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:

Abedon Enviro Bio-Waste Composting Project, Malaysia

Version 2.5, 20/05/2011

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

The Abedon Enviro Bio-Waste Composting Project ("Project") will be implemented on the premises of the Abedon Palm Oil Mill (APOM) in Lahad Datu, Malaysia, by the project company Abedon Enviro Sdn. Bhd ("Abedon"). A part of APOM's vision to provide a total waste treatment solution for the mill's bio-waste, the Project will use Empty Fruit Bunches (EFBs), decanter sludge and boiler ash currently being landfilled, as well as a portion of wastewater currently treated in open lagoons to produce bio-organic fertiliser that can be used by the surrounding palm oil estates.

The production of the bio-organic fertiliser will be carried out in an aerobic environment. When implemented, the Project will prevent the atmospheric release of methane that is released when EFB, sludge and wastewater decompose anaerobically in the landfill and open lagoons, thereby reducing a potent greenhouse gas (GHG). The GHG reduction effect of the Project is estimated to vary between 8,111 $tCO2_2e$/yr in Year 1 to 39,697 tCO_2e/yr in Year 10, averaging 26,963 tCO_2e/yr over the 10 year crediting period.

It is noted for the sake of transparency that APOM is considering, but has not decided on, the treatment of the entire wastewater stream. This may be included in the project boundary, if and when a decision is made to proceed with that project activity.

The Project contributes to the sustainable development of Malaysia in the following ways:

- The improvement of the local environment through the introduction of a sustainable solution to waste management. Apart from the reduction in methane, a potent GHG, the Project will improve the environmental performance of the APOM mill by (a) eliminating the need for EFBs, decanter sludge and boiler ash to be landfilled, and (b) reducing the wastewater that is otherwise left to degrade in open lagoons. The effect will be both a reduction in the stench coming from putrescible waste, as well as reduction in a flammable gas (methane) that is freely being emitted to the atmosphere.

  This is aligned with the 9th Malaysia Plan which encourages privately-led sustainable development in agro-based industry and biotechnology through environmentally friendly waste treatment and recycling. Chapter 22 of the 9th Malaysia Plan states: "Greater focus will be placed on preventive measures to mitigate negative environmental effects at source, intensifying conservation efforts and sustainable management of natural resources. Emphasis will be given to the fostering of closer cooperation between stakeholders in addressing environmental concerns."

- Reduction in the use of chemical fertilizers. The bio-organic fertiliser product from the Project is an effective natural replacement to chemical fertilizers. Such replacement has multiple benefits including, significantly, the reduction of chemical run off into waterways.

- The use of bio-organic fertilizers leads to better fruit yield and plant health, thereby improving the earnings of local farmers. Moreover, a steady and consistent supply of bio-fertilzer at a lower cost will encourage displacement of imported chemical fertilizers, which helps mitigate foreign exchange risk that the farmers are exposed to.

It is hoped that the successful implementation of the Project will pave the way for other palm oil mills to follow in Abedon's footsteps.

A.3. Project participants:

Table 1: Table of project participants

Name of party involved	Private and/or public entity(ies) project participants	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Malaysia (host)	Abedon Enviro Sdn. Bhd.	No
Japan	Carbon Partners Asiatica Co., Ltd.	No

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 Sabah

A.4.1.3. City/Town/Community etc:

Near the town of Lahad Datu, Sabah

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

The Project is located in the Abedon Palm Oil Mill with GPS coordinates of 5º18'57.20"N, 117º58'10.18"E.

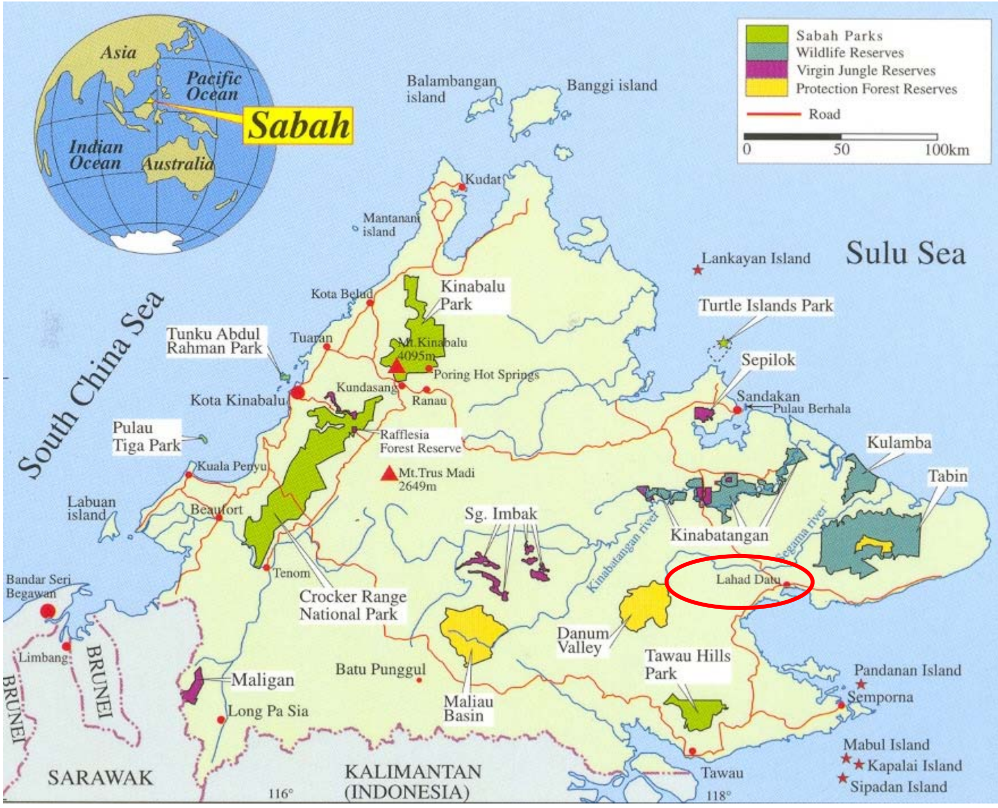

Figure 1: Map of Sandakan, State of Sabah

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

Type and categories

The Project fits the following type and category as defined in Appendix B to the *Simplified Modalities and Procedures for Small-Scale CDM Project Activities*:

Type III: Other project activities
Category III.F: Avoidance of methane emissions through controlled biological treatment of biomass.

Technology employed by Project

The process technology to be applied in the Project is a high-tech organic composting system developed specifically for the palm oil industry in Malaysia. The process will convert the mixture of EFB, POME, decanter sludge and boiler ashes into high grade bio-organic fertilizers.

(A) Description of the manufacturing process

The EFB from the Abedon mill will be shredded into a pre-determined size at the pre-composting area. A Mixer will blend the shredded EFB together with decanter sludge, boiler ash, POME and a special microbial inoculum into a premix feedstock. The feedstock is then loaded by front end loader to deposit into the composting module, which is a sealed aerobic composting apparatus, AeroPod™ module.

The premix feedstock will undergo a 14-Day period of aerobic composting in a controlled, sealed environment inside the AeroPod™. The AeroPod™ process is automated and computer programmed to enable the feedstock to undergo a controlled, accelerated composting process.

Leachate from the controlled composting process will be collected and recycled in a closed system, resulting in zero liquid discharge. Additional POME effluent and bio-inoculum may be further added in the controlled process to convert the feedstock into nutrient enriched compost.

After the 14-Day controlled processing inside AeroPod™ the composted feedstock will be unloaded by front end loader and placed into the Curing Area where the compost will undergo a further 14-Day curing period. At the end of curing, the compost will be screened and graded. The refined product will be bio-fertilizers ready for land application.

This process is described diagrammatically in the figure below.

