandy and fibrous nature
- High alkaline content

The main difficulty is the low melting point of the EFB ash, affecting the performance of the steam boiler. The solution to this is to maintain sufficient air input to ensure complete combustion and assure that the temperature profile of the furnace does not exceed the fusion temperature of the ash. Otherwise, the following problems occur[7]:

- Temperature in the combustion chamber will fall to a point where the high alkaline content of the EFB makes the ash 'sticky' resulting in the formation of clinker attached to the boiler.
- The presence of chlorine and sulphur in the flue gas and fuel erode the boiler wall. This will lead to the bursting of boiler tubes, causing plant breakdown and results in supply failure.
- Clinkers build-up on the grate will hinder further combustion, affecting the plant's efficiency, causing the plant to be shut down for regular maintenance. This affects the availability of the plant for steam generation.

Also, the fuel characteristics of EFB are poor -low calorific value, high moisture, formation of clinkers[8]. EFB is characterized by a low homogeneity and high moisture content that entails technical sophistication in a project. The production of energy from EFB requires specific technological development which was not well developed yet in Malaysia[9] at the time of planning the project activity . The major problems are linked to the poor fuel characteristics of EFB causing unstable combustion.

Palm oil mills in Malaysia that tried to utilize EFB as fuel (almost all of them are either CDM project activities or are being developed as CDM project activities) are facing the problem of severe fouling of the boiler tube surface whereby the full generation load could not be achieved[10].

On account of above barriers, using EFB as a fuel was not a realistic alternative available to the project proponent at the time of planning the project activity.

Barriers for alternative 5 – EFB is used for other energy purposes, such as the generation of bio-fuels

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[6] Industrial Power Technology PTE Ltd (http://www.ipttech.net/PoweringAsia.pdf)

[7] Industrial Power Technology PTE Ltd (http://www.ipttech.net/PoweringAsia.pdf)

[8] Sustainability of Palm Oil Production and Opportunities for Finnish Technology and Know-how transfer, Lappeenranta University of Technology, March 2009, page 59 http://www.scribd.com/doc/87048860/produksi-minyak-sawit

[9] Sustainability of Palm Oil Production and Opportunities for Finnish Technology and Know-how transfer, Lappeenranta University of Technology, March 2009, page 59 http://www.scribd.com/doc/87048860/produksi-minyak-sawit

[10] http://www.cogen3.net/doc/applicability/ApplicabilityofEuropeanTechnologiesinASEAN.pdf

The technology to convert EFB into bio-fuels is still in a laboratory stage and numerous researches[11] are still ongoing. Also, in Malaysia, the existing price structures for fuels are influenced by the fossil fuel-subsidizing policy, which makes bio-fuels even less competitive. *Hence this is not a realistic alternative available to the project proponent.*

Barriers for alternative 6 - EFB used as feed stock for non-energy purposes, e.g. in the pulp and paper industry

Use of EFB in the production of pulp and paper is relatively a new technology in this region. At the time of planning the project activity, there was no project using EFB to make paper; although now , there is one project in Sabah region (Eastern Malaysia) that utilizes EFB for pulp and paper production and it is a CDM project activity[12].
Therefore, use of EFB as feed stock for non -energy purposes was not a realistic alternative that was available to the project proponent.

Step 4: Identification of baseline scenario
As per step 2 and 3, the only scenario that was available to the project activity was alternative 2 - continuation of the current scenario - dumping of EFB in the SWDS.

Since the only remaining scenario corresponds to the baseline scenario provided in the methodology AMS III F, alternative 2 is the baseline scenario for the project activity.

Now the baseline scenario is identified for second component of the project activity namely POME – palm oil mill effluent.

Step 1: Identification of various alternatives available to the project proponent for POME
Alternative 1 **:** The proposed co-composting project using POME undertaken without being registered as a CDM project activity.

Alternative 2**:** Continuation of the current scenario whereby POME is treated in open anaerobic lagoons.

Alternative 3 **:** POME is treated in advanced treatment systems like closed anaerobic digesters to recover methane

Step 2 : Check for consistency with applicable laws and regulations

All the identified alternatives are consistent with applicable laws and regulations.

Step 3 – Barrier analysis

Step 3 of the guidelines suggests eliminating the alternatives taking into account the barrier tests as per 'Guidelines on the demonstration of additionality of small-scale project activities'. As per these guidelines, barriers for the identified barriers are discussed below:

[11] A case study on Palm Entry Fruit Bunch as energy feedstock, SEGi Review ISSN 1985-5672, Vol. 3, No. 2, Dec 2010, 3-15 (http://www.onlinereview.segi.edu.my/pdf/vol3-no2-art1.pdf)

[12] http://cdm.unfccc.int/Projects/DB/DNV-CUK1301035011.29/view

*Alternative 1 **:** The proposed co-composting project using POME undertaken without being registered as a CDM project activity.*
Investment analysis has been performed in the subsequent section B.5 as per the latest "Guidelines on the assessment of investment analysis" to show that alternative 1 could not be a baseline scenario.

Alternative 2 is the continuation of the current practice.

Barrier analysis for alternative 3 – Installation of advanced treatment systems like closed anaerobic digesters to recover methane

The installation of advanced treatment systems like closed anaerobic digesters involves additional investment as compared to current practice. The investment cost of closed anaerobic digester systems for treatment of POME alone for a similar size palm oil mill is more than RM 5 Million[13]. There are more than 40 small scale CDM registered projects with closed anaerobic digester systems for POME[14] and few more projects have been submitted for CDM registration[15].The fact that so many closed anaerobic digester projects for POME are CDM project activities shows that this alternative is not a common baseline scenario.

The open pond systems are well proven for POME and can readily be established by local technology suppliers. There is also adequate local labour available with experience in this technology. More than 85% of all palm oil millers are using anaerobic systems and open lagoon treatment system is, thus the mainstream technology. A further 5-10% use open tanks, while the rest use composting and others (Eco-Ideal 2004; Yeoh 2004a).[16].

Step 4: Identification of baseline scenario
As per step 2 and 3, the only scenario that was available to the project activity was alternative 2 - continuation of the current scenario – POME is treated in open anaerobic lagoons.

Since the only remaining scenario corresponds to the baseline scenario provided in the methodology AMS III H, alternative 2 is the baseline scenario for the project activity.

From the above presented discussions, it may be concluded that the continuation of the current practice – dumping of EFB in dumpsites and treatment of POME in open anaerobic lagoons – is the baseline scenario for the project activity.

[13] The investment cost for a closed anaerobic digester system for UNFCCC Registered project no. 5825 is RM7.231 Million http://cdm.unfccc.int/Projects/DB/SIRIM1329901987.95/view; the investment cost for closed anaerobic digester system for UNFCCC Registered project no. 7473 is RM6.933 Million excluding the electricity generation system http://cdm.unfccc.int/Projects/DB/RWTUV1348727208.1/view

[14] http://cdm.unfccc.int/Projects/projsearch.html - for Malaysia, AMS III H,

[15] http://cdm.unfccc.int/Projects/completeness_check.html

[16] Yeoh, B.G. (2004). A Technical and Economic Analysis of Heat and Power Generation from Biomethanation of Palm Oil Mill Effluent. Paper presented at the *Electricity supply industry in transition: issues and prospect for Asia conference Paragraph 1*.

According to AMS III.F./ Version 10, the baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. Figure 4 below shows the baseline scenario.

In the absence of the project activity, the solid waste biomass (EFB) would be dumped in an unmanaged solid waste disposal site close to the mill and left to decay in anaerobic conditions. Also, the wastewater produced during the processing of the FFB would be treated anaerobically in an open pond system to reduce its COD before being discharged in the local waterways, with consequent release of methane to the atmosphere.

Baseline emissions exclude emissions of methane that would have to be captured to comply with national regulations. In Malaysia, there are no legal requirements to collect and destroy or utilize methane gas from landfill, therefore the totality of the methane emissions are included in the baseline.

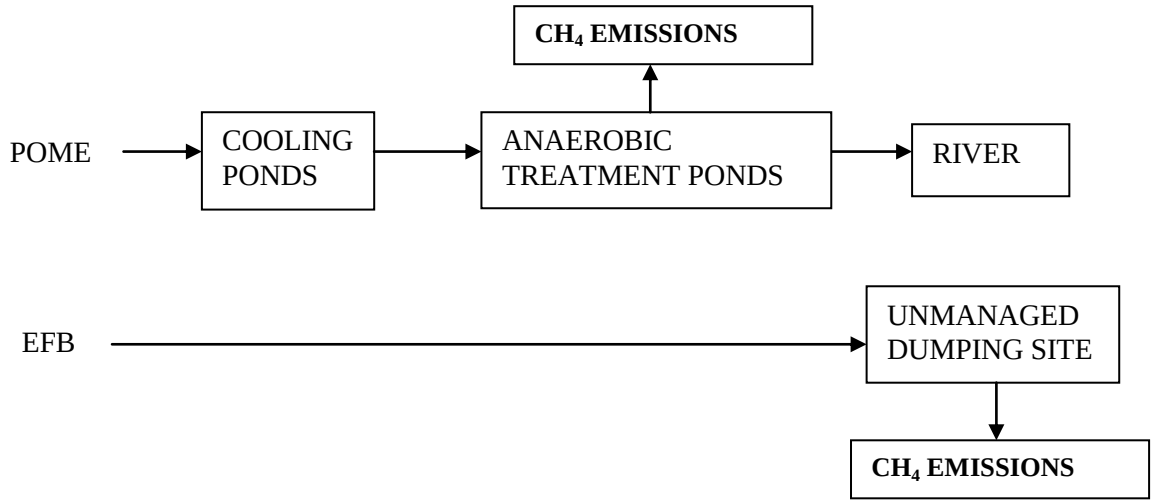

Figure 4: Baseline scenario for the proposed CDM project activity

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:

Early CDM Consideration

As the starting date of the proposed project activity is before the date of validation, early consideration of CDM must be demonstrated in accordance with the latest "Guidance on the demonstration and assessment of prior consideration of the CDM[17]". The revenues from CDM has been seriously considered by the project owner prior to the commencement of the construction, and a series of continuing actions have been undertaken to secure CDM support throughout the planning and construction phases. The key actions and the timeline of the project activity are outlined in Table 2 below.