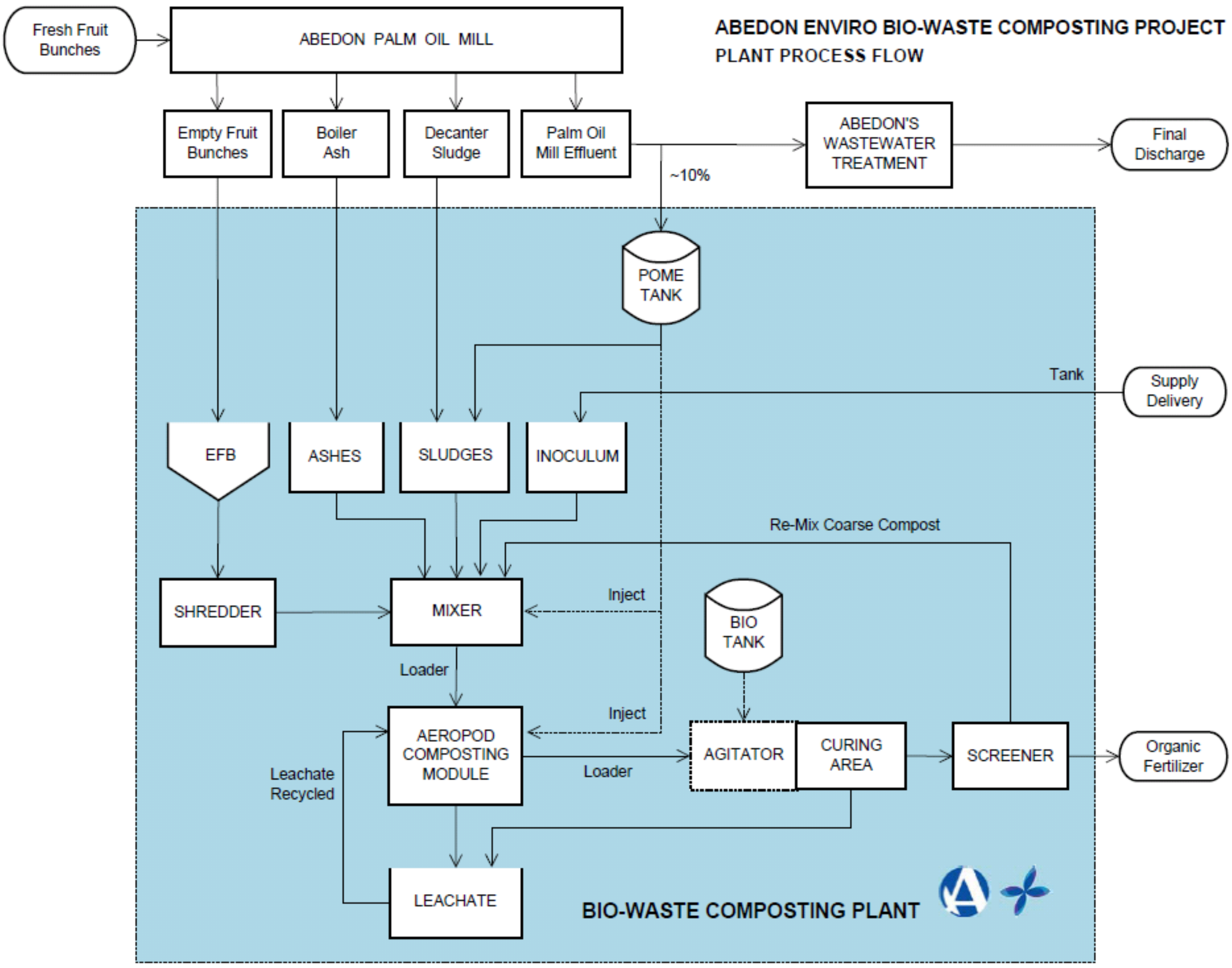

Figure 2: Co-composting Plant Process Flow

(B) AeroPod™ - The Core Technology

The core technology in the Abedon Enviro Bio-Waste Composting Plant is AeroPod™, a new invention under patents over the decades-old tunnel composting system. The unique composting apparatus has since 2008 been customised for the Abedon Enviro project, and its operational parameters configured for the specific characteristics of palm oil mill waste materials.

The apparatus is unique in that it was developed specifically for palm oil mill waste, not municipal solid waste. The unique features of AeroPod™ include: enhanced aeration, air-jacketed aeration exchange for more stable controlled environment, adaptive air flow control for improved moisture balancing and temperature distribution, simplified construction method to cater to local labour and material availability, and optimized mechanical equipment (i.e. reduced power consumption).

The enhanced aeration and adaptive air flow control are built-in features of AeroPod™ that minimize the likelihood of anaerobic or "cold" spots that afflict the common tunnel composting system, thereby assuring aerobic performance during the composting process. The new AeroPod™ invention not only delivers innovative process enhancement, but also has significantly reduced the capital cost per tonne of organic waste treated. This unit cost consideration is a crucial factor that decides whether a small scale project is feasible, such as in the case of Abedon Enviro.

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

Years	Estimation of annual emission reductions in tonnes of CO_2e
1 (Aug 2011 – Jul 2012)	8,108
2 (Aug 2012 – Jul 2013)	12,895
3 (Aug 2013 – Jul 2014)	19,029
4 (Aug 2014 – Jul 2015)	23,673
5 (Aug 2015 – Jul 2016)	27,591
6 (Aug 2016 – Jul 2017)	30,896
7 (Aug 2017 – Jul 2018)	33,685
8 (Aug 2018 – Jul 2019)	36,038
9 (Aug 2019 – Jul 2020)	38,022
10 (Aug 2020 – Jul 2021)	39,697
Total estimated reductions (tonnes of CO_2e)	269,634
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period (tCO_2e)	26,963

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

The Project does not involve funding from an Annex I country.

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

As defined in paragraph 2 of Appendix C of the SSC M&P, a proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or a request for registration by another small-scale project activity:

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

The proposed project activity is not a debundled component of any larger project activity as there is no other small-scale project activity that fulfils the above mentioned criteria.

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 approved baseline and monitoring methodologies which are applicable to the project activity is as follows:

- AMS-III.F. Avoidance of methane emissions through controlled biological treatment of biomass. Version 08, Scope 13, effective as of July 17, 2009

In addition, in accordance with the above methodology, the following tool is applied.

- Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site, version 05 (hereinafter referred to as "Methane Tool")

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

The Project meets all the applicability conditions of the methodology, as presented below.

Table 2: Applicability conditions for AMS-III.F. version 08

	Applicability condition	Project case
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)… In the project activity, controlled biological treatment of biomass is introduced through one, or a combination, of the following measures: (a) Aerobic treatment by composting and proper soil application of the compost…	The project activity involves controlled biological treatment of biomass through aerobic treatment by composting and proper soil application of the compost.
2	The project activity does not recover or combust landfill gas from the disposal site (unlike AMS-III.G), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS-III.E). Project activities that recover biogas from wastewater treatment shall use methodology AMS-III.H.	The project activity does not recover or combust landfill gas, undertake controlled combustion of the waste, or recover biogas from wastewater treatment.
3	Measures are limited to those that result in emission reductions of less than or equal to 60kt CO_2 equivalent annually.	*Ex ante* emission reductions due to both composting and wastewater treatment, were calculated as averaging 26,963 tCO_2e annually (or up to 39,697tCO_2e in Year 10), lower than the 60,000 tCO_2e threshold.
4	This methodology is applicable to the treatment of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure…	The Project involves the treatment of biomass wastes from agro-industrial activities (palm oil milling).
5	This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an	The project activity includes the construction of a treatment facility.

	existing facility…	
6	This methodology is also applicable for co-treating 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 involved co-treating a small amount of wastewater together with the main compost ingredient – the solid waste biomasses – where the wastewater would have otherwise been treated in the anaerobic open lagoon system located at the Abedon mill. In the Project the wastewater is used as a source of moisture and nutrients for the composting process.
7	The location and characteristics of the disposal site of the biomass in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions. Guidance in paragraphs 4, 6, and 7 in AMS-III.E shall be followed in this regard... The following requirement shall be checked *ex ante* at the beginning of each crediting period in the case of composting solid waste: • Establish that identified landfill(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or • Establish that it is common practice in the region to dispose of the waste in solid waste disposal site (landfill)…	The location and characteristics of the disposal site – a deep landfill within the bounds of the Abedon plantation – is known. It will be established during the DOE validation site visit that the landfill can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period.
8	In case residual waste from the biological treatment (slurry, compost or products from those treatments) are handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.	Residual waste (compost) from biological treatment will be handled aerobically and submitted to soil application. As per Sections A.4.2 and B.7.1, proper conditions and procedures will be ensured such that methane emissions will not occur.
9	In case residual waste from the biological treatment (slurry, compost or products from those treatments) are treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.	Not applicable. The residual waste (compost) will not be treated thermally/mechanically.
10	In case residual waste from the biological treatment (slurry, compost or products from those treatments) are stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual waste shall be taken into account….	Not applicable. The residual waste (compost) will not be stored under anaerobic conditions.
11	For project activities involving controlled anaerobic digestion and production of biogas, technical measures shall be use (e.g. flared, combusted) to ensure that all biogas produced by the digester is captured and gainfully used or combusted/flared.	Not applicable. The Project does not involve anaerobic digestion.
12	The recovered biogas from anaerobic digestion	Not applicable. The Project does not involve

	may also be utilized for the following applications instead of flaring or combustion…	anaerobic digestion.
13	If the recovered biogas is used for project activities covered under paragraph 12(a), that component of the project activity shall use a corresponding category under Type I.	
14	If the recovered biogas is used for project activities covered under paragraph 12 (b) or 12 (c), relevant provisions in AMS-III.H… shall be used.	
15	If the recovered biogas is used for project activities covered under paragraph 12 (d) that component of the project activity shall use corresponding methodology AMS-III.O.	

B.3. Description of the project boundary:

In line with AMS-III.F Version 08 and in the context of the Project, the project boundary is the physical/geographical site:

(a) Where the solid waste would have been disposed and the methane emission occurs in the absence of the project activity;
(b) Where the co-composting wastewater would have been treated anaerobically in the absence of the project activity;
(c) Where the treatment of biomass through composting takes place;
(d) Where the residual waste from biological treatment of products from those treatments, like compost and slurry, are handled, disposed, submitted to soil application, or treated thermally/mechanically;
(e) Where biogas is burned/flared or gainfully used;
(f) The itineraries between (a), (b), (c), (d), and (e), where the transportation of waste, wastewater, compost/slurry/products occurs.

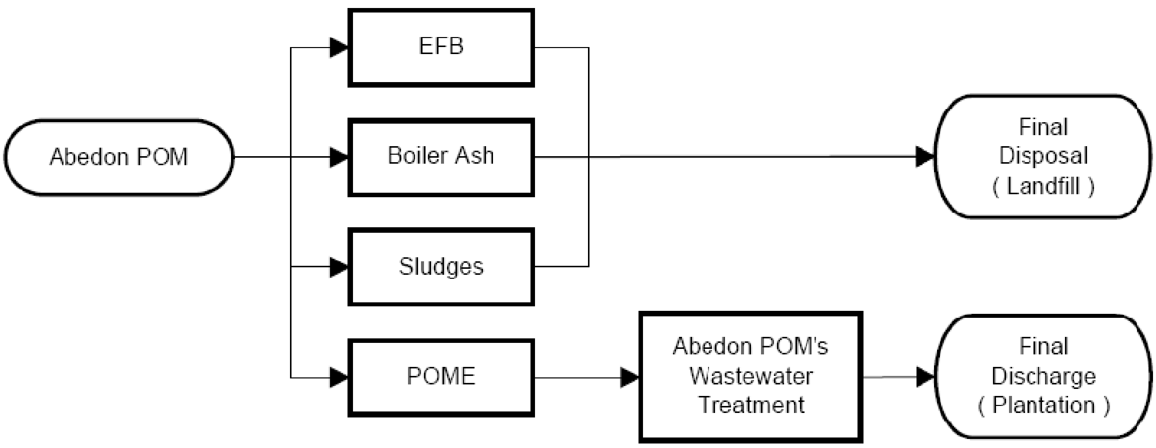

Figure 3: Baseline scenario

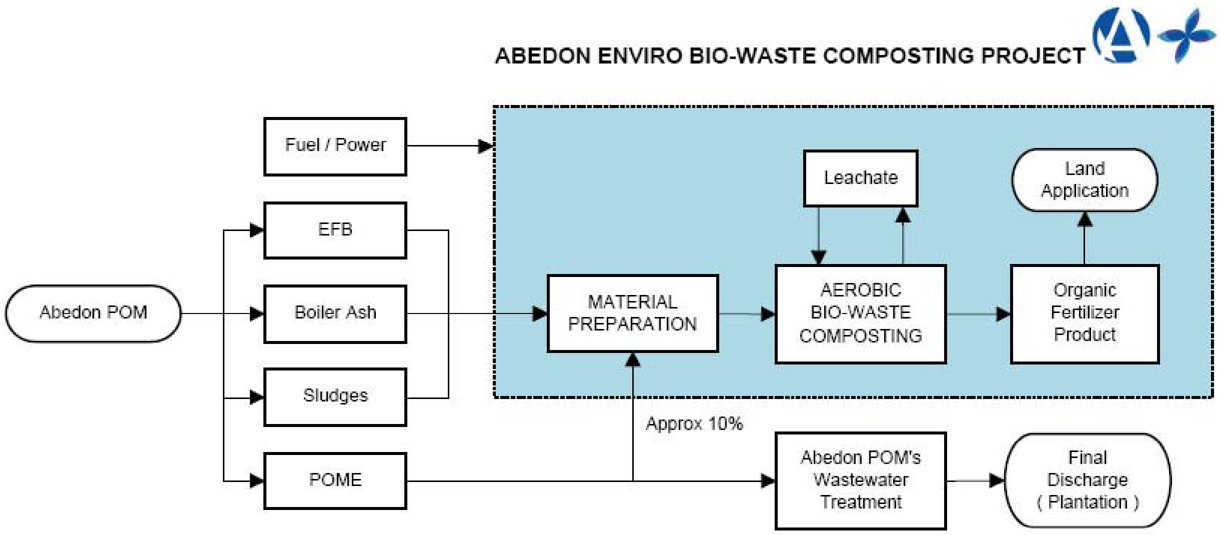

Figure 4: Project scenario and project boundary

B.4. Description of baseline and its development:

In accordance with paragraph 17 of AMS-III.F. Version 08, 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.

Key assumption and rationale are delineated in Sections B.6.1. and B.6.2.

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:

B.5.1. Barrier analysis

Consistent with Attachment A to Appendix B of 4/CMP.1 Annex II, the Project's additionality can be established to show that the project activity would not have occurred anyway due to at least one of the following barriers:

1. Investment barrier;
2. Technological barrier;
3. Barrier due to prevailing practice; and
4. Other barriers

The Project faces an investment barrier, where it is not sufficiently financially attractive without the CER income. This investment barrier is exacerbated by the fact that co-composting of palm oil mill wastes is still new to the palm oil industry in Malaysia, and is considered technologically risky. In the ensuing section, the investment barrier is elaborated.

B.5.1.1. Investment barrier

To continue landfilling the EFB, decanter sludge and boiler ash and processing POME using the existing anaerobic open lagoon is the least cost option for waste management at the APOM factory. Even in the event processing capacity is increased, the current mode of waste management is readily a viable, preferred choice due to abundant land availability.

While other options for waste treatment, such as co-composting without securing CDM revenue or biomass power generation, are also available, all require significant investments in comparison to the simple, low-tech waste management currently in place. While these options entail a revenue stream in the form of bio-fertilizer sales or power sales, such income alone will not give sufficiently-attractive financial returns for it to be implemented as a business-as-usual practice. This has meant that the business-as-usual practice in most palm oil mills is to adopt the most economic method of disposal – landfilling and/or mulching for solid wastes and open lagoon treatment for POME. It is only with the revenue from the CDM that such investment barrier can be overcome and better waste management can be realised.

According to EB 35 Annex 34 "Non-binding best practice examples to demonstrate additionality for SSC project activities", best practice examples to demonstrate an investment barrier include the application of investment comparison analysis using a relevant financial indicator and application of a benchmark analysis. Therefore, a benchmark analysis is applied, adhering to the procedures outlined in "Guidance on the Assessment of Investment Analysis" (Version 03) ("Guidance").

Determination of the benchmark

An indicative IRR benchmark was sourced from "Study on Clean Development Mechanism Potential in the Waste Sectors in Malaysia"[1], which cites the benchmark level of 15%. This was considered to be relevant to the Project in that the benchmark cited is specifically for the waste management sector with an emphasis on the palm oil industry.

Nevertheless, for the Project, a benchmark is separately calculated and applied. As the financial indicator used is Project IRR, the weighted average cost of capital (WACC) is an appropriate benchmark, in line with paragraph 12 of the Guidance.

The WACC is calculated as follows:

Equation 1

$$\mathrm{WACC} = \omega_d \times R_d(1 - T_C) + \omega_e \times R_e$$

Where:

Table 3: WACC input values

Parameter		Value	Source / Justification
ω_d	Debt percentage	0.5	In absence of (a) finalized debt-equity arrangement for the Project, and (b) absence of historical debt-equity percentage for Abedon in view of it being a new company, a 50:50 ratio is assumed. It is noted that the draft tool for calculating WACC also mentions this as a default value.
R_d	Cost of debt	8.8%	Commercial lending rates. Letter from potential lending bank submitted to DOE.
T_C	Applicable corporate tax rate	25%	Corporate tax rate for Malaysia.
ω_e	Equity percentage	0.5	See above for ω_d.
R_e	Cost of equity	15.7%	Value calculated based on capital asset pricing model (CAPM), which is a standard method in the finance for

[1] Ministry of Water, Energy and Communication / Malaysia Energy Centre / DANIDA. 2005.

			determining cost of equity for a particular industry. It is noted that whereas the standard calculation is CAPM = risk free rate + industry beta x (general market returns – risk free rate) = plantation industry beta x (KLCC returns – risk free rate), here, it was calculated as CAPM = risk free rate[2] + (industry returns[3] – risk free rate)[4], which is inclusive of beta.
WACC		11.2%	= 0.5 x 8.8% x (100% - 25%) + 0.5 x 15.7%

The resultant after-tax WACC is 11.2% and is an appropriate benchmark for comparison with an after-tax project IRR.