[17] EB 62 Annex 13.

Table 2: CDM consideration and project timeline

Event	Date	Evidence
Decision to develop project under the CDM	20/05/2007	Extract of Minutes of Board Meeting held on 20/05/2007
Local stakeholders consultation meeting	22/10/2007	Newspaper Advertisement dated 05/10/2007 and invitation letter dated 01/10/2007[18]
Appointment of CDM consultant	11/11/2007	Contract with Strec Sdn. Bhd.[19]
Project start date	13/11/2007	Letter of award to Harcos Construction Sdn. Bhd.[20]
1st publication of PDD on UNFCCC website for GSP (with AMS-III.F/ Version 05)	01/12/2007	UNFCCC records[21]
Submission for NC-CDM (National Committee on CDM) and the date for the presentation	03/04/2008	Letter from Ministry of Natural Resources and Environment (MNRE)[22]
Pre LoA from Host Country DNA	18/04/2008	Pre LoA and subsequent extensions[23]
Change of CDM consultant	15/10/2009	Contract with YTL-SV Carbon[24]
Final LoA from Host Country DNA	17/04/2012	LoA from DNA, Malaysia[25]

Additionality of the proposed project activity

The additionality of the project is discussed below in accordance with Attachment A of Appendix B of the Simplified M&P for small scale CDM project activities.This is done by identifying the barrier that would have prevented the project activity from occurring. At least one of the following barriers is required:

(a) Investment barriers
(b) Technological barriers
(c) Barrier due to prevailing practice
(d) Other barriers

[18] Notice in newspaper for stakeholder meeting and invitation letter

[19] Contract between Hi-Tech Activated Carbon Sdn Bhd and Strec Sdn Bhd.

[20] Letter of Award from Hi-Tech Activated Carbon to Harcos Construction Sdn. Bhd.

[21] http://cdm.unfccc.int/Projects/Validation/DB/CBU67UCY52SSIK88F86BUF7OPSG609/view.html

[22] Letter from Ministry of Natural Resources and Environment for National Committee of Clean Development Mechanism (NCCDM) Bil. 2/2008

[23] Pre-Letter of Approval from MNRE

[24] Contract signed between YTL-SV Carbon Sdn.Bhd. and Hi-Tech Activated Carbon Sdn.Bhd

[25] Letter of Approval dated 17/04/2012 from DNA, Malaysia

The main barrier faced by the project activity is discussed below:

B.5.1.Investment barrier

The current practice of disposal of EFB in an unmanaged solid waste disposal site only involves transportation costs. The treatment of POME is conducted using anaerobic and aerobic lagoons already established at the mill. Therefore the continuation of current practice will not require any additional capital investment.

On the other hand the construction of a new composting plant will require acquisition of land, new equipment and staff. Table 3 below details the estimated capital investment and annual operational costs. All values are in Malaysian Ringgits (RM).

Table 3: Estimations for financial analysis

Estimations for financial analysis	Investment costs (Pre-Operational) (RM)	Annual operation and maintenance cost (O&M cost) (Phase 1) (RM)	Annual operation and maintenance cost (O & M cost) (Phase 2) (RM)
1. Composting plant			
A. Capital cost / Investment cost (CAPEX)	559,300		
i. Vehicle	1,265,000		
ii. Establishment of the composting plant	570,000		
iii. Equipment	370,000		
iv. Project management, consultation and training fees			
B. Annual operational cost			
i. Annual operational & maintenance cost		432,850	968,211
ii. Annual labour cost		360,000	360,000
iii. land rental		88,000	88,000
Total	**2,764,300**	**880,850**	**1,416,211**
2. CDM Development Costs*			
- CDM consultation fee, Validation & registration fee	200,000	60,000	
Annual verification fee			60,000
3. Monitoring equipment	15,781		
4.Annual income		662,400	1,490,400
Compost sales @ 100 RM/tonne		487,681	874,627 -1,120,708
CER revenue			138,215[26]
Residual value at the end of project activity (year 20)			

**Only considered to calculate the IRR with CDM revenues.*

[26] At the end of the contract, the ownership of Composting facility would be transferred to the mill owner at agreed residual value at 5% of the CAPEX

The capital cost incurred for composting plant establishment is inclusive of:

i) Windrow turner, shredder, composting cover and backhoe. The cost is also inclusive of initial civil work to set-up the composting yard.
ii) Monitoring System establishment including monitoring and analysis equipment such as flow meters, COD test kit and portable monitoring kits for composting process monitoring.

Ongoing O&M costs include costs for the replacement of compost covers, microbes for composting, diesel for tractor and others machineries as well as costing for equipment service and maintenance cost, labor cost, monitoring cost and administration cost. Land rental is also included in the annual operation cost.

The implementation of the project demands an investment of RM 2.76 million in the composting equipment and civil works. The annual operation costs for the first year of operation is RM 0.88 million and is expected to increase to RM 1.41 million when the mill upgrades its processing capacity to 45t/hr during the second year. The expected income from the sale of the compost will be 100RM/tonne based on existing agreement between the project participating mill (which will purchase the compost for its plantation) and the proposed CDM project owner[27]. The compost production of 6,624t/year for the first year is expected to generate an income of RM 662,400 and to increase in subsequent years to RM 1,490,400 when compost production is expected to increase to 14,904 tonne/year.

A nominal residual value from the sale of the depreciated assets after the end of the crediting period was also calculated and included in the financial model in accordance with the 'Guidelines on the Assessment of Investment Analysis ("Investment guidelines")'.

The equity Internal Rate of Return (IRR) for the project has been calculated using the above estimates to evaluate the financial viability of the project. The results of the calculations are shown in the following Table 4:

Table 4: Results of equity IRR calculations for the proposed CDM project

Parameter	Year 10	Year 15	Year 20
Equity IRR for base case (without CER revenue)	- 20.17%	-10.7%	-5.07%

The investment guidelines suggest a minimum analysis period of 10 years and a maximum analysis period of 20 years. Therefore, IRR has been calculated for a period of 10 – 20 years and has been presented in the Table 4 above. Generally investors, bankers and financial institutions look at an analysis period of 10 years or shorter as they feel that a period more than 10 years is long period to decide on the investment. However, IRR has been calculated for a period of 20 years as per Investment Guidelines. In addition, it is necessary to consider that the project developer is planning to sell the entire project's assets at the end of the crediting period; therefore the project developer is interested in the project's return within this timeframe (10 years).

[27] Agreement between Hi-Tech Activated Carbon Sdn,Bhd. and Tee Teh Sdn. Bhd.

B.5.1.1.Benchmark for returns

As per Guidance 12 of the Investment guidelines, 'the required /expected returns on the equity are appropriate benchmark for equity IRR'. The expected returns benchmark is chosen from a Study for investment in waste sectors in Malaysia. The Study[28] was commissioned by Ministry of Energy, Water and Communications, Government of Malaysia and was conducted jointly by Danish International Development Assistance (DANIDA), Malaysian Energy Centre (PTM – Pusat Tenega Malaysia which has been now renamed as Malaysia Green Technology Corporation) and Eco-Ideal Consulting Sdn. Bhd., a local private entity. The Study has fixed 15% as expected returns for investment in the waste sectors in Malaysia.

The equity IRR for the project activity for 20 years is **-5.07%** (negative five point zero seven percent) which is much lower than the benchmark for expected returns. The fact that the equity IRR is negative clearly shows that the project is not financially attractive as per any benchmark.

B.5.1.2.Sensitivity Analysis

In accordance with the Investment guidelines, a sensitivity analysis was carried out for the project activity with variations as suggested by the Guidance 21 of the guidelines: The sensitivity was performed with -10 % and +10% for following variables:

(i.) Capital cost (CAPEX)
(ii.) Revenue (sale price of compost)
(iii.) Operation and maintenance (O&M) cost

As per Investment guidelines, 'only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation'. *As a conservative study, sensitivity analysis is done for entire investment cost, revenues and operation cost*

The equity IRR with -10 and +10 % variations for variables listed above are presented in the Table 5 below:

Table 5 –Sensitivity Analysis - Equity IRR for 20 years for various variations (without CDM revenues)

S. No.	Parameters	Variation	Equity IRR	Comments
1.	Variation in capital cost (CAPEX)	-10%	-4.47%	The IRR is much lower than the benchmark
		+10%	-5.6%	The IRR is much lower than the benchmark
2	Variation in revenues (compost sale price)	- 10%	Cannot be calculated	The IRR is lower than the benchmark
		+10%	3.9%	Project IRR is much lower than the benchmark
3	Variation in O & M costs	-10%	3.19%	Project IRR is much lower than the benchmark
		+10%	Cannot be calculated	Project IRR is much lower than the benchmark

[28] Study on Clean Development Mechanism Potential in the Waste Sectors in Malaysia

The sensitivity analysis results presented in Table 5 above show that the equity IRR is much lower than the benchmark for all variations.

B.5.1.3.Threshold analysis

A threshold analysis was carried out to see at what levels of capital costs, compost sale price and O&M costs, the equity IRR would cross the benchmark. The analysis and the possibility of crossing the benchmark are discussed in Table 6 below:

Table 6 – Threshold analysis

Parameter	Increase / decrease percentage to cross the benchmark	Possibility
Capital cost (Capex)	-92.5%	The equity IRR crosses the benchmark and becomes 15.1 % if the investment cost is reduced by 92.5 %. It is practically not possible for any project activity to reduce the investment costs by 92.5%. Moreover, all the investment has already been made and the actual investment cost is slightly higher than the one considered for investment analysis. Hence, there is no possibility for the investment cost to reduce by 92.5%.
Revenue (compost sale price)	+30%	The equity IRR of the project activity would cross the benchmark if the compost price increases by 30%. This is not possible as the compost price is fixed between project proponent and the mill supplying the biomass. Hence, there is no possibility of increase in sale price of compost and therefore not possibility of crossing the benchmark.
Operation and maintenance costs	-30.5%	The equity IRR crosses the benchmark if the operation and maintenance costs reduce by 30.5% . The operation and maintenance costs are estimated based on actual costs and the costs indicated by various suppliers and therefore there is no possibility for O&M costs to reduce by such a high margin. Further, 30.5% reduction is too big a reduction for O&M costs to occur practically.

The investment analysis, sensitivity analysis and threshold analysis clearly shows that the project activity is not financially attractive; and it is practically not possible for the project activity to be financially attractive even with some variations in costs and revenue. Therefore, it may be concluded that the project activity is not an attractive investment.

B.5.2.Project returns with CDM revenues

The registration of the project activity as CDM project activity would provide the project activity additional source of revenue. Given that the existing ERPA only covers sales up to 2012 (Kyoto Commitment period), for the rest of the crediting period 50% of the pre-2012 value was used as proxy

for potential income from CER sales. This is in line with a 2008 World Bank study[29] stating that half the CER prices before 2012 are possible on forward contracts after 2012. The combined income from the sale of CERs and compost will allow the project to be profitable. The IRR of the project activity increases to **24.99 %** with expected sale of CERs generated by the project activity.

It is clear from the calculations that only with the sales of CERs the project gets acceptable returns and therefore the project without the registration as CDM project activity would not make financial sense to the investors.

From the above investment analysis, it may be seen that the project activity has clear investment barrier**.** As already elaborated elsewhere, the project activity would reduce GHG emissions. **Hence, it may be concluded that the project activity is additional to business as usual scenario.**

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Based on the methodology applied, the emission reductions achieved by the project activity will be measured as difference between the baseline emissions (BE_y) and the sum of the project emission (PE_y) and leakage (LE_y).

$ER_y = BE_y - (PE_y + LE_y)$ (Eq.1)

Where,

- ER_y is emission reduction in the year y (tCO_2e)
- BE_y is the baseline emissions in the year y (tCO_2)
- PE_y is the project activity emissions in the year y (tCO_2e)
- LE_y is the leakage emissions in the year y (tCO_2e)

B.6.1.1 Baseline Emissions

The baseline emissions (BE_y) of the proposed CDM project activity are calculated as:

$$\mathbf{BE_y = BE_{CH4,SWDS,y} + BE_{ww,,y} + BE_{CH4,manure,y} - MD_{y,reg} * GWP\_CH_4} \quad \text{(Eq. 2)}$$

Where:

$BE_{CH4,SWDS,y}$ Yearly methane generation potential of the solid waste composted by the project activity during the years "x" from the beginning of the project activity (x=1) up to the year *y* estimated as per the 'Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site'[30] (tCO_2e).

$MD_{y,reg}$ Amount of methane that would have to be captured and combusted in the year *y* to comply with the prevailing regulations (tonne)

$BE_{CH4,manure,y}$ Where applicable baseline emissions from manure composted by the project activities as per the procedures of AMS-III.D

[29] State and Trends of the Carbon Market 2008" p 34 a report prepared by The World Bank, Washington, May 2008.

$BE_{ww,y}$ Where applicable, baseline emissions from the wastewater co-composted, calculated as per the procedures in AMS-III.H

GWP_CH_4 *GWP* for CH_4 (value of 21 is used)

In Malaysia there is no regulation to capture and/or combust methane resulting from the anaerobic degradation of EFB and POME; thus $MD_{y,reg}$ = 0 and will not be considered further. Also, since the project activity does not involve composting of manure, $BE_{CH4,manure,y}$=0.

Hence, $BE_y = BE_{CH4,SWDS,y} + BE_{ww,y}$ ---------- (Eq. 2a)

B.6.1.1.1 Baseline emissions from methane potential of SWDS- $BE_{CH4,SWDS,y}$

The methane emissions avoided during the year *y* from preventing waste disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2 e) are calculated for the year y according to the equation 1 of the tool "Emissions from solid waste disposal sites" (version 06.0.1) as reported in equation 3 below:

$$\mathbf{BE_{CH4,SWDS,y}} = \varphi_y \cdot (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j (y-x)} \cdot \left(1 - e^{-k_j}\right)$$

(Eq. 3)

Where:

$BE_{CH4,SWDS,y}$	Baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y (tCO_2e/yr)
φ_y	Model correction factor to account for model uncertainties for year y;
f_y	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y
GWP_{CH4}	Global Warming Potential of methane (tCO_2e/tCH_4);
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste);
F	Fraction of methane in the SWDS gas (volume fraction);
$DOC_{f,y}$	Fraction of degradable organic carbon (DOC) that can decompose under specific conditions occurring in the SWDS for year y (weight fraction);
MCFy	Methane correction factor for year y;
$W_{j,x}$	Amount of waste type *j* disposed or prevented from disposal in the SWDS in the year *x*;
DOC_j	Fraction of degradable organic carbon in the waste type *j* (weight fraction)*;*
k_j	Decay rate for the waste type *j* (1/yr)*;*
j	Type of residual waste or types of waste;
x	Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year *y* (x = *y*).

B.6.1.1.2. Baseline emissions from the wastewater co-composted

As suggested under paragraph 14 of the methodology AMS III.F. /Version 10, baseline emissions from wastewater co-composted shall be calculated as per equation 2 of methodology AMS III.H. /Version 16:

$$BE_{ww,y} = \sum_i (Q_{ww,i,y} * COD_{\inf low,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH4} \quad \text{(Eq.4)}$$

…

Where:

$Q_{ww,i,y}$	Volume of wastewater treated in baseline wastewater treatment system *i* in year *y* (m^3). For *ex ante* estimation, forecasted wastewater generation volume or the designed capacity of the wastewater treatment facility can be used. However, the *ex post* emissions reduction calculation shall be based on the actual monitored volume of treated wastewater
$COD_{\inf low,i,y}$	Chemical oxygen demand of the wastewater inflow to the baseline treatment system *i* in year *y* (t/m^3).
$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system *i*
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i*
i	Index for baseline wastewater treatment system
$B_{o,ww}$	Methane producing capacity of the wastewater (t_{CH4} /tCOD)
UF_{BL}	Model correction factor to account for model uncertainties (0.89)
GWP_{CH4}	Global Warming Potential for methane (value of 21 tCO_2e / tCH_4)

B.6.1.2. Project activity emissions

According to AMS-III.F/ Version 10, project emissions arise from incremental transportation, electricity and/or fossil fuel consumption, methane emissions during composting process as well as methane emissions from runoff water and from anaerobic storage of compost. The total project emissions in can be calculated using equation 5 below:

$$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,comp} + PE_{y,runoff} + PE_{y,res\ waste} \quad \text{(Eq.5)}$$

Where:

PE_y	Project activity emissions in the year y (tCO_2e)
$PE_{y,transp}$	Emissions from incremental transportation in the year y (tCO_2e)
$PE_{y,power}$	Emissions from electricity and/or fossil fuel consumption in the year y (tCO_2e)
$PE_{y,comp}$	Methane emissions during composting process in the year *y* (tCO_2e)
$PE_{y,runoff}$	Methane emissions from runoff water in the year *y* (tCO_2e)
$PE_{y,res\ waste}$	In case of produced compost is subjected to anaerobic storage or disposed in landfill this is methane emission from anaerobic decay in year *y*

The composting site will be covered with special material as described before and the run-off water will be fed back into the composting piles for moisture and nutrient. Thus, the project emission from runoff water is estimated as zero.

$PE_{y\ runoff} = 0$

The final compost will be evenly applied in the palm oil plantation in between the palm trees to ensure good yield of palm fruits. Thus, it is unlikely that the final compost will be subjected to anaerobic storage or disposal in landfill which may cause methane emissions from anaerobic decay of final compost. This, component of the project emissions is considered 0 for the project activity.

$PE_{y,res\ waste} = 0$

Hence, Eq.5 becomes,
$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,\ comp}$ (Eq.5a)

B.6.1.2.1. $PE_{y,transp}$ - Project emissions from incremental transportation

Project emissions due to incremental transport distances are calculated based on the incremental distance between:

i. The collection points of EFB and the compost treatment site as compared to the baseline solid waste disposal site;
ii. The collection points of wastewater and compost treatment site;
iii. Treatment site and the sites for soil application of the residual products.

Of the above, item (ii) is not applicable as the wastewater will be pumped from the wastewater treatment plant and the source of energy for pumping is biomass based electricity. Hence, item (ii) is not considered.