IRR computations

The following table summarises the input values used for the IRR analysis. All input values used in the analysis, valid and applicable at the time of decision making, were submitted to the DOE in the course of the Validation.

Table 4: Input values for IRR analysis

Key Parameters	Value		Notes
Expenditure			
Capex	11,485,953	RM	All quotes were submitted to DOE.
O&M Years 1 – 2 Years 3 – 10	2,283,520 2415,947	RM/yr RM/yr	Abedon expectation. Includes 64RM/tBF for cost of goods sold (e.g. transportation costs, electricity expenses etc.), 999,701RM/yr for plant overheads (e.g. worker' salaries and housing, office expenses) and 771,200 RM/yr for operation overheads (e.g. management salaries and housing,office expense, professional services, etc.). The price of purchasing the EFB raw material, originally set in line with market price, was excluded from the cost of goods sold at the instruction of the DOE. While this is a **legitimate real cost** to the project, this was removed for the sake of conservatism. Calculations and detailed basis submitted to DOE
Revenue			
Bio-fertilizer Income	415	RM/tBF	Abedon assumption. In the absence of a market price for bio-fertilizer in Malaysia, Abedon has carried out a benchmarking of its product by comparing lab results of the constituents against market prices of NPK and other major elements. This resulted in a mean price of

[2] 3.3%, based on 4.4% Malaysian government bond yield at time of decision making, adjusted for corporate tax (25%).

[3] 15.36%, based on average 3-year performance of top companies comprising >75% of the FTSE Bursa Malaysia Palm Oil Plantation Index. The index performance result itself could not be used as the index was established in 2009, whereas the individual performances of top companies were available on the main index before 2009.

[4] 2.91%, based on 3.9% average yield for government bonds with 10 year maturity for past 3 years, adjusted for corporate tax (25%).

			414RM/tBF. NPK test results for the compost product produced in mini-pilot as well as NPK quotes from third parties were submitted to DOE.
Salvage value	0	RM	Book value is 0, in line with Malaysian accounting practice. Fair value is 0, as there is little material to be salvaged. Modules cost more to salvage than to scrap, process systems such as computers will also be scrapped. It is noted that the modules are made mainly from concrete and any metal equipment used (fans etc.) are expected to be corroded due to the harsh environment and not sellable.
Taxation			
Tax rate	25	%	Malaysian corporate tax rate
Interest rate	8.8	%	For purpose of calculating interest repayments as per EB 51 Annex 58 paragraph 11. Letter from potential lending bank was submitted to DOE.
Depreciation	1,148,595	RM/yr	Flat rate depreciation. In line with Malaysian accounting practice.
Other			
Project lifetime	10	years	Abedon expectation, heavy wear and tear for heavy machinery in corrosive environment

The result of the above analysis is a base case project IRR of 4.7%, which is far below the 11.2% benchmark and clearly not viable under business-as-usual.

To test the robustness of the assumptions made, sensitivity analyses were carried out for parameters which are reasonably subject to change, as follows. It is noted that although both positive and negative fluctuations are equally possible, only those fluctuations which would result in a more favourable IRR (and hence conservative from the viewpoint of additionality) were considered. It is furthermore emphasized that the financial projections by Abedon at the time of decision making was carried out in painstaking detail[5]. Against this background, it is reasonably concluded that fluctuations beyond 10% cannot be expected or foreseen.

1. Decrease capital cost by 10%. This resulted in an IRR of 6.4% (+1.7%).
2. Decrease O&M cost by 10%. This resulted in an IRR of 7.1% (+2.4%).
3. Increase in bio-fertilizer sales price by 10%. This resulted in an IRR of 8.6% (+3.9%).
4. Increase in bio-fertilizer production by 10%. This resulted in an IRR of 8.0% (+3.3%).

Even at up to 8.6% for the most optimistic case, the project returns remains insufficiently attractive for the project to be viable under business-as-usual.

It was therefore concluded that the Project is not feasible under business-as-usual.

In addition to the sensitivity analysis above, a further test was carried out to determine the variations required by the critical parameters to reach the benchmark of 11.2%. The results were as follows:

[5] Detailed breakdown of all assumptions were provided to the DOE. Dozens of quotes and numerous laboratory test results of nutrients are just a fraction of the accompanying evidence also provided during the course of validation.

1. A 27.3% decrease in capital cost is required to reach the benchmark. It is clearly unrealistic that there is such a drastic decrease in capital cost. On the contrary, prices have been increasing steadily since the time of investment decision making.
2. A 28.0% decrease in O&M cost is required to reach the benchmark. This is also unrealistic given the detail with which the O&M cost was estimated. Similar to the capital cost, prices are on the rise.
3. A 17.0% increase in bio-fertilizer sales price is required to reach the benchmark. While clearly Abedon will strive to achieve good prices for its bio-fertilizer, it faces an uphill battle for two main reasons:
   (a) The bio-fertilizer price will be influenced by the amount of nutrients in it and the market value of the synthetic equivalent. No drastic price increases is expected beyond normal inflation; and
   (b) The market's unfamiliarity with bio-fertilizer meaning that as it is, it will be difficult to convince the market to pay the exact equivalent of synthetic fertilizers (i.e. to get the price of RM415/tBF which is calculated based on the nutrient content and the market rate for *their synthetic equivalent*).
4. A 20.4% increase in bio-fertilizer production is required to reach the benchmark. As with the bio-fertilizer price increase, it is also in Abedon's interest to achieve higher production. However, it is unrealistic as the investment analysis already takes into account an expected increase in FFB processing. It is also of note that the EFB quantity available to the Project is dictated solely by APOM's commercial decisions, which Abedon has no influence over.

B.5.2. Prior consideration and ongoing actions

Consistent with EB 49 Annex 22, for project activities with a start date after 2 August 2008, a prior consideration form was submitted to the UNFCCC Secretariat and Malaysian DNA on 29 April 2010 and 30 April 2010, respectively.

It is noted for transparency that APOM, the host mill, had previously been in agreement with a separate entity to develop a similar co-composting project at the same physical site. However, for commercial reasons unrelated to the CDM, that project (UNFCCC Reference 2270) was withdrawn by mutual consent of all parties involved. This Project is a separate, new project with different project participants and different technical parameters.

Table 5: Prior consideration and ongoing actions

Date	Action	Notes
Early 2009	First contact with Carbon Partners Asiatica ("Asiatica"), CDM consultant for the Project	
24 September 2009	Received Asiatica's final proposal	Proposal shown to DOE during validation site visit
3 November 2009	Executed CDM consultancy agreement with Asiatica	Agreement excerpt submitted to DOE
5 November 2009	Board resolution to appoint first three contractors	Board resolution submitted to DOE
10 November 2009 (project start date)	Abedon issued a confirmation letter to appoint quantity surveyor, the first contractor for the Project.	Confirmation letter submitted to DOE.
29 April 2010	Prior consideration form sent to UNFCCC Secretariat	
30 April 2010	Prior consideration form sent to	

	Malaysian DNA	
1 May 2010	Start of civil works	Progress report from contractor submitted to DOE
5 June 2010	Requested quote from DOE	
27 July 2010	PDD submitted to Malaysian DNA	
30 July 2010	Start of UNFCCC public comments	
6 September 2010	Validation site visit	

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

1. Baseline Emissions

The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass solid waste adjusted for methane that would have to be captured and combusted to comply with prevailing regulations, and methane from wastewater co-composted, as described below.

Equation 2

$$BE_y = BE_{CH4,SWDS,y} - \left(MD_{reg,y} \times GWP\_CH_4\right) + \left(MEP_{y,ww} \times GWP\_CH_4\right) + BE_{CH4,manure,y}$$

Which in the context of the Project becomes:

$$BE_y = BE_{CH4,SWDS,y} - MD_{reg,y} + BE_{CH4,ww,y}$$

Where:

$BE_{CH4,SWDS,y}$ = Yearly methane emissions from 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 Methane Tool.

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

$BE_{CH4,ww,y}$ = Methane emissions in year *y* from the co-composted wastewater calculated as $MEP_{y,ww} \times GWP\_CH_4$.

The calculation methods for each component of Equation 2 are delineated below.

1.1. $BE_{CH4,SWDS,y}$

The amount of methane emitted from the decay of the degradable organic carbon in the biomass solid waste, $BE_{CH4,SWDS,y}$, is calculated as per below.