Therefore:
$PE_{y,transp} = (Q_y/CT_y) * DAF_w * EF_{CO2} + (Q_{y,treatment,}/CT_{y,treatment,}) * DAF_{treatment,} * EF_{CO2}$ (Eq.6)

Where:

Q_y	Quantity of raw waste / manure treated and/or waste water co-treated in the year y (tonnes). Given that the waste water is pumped directly from the oil mill, this is only for solid EFB.
CT_y	Average truck capacity for waste transportation (tonnes/truck)
DAF_w	Average incremental distance for raw solid waste and wastewater transportation (km/truck)
EF_{CO2}	CO_2 emission factor from fuel use due to transportation ($kgCO_2/km$)
$Q_{y,treatment,}$	Quantity of compost produced in year y (tonnes)
$CT_{y,treatment,}$	Average truck capacity for compost transportation (tonnes/truck)
$DAF_{treatment,}$	Average distance for compost transportation (km/truck)

B.6.1.2.2. $PE_{y,,power}$ - Project emissions from electricity and/or fossil fuel consumption

The project emissions from electricity and/or fossil fuel consumption by the project facility are calculated accounting all equipment requiring electricity and/or fossil fuel to operate. Energy requirements to turn and aerate the material are to be considered.
As per paragrpah 17 of the methodology, if grid electricity is used by the project activity, then grid emission factor shall be calculated as described in AMS. I.D.

The following equation applies:
$PE_{y,power} = PE_{y,elec,} + PE_{y,diesel,onsite,}$ (Eq.7)

Where

$PE_{y,elec,}$	Emissions from consumption of grid electricity in the year y
$PE_{y,diesel,onsite,}$	Emissions from on-site fossil fuel consumption in year y

Emissions from electricity consumption ($PE_{y,elec}$)

The project emissions due to electricity consumption is given by the equation,

$PE_{y,elec,,} = EC_{PE,elec,y} * EF_{CO2,elec,y}$ (Eq. 8)

Where:

$EC_{PE,elec,y}$ Amount of electricity consumed for the project activity in year *y* (MWh)

$EF_{CO2,elec,y}$ CO_2 emission factor for electricity consumed (tCO_2/MWh)

However, the electricity consumed by the project activity will be imported from the palm oil mill's own energy generation system fuelled with biomass waste. As the biomass waste is a renewable energy, it is carbon neutral. Therefore, $PE_{y, elec}$ has been considered as 0.

However, in future, if diesel based electricity is consumed for the project activity, the project emissions due to diesel consumption for electricity will be calculated as explained below in section "Emissions from on-site fossil fuel consumption – $PE_{y,diesel,onsite}$".

Emissions from on-site fossil fuel consumption ($PE_{y,diesel,onsite,}$)

Emissions from fossil fuel use (diesel) for waste and compost management and other operations (electricity generation, if required at a later date) shall be calculated as per the tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion / Version 02.

The project emissions due to fossil fuel (diesel) consumption are estimated as s per equation 1 of the tool Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion / Version 02.
The suffixes of the equation (1) of the tool are modified to suit the project activity as :

$PE_{y,diesel,onsite,} = FC_{diesel,onsite,y(T)} * COEF_{diesel,y}$ (Eq. 9)

$$FC_{diesel,onsite,y(T)} = \frac{FC_{diesel,onsite,y(L)} * \rho_{diesel}\ (kg/l)}{1000}$$ (Eq.10)

Where:

$FC_{diesel,onsite,y(L)}$: Quantity of fossil fuel (diesel) combusted on-site during the year y (litres)

$FC_{diesel,onsite,y(T)}$: Quantity of fuel (diesel) combusted on-site during the year y (tonnes)

$COEF_{diesel,y}$: CO_2 emission coefficient of fuel (diesel) in year y in tCO_2e/tonne

ρ_{diesel} : Density of diesel (kg/l)

As per equation 4 of the tool which becomes equation 11 in this document:

$COEF_{diesel,y} = NCV_{diesel} * EF_{CO2,diesel,onsite,y}$ (Eq.11)

Where:

NCV_{diesel} : Weighted average net calorific value of the fuel (diesel) in year y

$EF_{CO2,diesel,onsite,y}$: Weighted average CO_2 emission factor of diesel in year y

As explained in section B.6.2 below, IPCC default values are adopted for density of diesel, net calorific value and CO_2 emission factor and therefore, weighted average values are not applicable.

B.6.1.2.3. Project emissions from composting

In order to maintain the composting process aerobic, an oxygen meter will be used at the composting site. Also, the constant turning of the composting material in the windrows througout the composting period means that aeration, thus aerobic process, is ensured. This should allow for zero methane emissions from the composting process; nonetheless the equation to estimate project emissions due to composting process is given below and has been included in the calculation so that the actual level of aeration can be monitored throughout the crediting period.

$$PE_{y\,comp} = Q_y * EF_{composting} * GWP_{CH4} \quad (12)$$

Where:

$EF_{composting}$ Emission factor for composting of organic waste (t CH_4/tonne waste treated). Emission factors can be based on facility/ site specific measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories).
Since facility/ site specific measurements, country specific values are not available, IPCC default value of 4 g CH_4/kg waste treated on a wet weight basis shall be adopted for the project activity[31].

B.6.1.3. Leakage

As per paragraph 21 of AMS III.F./version 10, 'if the project technology is the equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects are to be considered'. For the proposed CDM project activity, no equipment has been transferred from another site or project and no existing equipment is transferred to another activity. Therefore, there is no leakage emissions for the project activity.

B.6.1.4 Emission reductions of the project activity

Hence, emission reductions of the project activity, Eq.1 becomes,

$$ER_y\,(tCO_2e/yr) = BE_{CH4,SWDS,y} + BE_{ww} - PE_{y,transp} - PE_{y,power} - PE_{y,comp}$$

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

Data / Parameter:	φ_y
Data unit:	-
Description:	Model correction factor to account for model uncertainties for year y
Source of data used:	Table 3 of Methodological tool for "Emissions from solid waste disposal sites", version 06.0.1
Value applied:	0.85
Justification of the choice of data or description of measurement methods	Default value as per methodological tool "Emissions from solid waste disposal sites /Version 06.0.1" for application B under wet conditions

[31] $EF_{composting}$ can be set to zero for the portions of Q_y for which the monitored oxygen content of the composting process is above 8%.

and procedures actually applied :	
Any comment:	-

Data / Parameter:	OX
Data unit:	-
Description:	Oxidation factor
Source of data used:	Methodological tool for "Emissions from solid waste disposal sites" Version 06.0.1 and IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per the tool "Emissions from solid waste disposal site" / Version 06.0.1.
Any comment:	When methane passes through the top-layer, part of it is oxidized by methanotropic bacteria to produce CO_2. The oxidation factor represents the proportion of methane that is oxidized to CO_2. This is distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in upper layer of SWDS.

Data / Parameter:	F
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	Methodological tool for "Emissions from solid waste disposal sites"/ Version 06.0.1 and IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per the methodological tool "Emissions from solid waste disposal site" / Version 06.0.1.
Any comment:	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide.

Data / Parameter:	$DOC_{f,y}$
Data unit:	Weight fraction
Description:	Default value for the fraction of degradable organic carbon (DOC) that can decompose in the SWDS
Source of data used:	Calculated as per tool for "Emissions from solid waste disposal sites"/Version 06.0.1 for application B for residual waste (EFB)
Value applied:	0.4515
Justification of the choice of data or	Calculated as per the equation 11 of tool for "Emissions from solid waste disposal sites" /Version 06.0.1 for application B for residual waste (EFB):

description of measurement methods and procedures actually applied :	$DOC_{f,y}$ = 0.7*12/16* (BMP_j/F*DOC_j) = 0.7*12/16*{(0.086)/0.5*0.20} = 0.4515
Any comment:	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS. The value has been calculated based on BMP_j the value for which is based on the research paper "Bio-Methane Potential of Biological Materials and agricultural Wastes", published in Asian Journal on Energy and Environment, available online at http://www.asian-energy-journal.info/Abstract/Bio-methane%20potential%20of%20biological%20solid%20materials%20and%20agricultural%20wastes.pdf However for ex-post calculations, the sampled value as per the procedures defined in the tool for "Emissions from solid waste disposal sites" /Version 06.0.1 for BMP_j will be used and value shall be fixed for the entire crediting period. Accordingly the value of DOC_f will also be revised and fixed.

Data / Parameter:	MCF_y
Data unit:	-
Description:	Methane correction factor for year y
Source of data used:	Methodological tool for "Emissions from solid waste disposal sites"/, Version 06.0.1 and IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	The dumpsite is not managed with depth of less than 5 meters. 5 meters. Hence a default value for 'unmanaged-shallow solid waste disposal site' as per the tool "Emissions from solid waste disposal sites" /Version 06.0.1 has been adopted.
Any comment:	MCF accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.