Equation 3

$$BE_{CH4,SWDS,y} = \varphi \times (1-f) \times GWP_{CH4} \times (1-OX) \times \frac{16}{12} \times F \times DOC_f \times MCF \times \sum_{x=1}^{y} \sum_{j} W_{j,x} \times DOC_j \times e^{-k_j(y-x)} \times \left(1-e^{-k_j}\right)$$

Table 6: Input values and data sources for $BE_{CH4,SWDS,y}$

Parameter	Description	Value	Unit	Source
φ	Model correction factor to account for model uncertainties	0.9	Fraction	Default as per Methane Tool
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	0	Fraction	As per AMS-III.F. Version 08 paragraph 17
GWP_{CH4}	Global Warming Potential (GWP) of methane	21	tCO_2/tCH_4	Default as per Methane Tool
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)	0	Fraction	As per Methane Tool, for other types of SWDS
F	Fraction of methane in the SWDS gas	0.5	Volume Fraction	Default as per Methane Tool
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose	0.5	Fraction	Default as per Methane Tool
MCF	Methane correction factor	0.8	Fraction	As per Methane Tool, for unmanaged solid waste disposal sites – deep and/or with high water table
$W_{j,x}$	Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x*	14,697 – 18,493	t (dry)	Abedon (to be monitored). This figure includes only the EFB and excludes the decanter sludge and boiler ash, for which CERs are not claimed. Higher production from year 3 onwards.
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type *j*	0.49	% dry waste	As per Methane tool, for garden, park and yard waste to which EFB belongs
k_j	Decay rate for the waste type *j*	0.170	Fraction	As per Methane tool,

				for garden, park and yard waste to which EFB belongs
j	Waste type category (index)	-	-	-
x	Year during the crediting period: x runs from the first year of the first crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)	-	-	-
y	Year for which methane emissions are calculated	-	-	-

1.2. $MD_{reg,y}$

There are no prevailing regulations that requires methane to be captured and combusted at the current landfill. Therefore, $MD_{reg,y}$ is therefore not relevant.

1.3. $BE_{CH4,ww,y}$

Methane emissions in year *y* from the co-composted wastewater, $BE_{CH4,ww,y}$, is calculated as per below.

Equation 4

As:

$$MEP_{y,ww} = Q_{y,ww,in} \times COD_{y,ww,untreated} \times B_{o,ww} \times MCF_{ww,treatment} \times UF_b$$

Then:

$$BE_{CH4,ww,y} = Q_{ww,in,y} \times COD_{ww,untreated,y} \times B_{o,ww} \times MCF_{ww,treatment} \times UF_b \times GWP_{CH4}$$

Table 7: Input values and data sources for $BE_{CH4,ww,y}$

Parameter	Description	Value	Unit	Source
$Q_{ww,in,y}$	Volume of wastewater entering the co-composting facility in the year *y*	15,120 – 19,026	m^3	Abedon, expected to use 10% of total POME from APOM for pH and moisture balance (to be monitored). Higher production from year 3 onwards.
$COD_{ww,untreated,y}$	Chemical oxygen demand of the wastewater entering the co-composting facility in the year *y*	0.05	$tCOD/m^3$	Abedon estimate[6] from Department of Environment handbook, cross-checked against lab results (to be monitored)

[6] It is noted that Abedon and APOM have not yet come to an agreement on precisely where to tap the POME. However, since for a composting project the POME is required for pH and moisture balance, that the stream to be tapped is undecided in no way affects the IRR calculations.

$B_{o,ww}$	Methane producing capacity for the wastewater	0.21	$kgCH_4/kgCOD$	Default as per AMS-III.F Version 08
$MCF_{ww,treatment}$	Methane correction factor for the wastewater treatment system in the baseline scenario	0.8	Fraction	MCF value for anaerobic deep lagoon (depth more than 2 meters), as per table III.F.I of AMS-III.F Version 08
UF_b	Model correction factor to account for model uncertainties	0.94	Fraction	Default as per AMS-III.F Version 08
GWP_{CH4}	Global Warming Potential (GWP) of methane	21	tCO_2/tCH_4	Default as per AMS-III.F Version 08

2. Project Emissions

In the context of this Project, project activity emissions (PE_y) consist of:

(a) CO_2 emissions due to incremental transportation distances ($PE_{transp,y}$);
(b) CO_2 emissions from electricity and/or fossil fuel consumption by the project activity facilities ($PE_{power,y}$);
(c) CH_4 emissions during the compositing process ($PE_{comp,y}$);
(d) CH_4 emissions from runoff water ($PE_{runoff,y}$);
(e) In case the residual waste from the biological treatment (slurry, compost or products from these treatments) are stored under anaerobic conditions and/or delivered to a landfill, the CH_4 emissions from the disposal/storage of these residual waste/products ($PE_{res\_waste,y}$).

Thus:

Equation 5

$$PE_y = PE_{transp,y} + PE_{power,y} + PE_{comp,y} + PE_{runoff,y} + PE_{res\_waste,y}$$

2.1. $PE_{transp,y}$

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

(i) The collection points of biomass and the compost treatment site as compared to the baseline solid waste disposal site;
(ii) Treatment sites and the sites for soil application, landfilling and further treatment of the residual waste/products;

and is calculated as per the following formula:

Equation 6

$$PE_{transp,y} = \frac{Q_y}{CT_y} \times DAF_w \times EF_{CO2} + \frac{Q_{treatment,i,y}}{CT_{treatment,i,y}} \times DAF_{treatment,i} \times EF_{CO2}$$

It is noted that the wastewater co-composted will not be transported via trucks and emissions related to incremental transport of wastewater will be accounted for under $PE_{power,y}$.

Table 8: Input values and data sources for $PE_{transp,y}$

Parameter	Description	Value	Unit	Source
Q_y	Quantity of raw waste in the year *y*	34,776 – 43,760	t/yr (wet basis)	Abedon based on historical records and future projections (to be monitored). This includes all solid wastes – EFB, decanter sludge and boiler ash, which are all currently landfilled. Higher production from year 3 onwards.
CT_y	Average truck capacity for transportation	4	t/truck	Abedon
DAF_w	Average incremental distance for raw solid transportation	-5	km/truck (return)	Calculated as difference between APOM factory to Abedon composting plant (0.5km) and APOM factory to solid waste disposal site (3km). Distance checked by DOE during validation site visit.
EF_{CO2}	CO_2 emission factor from fuel use due to transportation	0.00055	$kgCO_2/km$	Derived using IPCC default values for diesel, see Section B.6.2 for details.
i	Type of residual waste / products and/or compost	-	-	-
$Q_{treatment,i,y}$	Quantity of residual waste / products and/or compost *i* produced in year *y*	7,838 – 9,863	t/yr	Abedon based on mini-trial results (to be monitored). Higher production from year 3 onwards.
$CT_{treatment,i,y}$	Average truck capacity for residual waste / products / compost *i* transportation	4	t/truck	Abedon
$DAF_{treatment,i}$	Average distance for residual waste / products / compost *i* transportation	20	km/truck (return)	Abedon (to be monitored)

2.2. $PE_{power,y}$

The project emissions from electricity and/or fossil fuel consumed by the project activity facilities are to include the energy consumption of all equipment/devices installed by the project activity, e.g. energy used for aeration, turning of compost piles, chopping of biomass for size reduction, screening, drying of final compost and for runoff wastewater treatment.

Equation 7

$$PE_{power,y} = EL_{cons} \times EF_{el} + FF_{cons} \times EF_{FF}$$

Table 9: Input values and data sources for $PE_{power,y}$

Parameter	Description	Value	Unit	Source
EL_{cons}	Quantity of electricity used to operate the Project facilities	2,608 – 3,282	MWh/yr	Abedon (to be monitored).
EF_{el}	Emission factor for electricity consumed	0	tCO_2/MWh	Power to the Project is expected to be supplied under agreement with APOM, which produces biomass-based carbon neutral power[7].
FF_{cons}	Quantity of fossil fuel used to operate the Project facilities	26,080 – 32,817	L/yr	Abedon (to be monitored).
EF_{FF}	Emission factor for fossil fuel consumed	0.0028	tCO_2/L	Derived using IPCC default values for diesel, see Section B.6.2 for details.

2.3. $PE_{comp,y}$

Methane emissions during the composting process is calculated as follows.

Equation 8

$$PE_{comp,y} = Q_y \times EF_{composting} \times GWP_{CH4}$$

Table 10: Input values and data sources for $PE_{comp,y}$

Parameter	Description	Value	Unit	Source
Q_y	Quantity of raw waste in the year *y*	14,697 – 18,493	t/yr	Abedon (to be monitored). Higher production from year 3 onwards.
$EF_{composting}$	Emission factor for composting of organic waste.	0	tCH_4/t waste treated (dry basis)	Assumed for *ex ante* estimate that oxygen content of composting process is above 8%.