Data / Parameter:	k_j
Data unit:	1/yr
Description:	Decay rate for the waste type *j*
Source of data used:	Methodological tool for "Emissions from solid waste disposal sites"/Version 06.0.1 and Table 3.3 of Volume 5 of IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.17
Justification of the choice of data or	The project site is located in Peninsular Malaysia where the mean annual temperature is more than 20^0C[32] and the annual rainfall is more than 1000

[32] 'Influence of Climate Change On Malaysia 's Weather Pattern'- Presentation by Wan Azli Wan Hassan, Malaysian Meteorological Department, Ministry of Science, Technology and Innovation

description of measurement methods and procedures actually applied :	mm[33]. The tool specifies that EFB has characteristics similar to that of garden waste. Hence, the corresponding value for garden waste as per the default value in the tool has been used.
Any comment:	-

Data / Parameter:	DOC_j
Data unit:	-
Description:	Fraction of degradable organic carbon in the waste type *j* (weight fraction)
Source of data used:	Table 4 of the methodological tool for "Emissions from solid waste disposal sites"/ Version 06.0.1 and as per Tables 2.4 and 2.5 of Volume 5 of IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value applied:	0.20
Justification of the choice of data or description of measurement methods and procedures actually applied :	The tool mentions that characteristics of Empty fruit bunches (EFB) are similar to wet garden waste and specifies to apply the value corresponding to that of garden waste in Table 4.
Any comment:	The procedure for the ignition loss test is described in BS EN 15169:2007 Characterization of waste. Determination of loss on ignition in waste, sludge and sediments. The percentages listed in Table 4 are based on a wet waste basis which is concentrations in the waste as it is delivered to the SWDS. The IPCC Guidelines also specify DOC values on a dry waste basis, which are the concentrations after complete removal of all moist from the waste, which is not believed practical for this situation

Data / Parameter:	BMP_j
Data unit:	tCH_4/t waste
Description:	Biochemical methane potential (BMP) of residual waste type j disposed or prevented from disposal
Source of data used:	Samples
Value applied:	0.086tCH_4/t EFB
Justification of the choice of data or description of measurement methods and procedures actually applied :	Fermentation test on a sample of the waste that is at least 500 g in weight. The test shall be taken according to a national or international standard which may need to be adapted to conduct the test on a sample that is 500g or more in weight. The duration of the fermentation test will be until no further methane is generated (indicating the complete conversion of BMP to methane). An average of at least three test results will be taken for the purpose of ex-post calculations. For ex-ante calculations, BMP has been calculated based on the research paper "Bio-Methane Potential of Biological Materials and agricultural Wastes",

[33] 'Influence of Climate Change On Malaysia 's Weather Pattern'- Presentation by Wan Azli Wan Hassan, Malaysian Meteorological Department, Ministry of Science, Technology and Innovation

	published in Asian Journal on Energy and Environment, available online at http://www.asian-energy-journal.info /Abstract /Bio-methane %20 potential %20of%20biological%20solid%20materials%20and%20agricultural%20wastes.pdf . Based on the research paper, the BMP of EFB has been calculated as follows: Solid Content of EFB: 35% (considering that 65% is moisture) Volume of solids on dry basis: 92.5% (as per above mentioned study) Ultimate methane yield of EFB: 0.37 l/g of VS = 370m^3/t VS (as per above mentioned study) Density of methane: 0.7168 kg/m^3 Therefore the Biochemical Methane Potential of methane per tonne of FFB shall be: Solid Content of EFB* Volume of solids on dry basis* Ultimate methane yield of EFB* Density of methane i.e. 0.35 t DS/t EFB * 0.925 t VS/t DS*370m^3/t VS * 0.0007168 t/m^3 = 0.086tCH_4/t EFB
Any comment:	At least three samples from different batches will be taken. Once calculated, the value will be fixed for the entire crediting period.

Data / Parameter:	$B_{o, ww}$
Data unit:	kg CH_4/kg COD
Description:	Methane producing capacity of the wastewater
Source of data used:	IPCC 2006 default value
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per IPCC 2006 and AMS-III.H / Version 16
Any comment:	-

Data / Parameter:	$MCF_{ww,treatment,BL,i}$
Data unit:	-
Description:	Methane correction factor for the baseline wastewater treatment system
Source of data used:	Table III.H.1 of AMS III H/ Version 16
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per IPCC and AMS III H/ Version 16. The existing anaerobic lagoon's depth is more than 2 metres. Hence, the corresponding value has been taken as per the Table III.H.1, of methodology AMS III.H. / Version 16.
Any comment:	-

Data / Parameter:	UF_{BL}
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	Default value as per methodology AMS III.H /Version 16
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per AMS-III.H / Version 16
Any comment:	-

Data / Parameter	$\eta_{COD,BL,i}$
Data Unit:	%
Description:	COD removal efficiency of the baseline treatment system i
Source of data:	Based on one year data for COD of leaving the baseline treatment system
Value(s) applied:	90 (actual value is close to 98%). However 90% is considered for conservatism.
Justification of the choice of data or description of measurement methods and procedures actually applied:	The COD removal efficiency is based on the COD of POME entering and leaving the baseline treatment system. The results of the measurement campaign are provided in the sheet 'Intro' in the attached spread sheet.
Any comment:	-

Data / Parameter:	$EF_{CO2,diesel}$
Data unit:	$kgCO_2/km$
Description:	CO_2 emission factor of fuel used for transportation
Source of data to be used:	Malaysia local data
Value applied	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per University of Malaya (2005) "Energy Used in the Transportation Sector of Malaysia", Page 230, 1 litre diesel contributes 2.7kg CO_2 emissions. Estimated that a 10 tonne truck can travel approximately 3km[34] using 1 litre diesel. Thus: 2.7 $kgCO_2/l \div 3$ km/l = 0.9 $kgCO_2/km$
Any comment:	-

[34] University of Malaya (2005) "Energy Used in the Transportation Sector of Malaysia", Page 230

Data / Parameter:	$EF_{composting}$
Data unit:	t CH_4/t waste
Description:	Emission factor for composting of organic waste
Source of data used:	Table 4.1, Chapter 4, Volume 5, 2006 IPCC Guidelines
Value applied:	0.004
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value on a wet weight basis as specified by the methodological tool, "Emissions from solid waste disposal sites / Version 06.0.1"
Any comment:	For the ex-ante calculations $EF_{composting}$ has been set to zero for the total quantity of compostable matter. The oxygen content of the composting process will be monitored to ensure that it is above 8% throughout the crediting period, thus allowing for aerobic process. See Section B.7.1.

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e / tCH_4
Description:	Global warming potential of methane
Source of data used:	IPCC
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value for first crediting period under the Kyoto Protocol applied. Shall be updated for future commitment periods according to any future COP/MOP decisions
Any Comment:	-

B.6.3 Ex-ante calculation of emission reductions:

Baseline Emissions

Baseline emissions from methane avoidance from waste disposal site

The EFB is categorised as garden waste as per the methodological tool for "Emissions from solid waste disposal sites / Version 06.0.1". For the ex-ante calculation of $BE_{CH4,SWDS,y}$ the following parameters are used:

Data	Value Applied	Justification
φ	0.85	Default value as per methodological tool " Emissions from solid waste disposal sites / Version 06.0.1"
f	0	In Malaysia there is no legal obligation to capture and flare/use methane gas at solid waste disposal sites.
OX	0.1	Default value as per tool "Emissions from solid waste disposal sites / Version 06.0.1"
F	0.5	Default value as per tool "Emissions from solid waste disposal sites /

		Version 06.0.1" and IPCC 2006 Guidelines for National Greenhouse Gas Inventories
DOC_f	0.45	Calculated as per tool "Emissions from solid waste disposal sites / Version 06.0.1
MCF	0.40	Default value as per tool "Emissions from solid waste disposal sites / Version 06.0.1" and IPCC 2006 Guidelines for National Greenhouse Gas Inventories
$W_{j,x}$	16,560 t/yr during first year and 37,620 t/yr during subsequent years	The total amount of EFB expected to be composted each year depends on the actual amount of FFB processed by the mill. An estimate of each tonne of FFB at the mill will deliver 0.23 tonne EFB on wet weight basis was determined[35]. The term '$W_{j,x}$' is as per the equation or estimation of baseline emissions in the tool "Emissions from solid waste disposal sites /Version 06.0.1" This term is same as per term 'Q_y' in this PDD and the applied methodology AMS III.F /Version 10. These two terms may be used interchangeably in this document
DOC_j	0.20	Default value as per tool "Emissions from solid waste disposal sites /Version 06.0.1 and IPCC 2006 Guidelines for National Greenhouse Gas Inventories for wet garden waste
k_j	0.17	Default value as per tool "Emissions from solid waste disposal sites", version 06.0.1 and IPCC 2006 Guidelines for National Greenhouse Gas Inventories for rapidly degrading garden waste in tropical wet climate

The baseline emissions, $BE_{CH4,SWDS,y}$ are calculated as per the equation 3 and the results are given in Annex 3.

Baseline Emissions from the wastewater co-composted

The following assumptions were employed in the ex-ante estimation of baseline emissions from wastewater.

$\eta_{COD,BL,i}$	COD removal efficiency of the baseline treatment system *i* has been taken as 90%
$MCF_{ww,treatment,BL,i}$	Methane correction factor for baseline wastewater treatment systems *i* has been taken as 0.8 as per Table.III.H.1 applicable to anaerobic deep lagoon with depth more than 2 meters
$B_{o,ww}$	IPCC default value for domestic wastewater of 0.25 kg CH_4/kg COD
UF_{BL}	Model correction factor to account for model uncertainties (0.89) as per the methodology
GWP_{CH4}	Global Warming Potential for methane (value of 21)

[35] ***Anders Evald, 2004:*** Barrier Analysis for the Supply Chain of Palm Oil Processing Biomass (Empty Fruit Bunch) as Renewable Fuel, pg 13.