[7] It is noted for the sake of transparency that the use of APOM's biomass-based power will not lead to leakage, as the quantity of biomass left over is too small to be sold to other potential users. All excess biomass is currently landfilled.

GWP_{CH4}	Global Warming Potential (GWP) of methane	21	tCO_2/tCH_4	Default as per AMS-III.F Version 08

2.4. $PE_{runoff,y}$

Under the Project, all leachate from the composting process will be re-circulated in the system for moisture control, and there will be no runoff water leaving the composting facility. $PE_{runoff,y}$ is therefore not relevant.

2.5. $PE_{res\_waste,y}$

There is no anaerobic storage and/or disposal in a landfill of the compost. The compost will be transported by truck to the final end-use site for land application frequently. $PE_{res\_waste,y}$ is therefore not relevant.

3. Leakage

There is no leakage due to the Project as there is no equipment transfer involved.

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

Data / Parameter:	Φ
Data unit:	Fraction
Description:	Model correction factor to account for model uncertainties
Source of data used:	Methane Tool
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per Methane Tool
Any comment:	N/A

Data / Parameter:	OX
Data unit:	Fraction
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Methane Tool; validated by DOE during site visit
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value for “other types of solid waste disposal sites” as per Methane Tool
Any comment:	N/A

Data / Parameter:	F
Data unit:	Volume fraction
Description:	Fraction of methane in the SWDS gas
Source of data used:	Methane Tool
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per Methane Tool
Any comment:	N/A

Data / Parameter:	DOC_f
Data unit:	Fraction
Description:	Fraction of degradable organic carbon that can decompose
Source of data used:	Methane Tool
Value applied:	0.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per Methane Tool
Any comment:	N/A

Data / Parameter	MCF
Data unit:	Fraction
Description:	Methane correction factor
Source of data used:	Methane Tool; validated by DOE during site visit
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value for “unmanaged solid waste disposal sites – deep and/or with high water table” as per Methane Tool
Any comment:	N/A

Data / Parameter:	DOC_j
Data unit:	Fraction
Description:	Fraction of degradable organic carbon (by weight) in the waste type *j*
Source of data used:	Methane Tool
Value applied:	0.49 (% dry waste)
Justification of the choice of data or description of measurement methods	Dry basis value for “garden, yard and park waste” which EFB is considered to be, as per Methane Tool. Should wet mass be used for the ex post CER calculation, then the wet basis value of 0.20 (% wet waste) will instead be applied.

and procedures actually applied :	
Any comment:	N/A

Data / Parameter:	k_j
Data unit:	Fraction
Description:	Decay rate for the waste type *j*
Source of data used:	Methane Tool
Value applied:	0.17
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value for “garden, yard and park waste” which EFB is considered to be, in Tropical and Wet conditions, as per Methane Tool.
Any comment:	According to World Weather Information Service of the World Meteorological Organization for Sandakan, Malaysia http://www.worldweather.org/020/c00091.htm, the mean annual *minimum* temperature is 23.7 degC, and mean annual precipitation is 3,017mm.

Data / Parameter:	B_o
Data unit:	$kgCH_4/kgCOD$
Description:	Methane producing capacity for the wastewater
Source of data used:	AMS-III.F Version 08
Value applied:	0.21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per AMS-III.F Version 08
Any comment:	N/A

Data / Parameter:	$MCF_{ww,treatment}$
Data unit:	Fraction
Description:	Methane correction factor for the wastewater treatment system in the baseline scenario
Source of data used:	AMS-III.F; validated by DOE during site visit
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value for “anaerobic deep lagoon (depth more than 2 metres)” as per Table III.F.1.
Any comment:	N/A

Data / Parameter:	DAF_w

Data unit:	km/truck (return)
Description:	Average incremental distance for raw solid transportation
Source of data used:	Abedon
Value applied:	-5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Incremental distance between: • APOM mill and Project co-composting facility (1km return); and • APOM mill and baseline landfill (6km return).
Any comment:	N/A

Data / Parameter:	CT_y
Data unit:	t
Description:	Average truck capacity for transportation
Source of data used:	Abedon
Value applied:	4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Truck capacity as validated by DOE during site visit
Any comment:	N/A

Data / Parameter:	EF_{CO2}
Data unit:	tCO_2/km
Description:	CO_2 emission factor from fuel use due to transportation
Source of data used:	IPCC
Value applied:	0.00055
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using fuel economy = 5km/L for diesel vehicles (2006 IPCC Guidelines Table 3.2.2), density of diesel = 0.85 kg/L, NCV of diesel = 43.3TJ/kt (2006 IPCC Guidelines Table 1.2), and emission factor of diesel = 74,800kgCO_2/TJ (2006 IPCC Guidelines Table 1.4), i.e.: $\frac{1\text{L}}{5\text{km}} \times \frac{0.85\text{kg}}{\text{L}} \times \frac{\text{kt}}{1{,}000{,}000\text{kg}} \times \frac{43.3\text{TJ}}{\text{kt}} \times \frac{74{,}800\text{kgCO2}}{\text{TJ}} \times \frac{\text{tCO2}}{1{,}000\text{kgCO2}} = 0.00055\,\frac{\text{tCO2}}{\text{km}}$
Any comment:	Applicable to diesel-run vehicles

Data / Parameter:	EF_{el}
Data unit:	tCO_2/MWh
Description:	Emission factor for electricity consumed
Source of data used:	AMS-III.H paragraph 22, for carbon-neutral electricity
Value applied:	0
Justification of the choice of data or description of	The Project will purchase excess carbon-neutral power from APOM's boiler capacity.

measurement methods and procedures actually applied :	
Any comment:	If the Project uses diesel-based power instead, the appropriate value will be 0.8.

Data / Parameter:	EF_{FF}
Data unit:	tCO_2/L
Description:	Emission factor for fossil fuel consumed
Source of data used:	IPCC
Value applied:	0.0028
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using density of diesel = 0.85 kg/L, NCV of diesel = 43.3TJ/kt (2006 IPCC Guidelines Table 1.2), and emission factor of diesel = 74,800kgCO_2/TJ (2006 IPCC Guidelines Table 1.4), i.e.: $\frac{0.85\text{kg}}{\text{L}} \times \frac{\text{kt}}{1{,}000{,}000\text{kg}} \times \frac{43.3\text{TJ}}{\text{kt}} \times \frac{74{,}800\text{kgCO2}}{\text{TJ}} \times \frac{\text{tCO2}}{1{,}000\text{kgCO2}} = 0.0028\,\frac{\text{tCO2}}{\text{km}}$
Any comment:	N/A

At the renewal of the crediting period, the following data should be updated according to default values suggested in the most recently published IPCC Guidelines for National Greenhouse Gas Inventories:

- Oxidation factor (OX);
- Fraction of methane in the SWDS gas (F);
- Fraction of degradable organic carbon (DOC) that can decompose (DOCf);
- Methane correction factor (MCF);
- Fraction of degradable organic carbon (by weight) in each waste type j (DOCj);
- Decay rate for the waste type *j* (kj).

Respectively, if the most recent IPCC Guidelines suggest different categorization of waste types, solid waste disposal sites or climate conditions, these should be applied respectively.

B.6.3 Ex-ante calculation of emission reductions:

1. Baseline Emissions

1.1. $BE_{CH4,SWDS,y}$

By applying Equation 3 and Table 6, $BE_{CH4,SWDS,y}$ is calculated as follows.

Table 11: Value of $BE_{CH4,SWDS,y}$

Year	**$BE_{CH4,SWDS,y}$ (tCO_2e)**
1	5,674
2	10,461
3	15,966
4	20,610
5	24,528
6	27,833
7	30,622
8	32,975

9	34,959
10	36,634

1.2. $MD_{reg,y}$

As per Section B.6.1., $MD_{reg,y}$ is not relevant to the Project.

1.3. $BE_{CH4,ww,y}$

By applying Equation 4 and Table 7, $BE_{CH4,ww,y}$ becomes:

Table 12: Value of $BE_{CH4,ww,y}$

Year	$BE_{CH4,ww,y}$ (tCO_2e)
1	2,507
2	2,507
3	3,155
4	3,155
5	3,155
6	3,155
7	3,155
8	3,155
9	3,155
10	3,155

2. Project Emissions

2.1. $PE_{transp,y}$

By applying Equation 6 and the values in Table 8, $PE_{transp,y}$ becomes 0 tCO_2e/yr.

2.2. $PE_{power,y}$

By applying Equation 7 and the values in Table 9, $PE_{power,y}$ becomes:

Table 13: Value of $PE_{power,y}$

Year	$PE_{power,y}$ (tCO_2e)
1	73
2	73
3	92
4	92
5	92
6	92
7	92
8	92
9	92

10	92

2.3. $PE_{comp,y}$

Applying Equation 8 and Table 10, $PE_{comp,y}$ is zero (0).