Based on this values and with an estimated COD $_{y,ww,untreated}$[36] of 79 kg/m^3 and expected 56,716 m^3 of waste water to treat in Year 1 and 127,611 m^3 in subsequent years[37], the baseline emissions from the wastewater composted :
$BE_{ww,treatment,y}$ = 14,385 tCO_2 e / year during Year 1; and

$BE_{ww,treatment,y}$= 32,367tCO_2e /year during subsequent years.

The COD analysis results may vary from time to time during the project implementation period due to mill operational issues. Direct measurements will be taken during the monitoring period.

Project Activity Emissions
Project emissions from incremental transportation

Project emissions from transportation were calculated based on the following assumptions:

Q_y refers to the actual EFB volume treated. This will be monitored during the project implementation, but for the purpose of ex-ante calculations the amount of EFB composted is estimated based on amount of FFB processed by the mill at the rate of 0.23 t EFB/t FFB[38].

Q_y = 16,560 tonnes/ year – Year 1
Q_y = 37,260 tonnes / year – subsequent years

The estimated compost production, based on 0.4 tonne of compost per tonne of EFB is:

$Q_{y,treatment,}$ = 6,624 tonnes / year – Year 1
$Q_{y,treatment,}$ = 14,904 tonnes / year - subsequent years.

The average truck capacity used for solid waste distribution to the project activity site and for compost delivery to the plantation is 5 tonne. The estimated distance travelled for EFB transportation, DAF_w is 1 km, therefore the total distance travelled by each truck is assumed to be 2 km (return trip). The distance travelled to deliver compost $DAF_{treatment,}$ is 5 km (10 km return trip).

The CO_2 emission factor from diesel used for transportation purpose is calculated based on IPCC default value whereby 1 litre of diesel contributes to 2.7 kg CO_2 released to the atmosphere. It is estimated that a 10 tonne truck can travel approximately 3km[39] using 1 litre diesel. Thus EF_{CO2} : 2.7 $kgCO_2$/l ÷ 3 km/l = 0.9 $kgCO_2$/km. (Refer to Annex 3)

The transport related emissions are:

[36] The value of COD for ex-ante estimations is based on a 4 days average of real data available from the palm oil mill.

[37] Details of POME estimations are available in Annex 3.

[38] Barrier Analysis for the Supply Chain of Palm Oil Processing Biomass (Empty Fruit Bunch) as Renewable Fuel, page 14 – Study by Malaysian – Danish Environmental Cooperation Programme – Renewable and Energy Efficiency component

[39] University of Malaya (2005) "Energy Used in the Transportation Sector of Malaysia", Page 230.

$PE_{y,transp}$ = 17.88 tCO_2e / year – Year 1

$PE_{y,transp}$ = 40.24 tCO_2 e / year – Subsequent years

Project emissions from fossil fuel consumption

As described in B.6.1 no project emissions arise from usage of electricity as the electricity consumed by the project will be imported from the palm oil mill's own energy generation system fuelled with biomass waste. As the biomass waste is a renewable energy, it is carbon neutral. Therefore, $PE_{CO2,elec,y}$ has been considered as 0.Based on an estimated volume of diesel consumption of 31,980 litres in year 1 and 63,960 in the subsequent years, the project emissions due to on-site fossil fuel consumption shall be:
$PE_{y,power}$ = 87.01 t CO_2 e – Year 1

$PE_{y,power}$ = 174.01 t CO_2 e/year – Subsequent years

Emissions reductions
Total emission reductions are presented in the following Section B.6.4.

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

Year	Estimation of project activity emissions (t CO_2e)	Estimation of baseline emissions (t CO_2e)	Estimation of leakage (t CO_2e)	Estimation of overall emission reductions (t CO_2e)
Year 1*	105	15,387	0	15,282
Year 2	214	35,269	0	35,055
Year 3	214	36,873	0	36,659
Year 4	214	38,226	0	38,012
Year 5	214	39,368	0	39,154
Year 6	214	40,331	0	40,117
Year 7	214	41,144	0	40,929
Year 8	214	41,829	0	41,615
Year 9	214	42,407	0	42,193
Year 10	214	42,895	0	42,681
Total (tonnes of CO_2e)	**2,033**	**373,729**	**0**	**371,696**

**Year 1 starts from the date of registration of the project activity*

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

B.7.1 Data and parameters monitored:

Data /Parameter ID	01
Data / **Parameter**:	Q_y
Data unit:	Tonnes
Description:	Quantity of EFB composted in the project activity
Source of data to be used:	Weighbridge data
Value of data:	16,560 tonnes/ year - Year 1 37,260 tonnes/ year - Subsequent years
Description of measurement methods and procedures to be applied:	On-site data sheets recorded monthly using weighbridge. Trucks assigned for EFB transportation from mill to compost plant will be weighed at the mill using the weighbridge. Data will be recorded at least monthly with annual aggregation
QA/QC procedures to be applied:	The weighbridge will be maintained as per manufacturer / supplier's recommendations and calibrated at least once in 3 years.
Any comment:	i) This data is same as 'W_{jx}' as per the equation for estimation of baseline emissions in the tool "Emissions from solid waste disposal sites / Version 06.0.1" These two terms may be used interchangeably in this document ii) The actual EFB volume generated will be monitored during the project implementation. For the purpose of ex-ante calculations the amount of EFB composted is estimated based on amount of FFB processed by the mill, i.e. 0.23 t EFB/t FFB processed . iii) Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	02
Data / **Parameter**:	$Q_{ww,i,y}$
Data unit:	m^3 / month
Description:	Volume of wastewater (POME) treated in month
Source of data to be used:	Measured using a flow meter
Value of data:	4726.3 m^3 /month - during phase I 10634.3m^3 / month - during phase II
Description of measurement methods and procedures to be applied:	Monitored continuously using a flow meter. Hourly records will be made. When the meter is removed for off-site calibration, which may take several days, the volume will be calculated based on POME: FFB ratio used during ex-ante calculations. During the ex-ante calculations a value of 0.79 (for year 2009) has been taken for conservativeness, instead of average of three year data which is 0.95m^3/tFFB.
QA/QC procedures to be applied:	The flow meter would be subjected to calibration once in 3 years. Records of calibration will be kept at site.
Any comment:	The actual POME volume generated will be monitored during the crediting period . For ex-ante estimation, the ratio using the total amount of POME

	generated divided by the total amount of FFB processed in the mill for year 2009 records, which resulted as. 0.79 m^3 POME/t FFB has been adopted. Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	03
Data / **Parameter**:	$COD_{y,ww,untreated,y}$
Data unit:	t COD/m^3
Description:	Chemical Oxygen Demand of wastewater (POME) entering the project activity
Source of data to be used:	COD of the POME entering co –composting plant.
Value of data:	0.075
Description of measurement methods and procedures to be applied:	COD will be analysed once in two weeks. Date, time and place of sampling will be noted.
QA/QC procedures to be applied:	Samples will be analysed as per nationally internationally accepted standards.
Any comment:	The value used for ex-ante calculation is based on the average over 4 days. Actual COD values will be measured during the project crediting period. Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data/ Parameter ID	04
Data / **Parameter**:	$Q_{y,\ treatment,}$
Data unit:	Tonnes/year
Description:	Amount of compost produced
Source of data to be used:	Weighbridge records
Value of data:	6,624 tonnes / year – Year 1 14,904 tonnes/ year - subsequent years
Description of measurement methods and procedures to be applied:	On-site data sheets recorded monthly using weighbridge Trucks assigned for compost transportation will be weighed at the weighbridge. Data will be recorded at least monthly with annual aggregation
QA/QC procedures to be applied:	Calibration of weighbridge will be carried out at least once in 3 years in accordance with stipulation of the weighbridge supplier. The data will be cross checked with the compost sales records.
Any comment:	The actual compost volume produced will be monitored during the project crediting period. For present estimation, the amount of compost generated is estimated based on the EFB processed in the mill at the rate of 40% compost produced from 1 tonne of EFB. Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	05
Data / **Parameter**:	$CT_{y,}$
Data unit:	tonnes/truck
Description:	Average truck capacity for EFB transportation
Source of data to be used:	On-site measurements
Value of data:	5
Description of measurement methods and procedures to be applied:	Trucks for EFB supply to the compost site will be weighed in the weighbridge regularly and records will be maintained by the operator.
QA/QC procedures to be applied:	Data from weigh bridge measurement can be used to reconfirm the recorded data accuracy. The weigh bridge is to be regularly maintained as per manufacturer / supplier 's recommendations and calibrated at least once in 3 years.
Any comment:	Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	06
Data / **Parameter**:	$CT_{y,treatment,}$
Data unit:	tonnes/truck
Description:	Average truck capacity for compost transportation
Source of data to be used:	On-site measurements
Value of data :	5
Description of measurement methods and procedures to be applied:	Trucks for compost distribution to the plantation area will be weighed in the weighbridge regularly and records will be maintained
QA/QC procedures to be applied:	The weigh bridge is to be regularly maintained as per manufacturer / supplier 's recommendations and calibrated at least once in 3 years.
Any comment:	Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	07
Data / **Parameter**:	DAF_w
Data unit:	km / truck
Description:	Average incremental distance for EFB transportation
Source of data :	On site measurement
Value of data:	2
Description of measurement methods and procedures to be	Since the distance of transportation of EFB to the project activity will be same, the measurement will be done once at the start of the crediting period