2.4. $PE_{runoff,y}$

As per Section B.6.1., as there will be no runoff water leaving the composting facility, $PE_{runoff,y}$ is not relevant.

2.5. $PE_{res\_waste,y}$

As per Section B.6.1., there is no anaerobic storage and/or disposal in a landfill of the compost, and therefore $PE_{res\_waste,y}$ is not relevant.

3. Leakage

Leakage is zero (0).

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

Table 14: Ex-ante estimation of emission reductions

Year	Estimation of baseline emissions (tCO_2e)	Estimation of project activity emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
1 (2011)	8,181	73	0	8,108
2 (2012)	12,968	73	0	12,895
3 (2013)	19,121	92	0	19,029
4 (2014)	23,765	92	0	23,673
5 (2015)	27,683	92	0	27,591
6 (2016)	30,988	92	0	30,896
7 (2017)	33,777	92	0	33,685
8 (2018)	36,130	92	0	36,038
9 (2019)	38,114	92	0	38,022
10 (2020)	39,789	92	0	39,697
Total (tonnes of CO_2e)	270,516	882	0	269,634

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$W_{j,x}$
Data unit:	t/yr
Description:	Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x*

Source of data to be used:	Abedon
Value of data	14,697– 18,493 (dry basis)
Description of measurement methods and procedures to be applied:	EFB will be monitored, by weighing (wet basis) EFB at the hopper for each batch of EFB offloaded from the hopper into the trucks. As Abedon intends to conduct monthly on-site measurement by oven test to monitor moisture content of EFB, this result will be used to convert to dry basis weight. Paragraph 31 of AMS-III.F Version 08 stipulates that the composition of waste should be established through representative sampling. However, for the Project, since only the EFB portion is counted towards the methane avoidance calculation, only the EFB weight will be monitored for the purpose of $W_{j,x}$, thereby negating the need for representative sampling. The weights of the other biomass (decanter sludge and boiler ash) are not relevant to $W_{j,x}$ as they are not a part of the baseline calculations, i.e. methane avoidance is only claimed for EFB. These two weights however will be monitored for the parameter Q_y below, for the purpose of project emission calculations.
QA/QC procedures to be applied:	Load cells will be calibrated according to manufacturer's instructions.
Any comment:	It is noted that if Abedon does not carry out the monthly oven testing, wet basis measurement may be conducted instead of dry basis. Both wet- and dry-basis measurements are allowed according to the Methane Tool.

Data / Parameter:	f
Data unit:	Fraction
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner (equivalent to $MD_{reg,y}$ in paragraph 31 of AMS-III.F Version 08)
Source of data to be used:	Written information from the operator of SWDS (APOM) and/or site visits at the SWDS
Value of data	0
Description of measurement methods and procedures to be applied:	This will be monitored annually.
QA/QC procedures to be applied:	N/A
Any comment:	N/A

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of methane
Source of data to be used:	Decisions under UNFCCC and the Kyoto Protocol
Value of data	21, for the first commitment period of the Kyoto Protocol
Description of	Decisions under UNFCCC and the Kyoto Protocol are to be monitored annually.

measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	N/A
Any comment:	N/A

Data / Parameter:	$Q_{ww,in,y}$
Data unit:	m^3
Description:	Volume of wastewater entering the co-composting facility in the year *y*
Source of data to be used:	Abedon
Value of data	15,120 – 19,620
Description of measurement methods and procedures to be applied:	Monitored by continuous magnetic flow meter at point of entering the co-composting facility / exiting Abedon mill.
QA/QC procedures to be applied:	Flow meter to be calibrated by independent entity, according to the frequency recommended by the flow meter supplier. If there is no recommendation from the supplier, calibration will be carried out every 12 months.
Any comment:	N/A

Data / Parameter:	$COD_{ww,untreated,y}$
Data unit:	$tCOD/m^3$
Description:	Chemical oxygen demand of the wastewater entering the co-composting facility in the year *y*
Source of data to be used:	Abedon
Value of data	0.05
Description of measurement methods and procedures to be applied:	COD content shall be monitored at least once a week. The COD measurement method recommended by the Malaysian Department of Environment, the American Public Health Association 5220 B 1995 method, or the World Health Organisation method. Abedon will adhere to one of these two methods.
QA/QC procedures to be applied:	Calibration will be carried out according to manufacturer's instructions.
Any comment:	N/A

Data / Parameter:	Q_y
Data unit:	t/yr (wet basis)
Description:	Quantity of raw waste in the year *y*
Source of data to be used:	Abedon
Value of data	33,868 – 42,618
Description of measurement methods and procedures to be applied:	Total wet basis quantity of biomass feed to the co-composting facility.

QA/QC procedures to be applied:	APOM's weighbridge is calibrated according to industry standard. Refer to $W_{j,x}$ for QA/QC for load cells.
Any comment:	N/A

Data / Parameter:	$Q_{treatment,i,y}$
Data unit:	t/yr
Description:	Quantity of residual waste / products and/or compost *i* produced in year *y*
Source of data to be used:	Abedon
Value of data	7,838 – 9,836
Description of measurement methods and procedures to be applied:	Monitored via logs of compost product sales.
QA/QC procedures to be applied:	Can be checked against actual number of truck trips made as this parameter and the parameter $CT_{treatment,i,y}$ are only relevant *ex post* to arrive at the number of truck trips.
Any comment:	N/A

Data / Parameter:	$CT_{treatment,i,y}$
Data unit:	t
Description:	Average truck capacity for residual waste / products / compost *i* transportation
Source of data to be used:	Abedon
Value of data	4
Description of measurement methods and procedures to be applied:	Average capacity of truck fleet transporting the compost product out of the Project site will be updated annually.
QA/QC procedures to be applied:	Can be checked against actual number of truck trips made as this parameter and the parameter $Q_{treatment,i,y}$ are only relevant *ex post* to arrive at the number of truck trips.
Any comment:	N/A

Data / Parameter:	$DAF_{treatment,i}$
Data unit:	km/truck (return)
Description:	Average distance for residual waste / products / compost *i* transportation
Source of data to be used:	Abedon
Value of data	20
Description of measurement methods and procedures to be applied:	Distance to destination will be measured once, for each recipient.
QA/QC procedures to be applied:	N/A
Any comment:	N/A

Data / Parameter:	EL_{cons}
Data unit:	MWh/yr
Description:	Quantity of electricity used to operate the Project facilities
Source of data to be used:	Abedon
Value of data	2,608 – 3,282
Description of measurement methods and procedures to be applied:	This parameter will be measured continuously by electricity meters. Alternatively the consumption can be calculated by assuming that all relevant electrical equipment operate at full rated capacity for 8,760 hours per year, with 10% added to account for distribution losses.
QA/QC procedures to be applied:	Industry standards will be adhered to for calibration. In the absence of industry standards, the electricity meters will either be calibrated or replaced every 12 months.
Any comment:	The Project plans to use carbon-neutral electricity provided by APOM. However, during times such as shutdown of APOM's milling operations, the Project may import diesel-based power. In such as case, separate electricity meters will be installed for each source and EL_{cons} will therefore be the sum of the two meters.

Data / Parameter:	FF_{cons}
Data unit:	L/yr
Description:	Quantity of fossil fuel used to operate the Project facilities
Source of data to be used:	Abedon
Value of data	26,080 – 32,817
Description of measurement methods and procedures to be applied:	Diesel will be used to power machinery such as front end loaders. Diesel will be drawn from APOM's diesel refuelling station, which will monitor the amount of diesel used by the Project.
QA/QC procedures to be applied:	Readings from APOM's refuelling point will be consistent with the purchase receipt issued by APOM.
Any comment:	N/A

Data / Parameter:	$EF_{composting}$
Data unit:	tCH_4/t waste treated (dry basis)
Description:	Emission factor for composting of organic waste
Source of data to be used:	Abedon; AMS-III.F Version 08
Value of data	0
Description of measurement methods and procedures to be applied:	$EF_{composting}$ can be set to zero (0) for the portions of Q_y for which the monitored oxygen content of the composting process is above 8%. For this purpose a portable oxygen meter with lancets of at least 1m length will be used. There will be 14 modules each filled daily and with a composting period of 14 days. Thus, at any one time, the 14 modules will represent the different stages of the composting process. A weekly sampling of all 14 modules will be carried out.
QA/QC procedures to be applied:	The oxygen device will be calibrated in accordance with manufacturer's recommendation. If there is no recommendation for calibration frequency,

	calibration will be carried out every 12 months.
Any comment:	If $EF_{composting}$ is not monitored, then the default values of 0.01kgCH_4/kg waste (dry basis) or 0.004kgCH_4/kg waste (wet basis) may be applied instead.