applied:	
QA/QC procedures to be applied:	The measurement will be cross checked once in a year.
Any comment:	Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	08
Data / **Parameter**:	$DAF_{treatment}$
Data unit:	km / truck
Description:	Average distance travelled by trucks for transporting compost to be applied in the plantation
Source of data :	Onsite measurement
Value of data :	10
Description of measurement methods and procedures to be applied:	The average distance travelled by each truck will be calculated once annually. The truck driver will record the meter reading prior to trip and after the compost distribution trip to measure distance travelled by the truck for each trip
QA/QC procedures to be applied:	All data will be recorded and confirmed by supervisor & bills/invoices for fuel purchased from fuel supplier on a monthly basis with annual aggregation.
Any comment:	Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	09
Data / **Parameter**:	$FC_{diesel,onsite,y(L)}$
Data unit:	Litres / year
Description:	Quantity of diesel consumed for the project activity
Source of data to be used:	Onsite measurements - Measured volume of diesel consumed by machineries / vehicles
Value of data :	31,980 during phase I and 63,960 during subsequent phase
Description of measurement methods and procedures to be applied:	Monitored using ruler gauge continuously whenever fuel is withdrawn from the tank.
QA/QC procedures to be applied:	Data will be cross-checked with bills / invoices from fuel suppliers. The ruler gauge will be calibrated once a year
Any comment:	Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	10
Data / **Parameter**:	O_2 content
Data unit:	%
Description:	Percentage of dissolved oxygen in composting process
Source of data to be	Oxygen Meter records

used:	
Value of data:	-
Description of measurement methods and procedures to be applied:	The oxygen level will be recorded daily using the oxygen meter with lancets of at least 1 m length. The compost pile will be turned if the oxygen level drops to below 10% to ensure the compost pile is in aerobic condition all times.
QA/QC procedures to be applied:	The oxygen meter will record data from at least 3 different points in the window to ensure homogeneity of reading taken. Average value of these data will be used to determine the oxygen level of the windrow. The oxygen meter will be calibrated annually as per manufacturer's specification.
Any comment:	Daily measurements throughout the year but aggregated once per year only. Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	11
Data / **Parameter**:	f_y
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emission of methane to the atmosphere in year y
Source of data to be used:	Written information from the operator of the SWDS and/or site visits at the SWDS
Value of data :	Maximum value from the following: (a) contact or regulation requirements specifying the amount of methane that must be destroyed/used (if available) (b) historic data on the amount captured
Description of measurement methods and procedures to be applied:	Once in a year
QA/QC procedures to be applied:	This parameter will be monitored annually to reflect the situation at the landfill site
Any comment:	At present, there is no regulation/prevailing practice to capture and flare/combust/ or use in other manner methane at SWDS. Data will be stored for 2 years after the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter ID	12
Data / Parameter:	$EF_{CO2,diesel,onsite,y}$
Data unit:	tCO_2 / GJ
Description:	CO_2 emission factor of fuel used (diesel)
Source of data :	Default value at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value of data :	0.0748

Description of measurement methods and procedures to be applied :	As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" / version 02, this data has to be monitored and weighted average value has to be adopted; various options of data sources are listed in the tool for monitoring this data. But reliable data sources are not available to monitor as per options (a), (b) and (c), and therefore option (d) which is IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories has been adopted
Any comment:	Since IPCC default value is adopted, weighted average CO_2 emission factor need not be calculated. Any change in IPCC value for this data will be accordingly adopted.

Data / Parameter ID	13
Data / Parameter:	$NCV_{diesel,y}$
Data unit:	GJ/tonne
Description:	Net Calorific value of fuel used (diesel)
Source of data to be used:	IPCC default value at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value of data :	43.3
Description of measurement methods and procedures to be applied :	As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" / version 02, this data has to be monitored and weighted average value has to be adopted; various options of data sources are listed in the tool for monitoring this data. But reliable data sources are not available to monitor as per options (a), (b) and (c), and therefore option (d) which is IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories has been adopted
Any comment:	Since IPCC default value is adopted, weighted average net calorific value need not be calculated. Any change in IPCC value for this data will be accordingly adopted.

Data / Parameter ID	14
Data / Parameter:	$\rho_{diesel,y}$
Data unit:	Kg/l
Description:	Density of diesel
Source of data to be used:	Environmental Quality (Control of Petrol and Diesel Properties) Regulations 2007[40]
Value of data :	0.84
Description of measurement methods and procedures to be applied :	As per "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" / version 02, this data has to be monitored and weighted average value has to be adopted; various options of data sources are listed in the tool for monitoring this data. But reliable data sources are not available to monitor as per the listed options, and therefore publicly available value as stipulated by

[40] http://www.doe.gov.my/v2/files/legislation/pua0145y2007.pdf

	the Environment Quality Regulations of Malaysia has been adopted
Any comment:	This is a fairly reliable value as this is published by a government agency of Malaysia and can be considered equivalent to 'Regional or national default value which is option c) of the data source for the parameter. Since publicly available (national value) data is adopted, weighted average density need not be calculated. Any change in the 'regional or national default value' will be duly adopted.

B.7.2 Description of the monitoring plan:

The project participants will develop a monitoring plan containing monitoring methodology including methods, indicators and frequencies to meet the requirement laid down in AMS. III.F. Version 10.

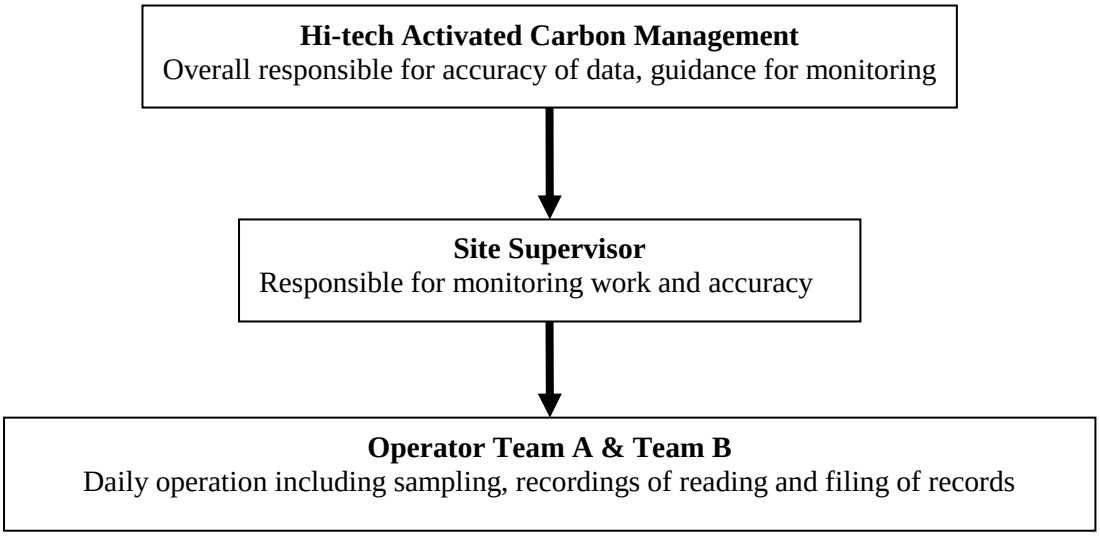

Figure 5: Organization of monitoring management team

Monitoring Management

(1) Hi-Tech Activated Carbon Management

Hi-Tech Activated Carbon Management is the overall body responsible for this monitoring plan. It shall oversee the implementation of monitoring plan, including all quality management of all data. The site supervisor shall regularly report to the Management regarding the performance of project and data management. The management shall provide guidance and instruction regarding improvement of performance of the project and approaches in dealing with non-performance and develop the monitoring reports for the emission reductions for this project activity for the purpose of verification and certification of Certified Emission Reductions (CERs). A third party verifier/designated operational entity (DOE) will be appointed by the Management to ensure the performance of the project according to its design in the registered Project Design Document (PDD) and that claimed CERs are actually achieved.

(2) Site Supervisor
A Site supervisor shall be appointed to supervise the implementation of the project at Keratong palm oil mill. He /She shall regularly inspect the performance of the project, including the transport of EFB, processing of compost, operation of turner, condition of composting and disbursement of compost. He / She shall record all non-performance and rectify the fault soonest. All non-performance shall be recorded in writing and reported to the Management for further guidance, if necessary. He / She is responsible for the safe-keeping and storage of all monitoring data. He She shall also supervise the technicians regarding the daily operation, inspection and maintenance as well as the collection and storage of data from the project. He /She shall also summarize the results and submits to the management for the calculation of the emissions reductions of the proposed composting project.

(3) Operator teams
Technicians will be appointed to conduct daily operations at the composting plant. These include transport of EFB, preparation of windrows, mechanical turning of windrows, spraying of POME, adding microbes, measurement of compost temperature and oxygen content, recording and entry of relevant data. They shall report to the Site Supervisor as soon as they have noticed any non-performance of the system or sub-systems.

(4) Training
Training forms an integral part of the Monitoring Plan. Training will be conducted to all employees involved in the project activity. A Training Plan will be developed with the view of enabling each employee will have sufficient skills in the monitoring, storage and evaluation of the performance of the CDM project. The training shall be tailored made to each post so that each employee will acquire sufficient technical knowledge in carrying out his duties and responsibilities. The training will include lectures and on-the-job training.

(5) Standard Operating Procedures (SOP)
A set of SOP will be developed for the monitoring of the CDM project activity. It shall contain procedures for each task in the monitoring of emission reduction as well as data quality control procedures.

The SOP will also include procedures for emergency and unintended leakage. The technicians at site will be trained to cope with emergency situation so that corrective action could be taken immediately to prevent any unintended event.

(6) Site audits
Hi-Tech Activated Carbon Management or its appointed representative shall make periodic site audits to ensure that monitoring and operational procedures are being observed in accordance with the Monitoring Plan. All findings have to be documented.

(7) Data Management
Periodic monitoring will be carried out at the compost to determine the extent of aerobic oxidation. The data will be entered into forms at site. These forms will be checked and data will be entered into electronic forms and stored.

The data are subject to periodic verification in order to identify deviation from norm or non-performance of any sub-systems. A report shall be made by CDM Site Supervisor to the Hi-Tech Activated Carbon

Management and remedial action to be taken. All fault rectification will be recorded and stored for future reference.

(8) Data Storage
All data are to be stored in electronic form, either in spreadsheet or database for ease of future verification and reference. The database shall be periodically updated and stored in CDs. There shall be three sets of database, clearly marked and stored at three different locations for safe-keeping. These CDs shall be checked annually and any defective one shall be replaced by duplicate copy from other site.

Data storage will be handled by the by the Assistant Plant Manager under the supervision of the Compost Plant Manager. All monitoring records shall be kept for verification up to at least two years after the end of the project activity or the last issuance of CERs for this project activity, whichever occurs later.

(9) Application of Compost
Soil application of the compost in agriculture or related activities will be monitored. This includes documenting the delivery of the compost final product. It shall also include an in situ verification of the proper soil application of the compost to ensure aerobic conditions for further decay. Such verification shall be done at representative sample of user sites.

(10) Maintenance and calibration of monitoring equipment
All monitoring equipments are subjected to regular maintenance and testing regime to ensure accuracy. Calibration will occur at intervals determined on the basis of manufacturers' recommendation. Recalibration should be performed whenever an event occurs that places the accuracy of the equipment in doubt. Clear preventive and corrective actions to be prepared for quality assurance of the monitoring process.

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 of completion:
07/02/2012

Name of person(s)/entity(ies) determining the baseline:
YTL-SV Carbon Sdn Bhd
Lot 10 Shopping Centre
50, Jalan Sultan Ismail
50250, Kuala Lumpur, Malaysia
Tel : +60321447200

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:

13/11/2007[41]
The starting date of project is the date of award of the construction to the contractor

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

20 years, 0 months

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

The project will apply fixed crediting period

C.2.1. Renewable crediting period

Not applicable

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

The project will apply fixed crediting period

C.2.2.1. Starting date:

01/12/2012 or the date of registration, whichever is later

C.2.2.2. Length:

10 years, 0 months

SECTION D. Environmental impacts

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

The project is not a prescribed activity and in accordance with the EIA Order 1988 under the Environmental Quality Act 1976 of Malaysia, the Department of Environment Malaysia does not require an EIA study to be conducted on this project.

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:

[41] Letter of Award from Hi-Tech Activated Carbon to Harcos Construction Sdn. Bhd

No adverse impact on the environment is expected from the implementation of the project activity. The project will improve the environmental quality through reduction of odour and destruction of methane due to the anaerobic process.

SECTION E. Stakeholders' comments

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

A stakeholders meeting was held at the premise of Tee Teh Palm Oil Mill at 11.00 am on 22 October 2007. The project developer has published in a local newspaper on 10 October 2007 inviting interested stakeholders to attend the consultation. Letters of invitation had been sent to relevant government agencies on 1 October 2007. The local residents have been personally invited.

At the stakeholders meeting, a description of current situation was first presented. This was followed by the detailed explanation of new facilities to be installed under this project. The benefits of the project such as odour reduction, improvement of environmental quality were explained. The implementation plan of the project was further explained to the participants. After the briefing, a question and answer session was held to clarify any question raised by stakeholders regarding the implementation of the project.

Table E.1: Stakeholder Participants

Invited Stakeholders	**Representatives**
Local Residents	8
Mill Management and Staff	9
Consultants	2
Total	**19**

E.2. Summary of the comments received:

Below is a summary of the comments received during the stakeholders meeting held by the project developer.

Stakeholder	**Question/Comments**
M Yusnedi	In view of the new composting plan to be built, how would the traffic flow in the area be affected by the new activity?
Wati Yem	Will the composting plant generate additional waste water? Will there be any new treatment plant be installed? Will the discharge affect the river quality and hence fishes in the river?
Sabugin	He expressed concern with the new activity that may affect his work. Will his work load be increased to take care of the additional work at the composting plant?
Maliki Yusof	Is there any approval from Department of Environment needed for composting activity?
Hariyati Abdullah	How will be compost be used? Will there be a shop to set up to sell compost in the palm oil mill?

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

Comments /Questions	
Traffic in nearby areas	The plant is to be built next to the existing palm oil mill. Therefore, the movement of EFB is kept to a minimum. No additional traffic from outside is expected as the compost will be used within the oil palm plantation.
Discharge of wastewater of the composting plant into nearby river	A storm water pond will be established to collect discharge from the compost plant. The quality of water will be monitored before they are discharged into river as Department of Environment has stringent requirement for any discharge of waste water.
Workload and welfare of workers	There will not be any increase of work load for present workers as new employees will be engaged separately for this plant. There will not be any retrenchment of present staff. The workers will enjoy a better environment as the bad odour from POME and decay of EFB will be minimised.
Approval from Department of Environment	The project proposal has been submitted to Department of Environment and approval has been given.
Usage of compost	Compost is a nutrient supplement for plant. The compost produced will be mainly applied in the oil palm plantation.

In summary, there was no objection or serious concern raised by stakeholders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Contact information of Host Party entity

Organization:	Hi-Tech Activated Carbon Sdn. Bhd.
Street/P.O.Box:	No. 10 Bukit Ceylon
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E-Mail:	harcos_cons@yahoo.com
URL:	
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Wong
Middle Name:	
First Name:	M C
Department:	General Manager
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Contact information of Annex I entity

Organization:	Belektron d.o.o.
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City:	Ljubljana
State/Region:	-
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Telephone:	+386 1 620 88 54
FAX:	+386 1 620 88 55
E-Mail:	info@belektron.si
URL:	www.belektron.si
Represented by:	Matej Kozar

Title:	Regional Manager
Salutation:	Mr.
Last Name:	Kozar
Middle Name:	-
First Name:	Matej
Department:	-
Mobile:	+386 40 461 062
Direct FAX:	+386 1 620 88 55
Direct tel:	+386 1 620 88 54
Personal E-Mail:	matej.kozar@belektron.si

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding provided by any Annex I Party for the project activity.

Annex 3

BASELINE INFORMATION

Baseline Emissions

The baseline methane emissions avoided from SWDS are given in Table A.3-1 below:

Table A.3-1 – Baseline methane emissions avoided from SWDS

Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
$W_{j,x}$ (t/y) (same as Q_y)	16,560	37,260	37,260	37,260	37,260	37,260	37,260	37,260	37,260	37,260
Avoided methane	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Deposited year 1	1,002	1,901	1,604	1,353	1,142	963	813	686	578	488
Deposited year 2		1,002	1,901	1,604	1,353	1,142	963	813	686	578
Deposited year 3			1,002	1,901	1,604	1,353	1,142	963	813	686
Deposited year 4				1,002	1,901	1,604	1,353	1,142	963	813
Deposited year 5					1,002	1,901	1,604	1,353	1,142	963
Deposited year 6						1,002	1,901	1,604	1,353	1,142
Deposited year 7							1,002	1,901	1,604	1,353
Deposited year 8								1,002	1,901	1,604
Deposited year 9									1,002	1,901
Deposited year 10										1,002
BE CH4,SWDS,y (tCO2e/yr)	**1,002**	**2,903**	**4,507**	**5,860**	**7,001**	**7,964**	**8,777**	**9,462**	**10,041**	**10,529**

Assumptions to estimate volume of POME to treat at the co-composting plant are as follows:

- The average amount of FFB processed by the palm oil mill is estimated as 72,000 t/y for Year 1 and 162,000 t/y for subsequent years.
- The average amount of POME generated from FFB processing at the mill is 0.79 m^3/t FFB based on 1 year historical data in 2009.
- Raw POME COD concentration, $COD_{y,ww,\ untreated}$ is 79kg/m^3 (average of 4 days COD analysis)

Total baseline emissions

The total baseline emissions from methane avoided from SWDS and anaerobic lagoons are given in Table A.3-2 below.

(Detailed calculations are given in attached spread sheet)

Table A.3 -2- Baseline emissions

Year	Methane emissions from EFB avoided in SWDS (tCO_{2e}/yr)	Methane emissions avoided from POME (tCO_{2e}/yr)	BE_y (tCO_2 / yr)
1	1,002	14,385	15,387
2	2,903	32,367	35,269
3	4,507	32,367	36,873
4	5,860	32,367	38,226
5	7,001	32,367	39,368
6	7,964	32,367	40,331
7	8,777	32,367	41,144
8	9,462	32,367	41,829
9	10,041	32,367	42,407
10	10,529	32,367	42,895
Total	**68,045**	**305,684**	**373,729**
Average ER_y			**37,373**

Total Project Emissions

Total project emissions due to transportation and emissions due to fossil fuel consumption for power generation (in machinery used in the composting process) are given in Table A.3-3 below. (Please refer attached spread sheet for detailed calculations)

Table A.3-3 – Project emissions

Year	Project Emission (tCO_2e/yr)
1	105
2	214
3	214
4	214
5	214
6	214
7	214
8	214
9	214
10	214
Total	**2,033**

Annex 4

MONITORING INFORMATION

The monitoring plan has been discussed in Paragraph B.7.1 and B.7.2