Data / Parameter:	Operation of the composting facility
Data unit:	-
Description:	Operation of the composting facility
Source of data to be used:	Abedon
Value of data	-
Description of measurement methods and procedures to be applied:	The operation of the composting facility will be documented in a standard operation procedure (SOP), monitoring the conditions and procedures that ensure the aerobic condition of the waste during the composting process. The draft SOP was shown to the DOE during the validation site visit and will be finalized prior to the commercial operation of the Project. That the composting process occurs under aerobic condition is also explained under Section A.4.2, in relation to the AeroPod™ technology.
QA/QC procedures to be applied:	N/A
Any comment:	N/A

Data / Parameter:	Soil application of the compost product
Data unit:	-
Description:	Soil application of the compost product
Source of data to be used:	Abedon
Value of data	-
Description of measurement methods and procedures to be applied:	This includes documenting sales or delivery of the compost final product. It shall also include an in situ verification of the proper soil application of the compost/slurry to ensure aerobic conditions for further decay. Such verification shall be done at representative sample of user sites.
QA/QC procedures to be applied:	N/A
Any comment:	N/A

Data / Parameter:	Condition of SWDS
Data unit:	-
Description:	Condition at SWDS where the waste would in the absence of the project activity be dumped
Source of data to be used:	SWDS operator
Value of data	-
Description of measurement methods and procedures to be applied:	This involves an annual assessment of the conditions at the SWDS, as per p7 of the Methane Tool.
QA/QC procedures to be applied:	N/A

Any comment:	N/A

B.7.2 Description of the monitoring plan:

1. Implementation of the monitoring plan

Abedon staff will be responsible for implementation of the monitoring plan. The planned operation and management structure for the Project is described in Figure 5 below.

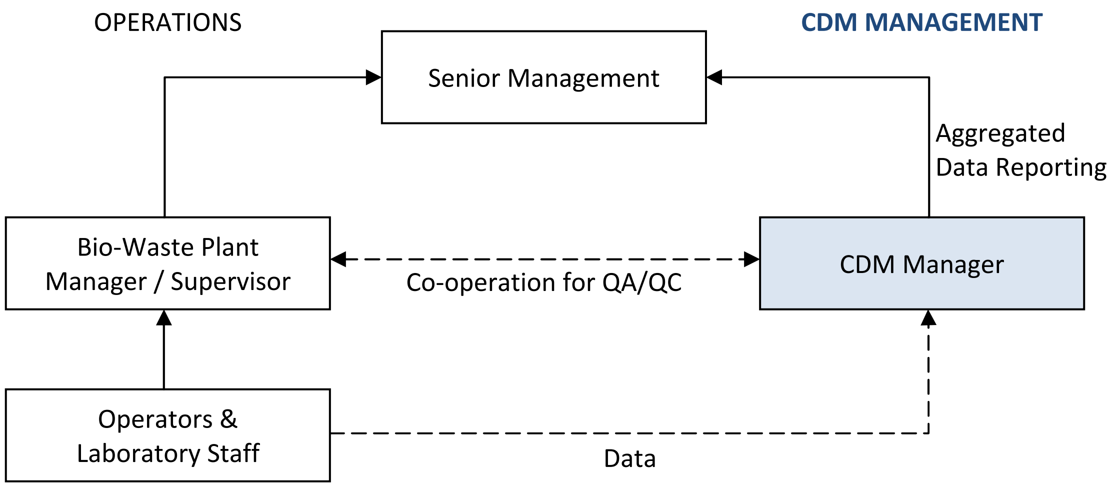

Figure 5: Operation and Management Structure for Monitoring Activities

2. Staff training

Staff will be trained on the safe and proper operation of major equipments such as the shredder, mixer, screener and AeroPod™, and will also be trained on the monitoring equipment installed. Such training will be carried out prior to the commissioning of the Project plant, and will be documented. Training has been ongoing since June 2010.

3. Data recording and archiving

(a) Data recording

Recording will be done online for as many parameters as possible, though the exact meters to be connected is yet to be determined. For manual records (including backup manual recording when there is an error with the online system for parameters normally recorded online), recording will be carried out once daily where measurement is continuous, and as and when measurements occur for when measurement is done on batch basis (e.g. weekly COD measurements)

(b) Data archiving

All monitored data will be archived for the duration of the crediting period and 2 years thereafter.

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

The baseline study was completed in 26/07/2010

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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:

10/11/2009

The starting date of the project activity is defined as the day on which Abedon sent the confirmation letter to appoint the quantity surveyor, the first contractor to be appointed for the Project. The company is responsible for, among other tasks, contractor coordination, project scheduling, process equipment procurement and project commissioning.

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

10 years

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

C.2.1. Renewable crediting period

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

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/08/2011 or the date of CDM registration, whichever is later.

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

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

Under Malaysian law, namely the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987[8], there is no requirement for an environmental impact assessment or similar assessment in relation to the Project.

The project activity will contribute major positive environmental impacts to the neighboring environment and neighboring residences. The impacts are as follows:

- Elimination of the need to landfill EFB, decanter sludge and boiler ash, and reduction in the order of 10% the amount of POME flowing to the open lagoon system. Both result in a reduction of GHGs (methane) emitted during the decomposition process and the accompanying pungent stench from the putrefying wastes.

- Reduction of leachate currently running off from the landfill, by co-composting in a zero-discharge system.

- Reduced use of chemical fertilizers by the end users. The use of replacement bio-fertilizer product will improve soil conditions in the oil palm plantations and will reduce the run-off of chemicals associated with the use of chemical fertilizers.

No negative environmental impacts are identified in relation to the project activity.

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:

As stated in Section D.1. above, no EIA or similar assessment is required under Malaysian regulations.

[8] http://www.doe.gov.my/v2/files/penilaian26/Appendix_2.pdf

SECTION E. Stakeholders' comments

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

The local stakeholder forum for the Project was organized on 8 June 2010, at the Bumiwealth Office in Kinabatangan, Sabah. Kinabatangan is a small town to the North West of Lahad Datu, as can be seen in Figure 1 in Section A.4.1.4.

The forum was advertised via local newspapers, targeting the general population. In addition to the newspaper advertisements, private invitations by letters were made to 12 invitees, comprising the local authorities, district offices, Department of Environment, NGOs, local village chief and schools.

On the day, there were 61 registered attendees. In addition, a reporter from the "Daily Express" newspaper attended the session and later published the contents of the event[9].

Figure 6: Stakeholders listening to presentation of Project (in Malay language)

The meeting agenda was as follows:

8:45 am	Arrival of participants
9:00 am	Registration
9:15 am	Morning coffee
9:45 am	Welcome speech
10:00 am	Presentation of Abedon Enviro Bio-Waste Composting Project
10:30 am	Question/Answer and Comment

[9] "Bio-waste composting project in Lahad Datu proposed", Daily Express, 13 June 2010.

10:45 am Tea Break
11:00 am End

The presentation of the Project consisted of (1) a description of the palm oil milling process itself in order to explain the various waste streams, (2) an explanation of the current disposal pathway of the waste streams (solid wastes to landfill, liquid wastes to open lagoons) and (3) a detailed description of the proposed Project, including the major equipments, process flow, and building layout.

A questionnaire (voluntary) was also distributed during the session. Results of this and the Q&A session are summarized in Section E.2.

E.2. Summary of the comments received:

During the Q&A session, in addition to questions about the composting process and product, questions about the environmental performance of the Project were raised. Questions and answers are summarized below.

Table 15: Questions and answers relating to environmental performance

	Question Raised	Answer Provided
1.	How leachate and odours from the composting process will be managed.	The Project will not discharge leachate or create odour as all leachate will be recycled and the process is aerobic composting.
2.	Whether the compost product will contain chemicals and whether it is necessary to apply chemical fertilizer in addition to compost product to the plantations.	The organic fertilizer is free of chemicals. A detailed study will be conducted with a competent entity to formulate a fertilizing programme to properly apply this organic fertilizer.
3.	Whether there will be any discharge by the Project, to the already-polluted river.	The composting plant process will use up the palm oil mill waste and there will be no leachate released or waste disposed of, so the Project will not cause pollution to the river.

For the voluntary questionnaire, 19 attendees chose to provide feedback. Of the 19 respondents, 12 were in favour of the project implementation, 7 were neutral, and nobody was against the Project.

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

As all questions raised were answered during the stakeholder consultation forum, no further action was deemed necessary.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

N/A.

Annex 3

BASELINE INFORMATION

N/A. Please see section B.6.

Annex 4

MONITORING INFORMATION

N/A. Please see section B.7.

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