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

CONTENTS

Revision history of this document

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

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Lowpal Timbers Wood Waste to Energy Project in Sabie, South Africa
Version Number: 1
Date: 17 September 2009

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

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The project will generate 2 MW net of electricity from wood waste at Lowpal Timbers near Nelspruit, South Africa. The project consists of two parts, each resulting in emission reductions: Methane Avoidance and Electricity Generation.

Methane Avoidance

Wood waste is generated as part of the daily operations (sawmilling process) of Lowpal Timbers. Currently, wood waste is stockpiled and allowed to decompose anaerobically. The stockpile has existed for 13 years and the average age of the waste in the stockpile is 6 and a half years. The wood waste is milled and fed to a pelletizer to make biomass pellets. The utilisation of the waste will avoid the generation of methane emissions resulting from anaerobic decomposition.

Electricity Generation

The biomass pellets will be gasified to generate producer gas (synthesis gas). This gas will be combusted in Shandong internal combustion engines to generate electricity. Since the wood waste originates from sustainably managed plantations (FSC certified), '*that remains a forest, and undertake sustainable management practices to ensure the level of carbon stock and comply with national nature conservation regulations'*, it can be classified as renewable in accordance with EB23 Annex 18.

The electricity will be generated on site and tie into the national grid. The electricity generated from this renewable source will displace grid electricity. The South African national grid is based on low grade coal; therefore it has a high emission factor relative to the emission factor of the national grid.

The pelletizing and electricity generation process is depicted below:

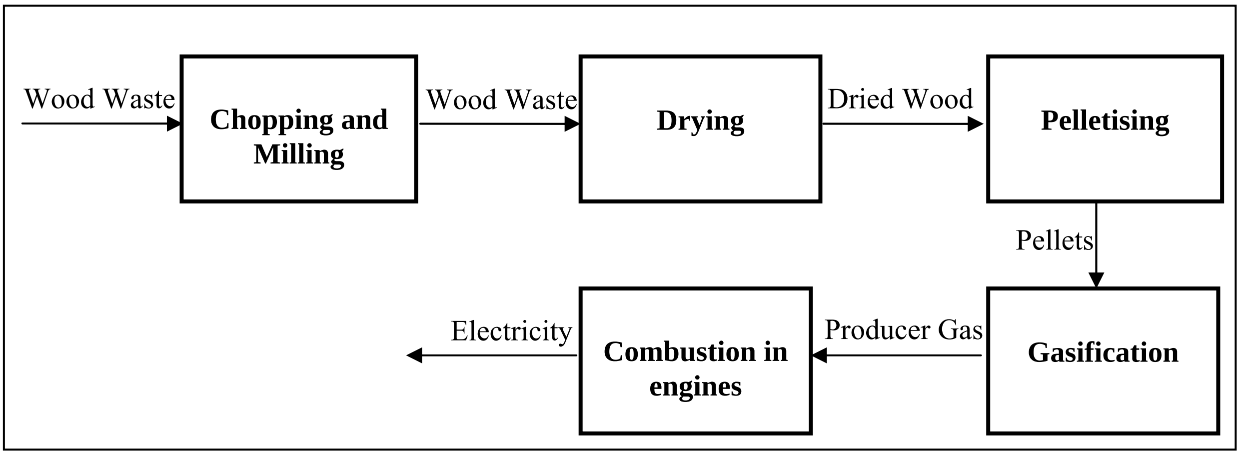

Figure 1: The electricity generation process at Lowpal Timbers

The project makes positive contributions to sustainable development. The South African Designated National Authority (DNA) evaluates sustainability in three categories: Economic, environmental and social. The contribution of the project towards sustainable development in South Africa is discussed in terms of these three categories:

Economic:

- The project will contribute to foreign reserve earnings for South Africa via the revenue from the sale of the carbon credits.
- The project will create employment opportunities in the area.

Environmental:

- The project will avoid the anaerobic decomposition of biomass; thereby avoiding the release of methane.
- The project reduces the amount of wood waste that is stockpiled; resulting in a reduced risk of fires.
- At a regional level, the project will have a positive impact on the environment. This positive impact relates to a reduction in the generation of coal-based electricity and its associated environmental consequences. These consequences include: the impact of coal mining, the utilisation of scarce water resources, SO_2 emissions and the impacts associated with the disposal of coal ash.
- The production of the biomass pellets is environmentally friendly as there is no harmful additives, no air pollution and no harmful waste products.

Social:

- The project will require labour during the construction phase of the project. A number of new permanent positions will also be created in the operational phase of the project.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa (host)	EECO Fuels Renewable Fuels Company	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.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

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

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

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A.4.1.1. Host Party(ies):

>> South Africa

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

>> Mpumalanga Province

A.4.1.3. City/Town/Community etc:

>> Nelspruit

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

>> The location of the project is shown below:

Project Site

Figure 1: The Lowpal Timbers site is situated near Nelspruit in South Africa

Figure 2: The Location of the Lowpal Timbers site (http://maps.google.com)

Project Site

The GPS co-ordinates of the site are:
24°32’40 S
30°22’36 E

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

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The project can be divided into two sections. The first section is the avoidance of methane from the use of the wood waste. The second section is the generation of electricity from a renewable source. The project will be discussed in these two sections.

Avoidance of Methane

This section of the project will be registered in Sectoral Scope 13 under AMS III. E: “*Avoidance of methane production from decay of biomass through controlled combustion, gasification, or mechanical/thermal treatment*” (Version 16).

This project involves the pelletizing of wood waste from four different sources:

1. Lowpal Timbers has been stockpiling wood waste in the form of sawdust and off-cuts since 1996. The waste is allowed to undergo anaerobic decomposition; generating methane. The use of this wood waste will avoid the generation of methane and result in emission reductions.
2. The freshly generated sawdust would have been stockpiled on site and left to decay under anaerobic conditions. This sawdust will be pelletized and used as fuel. It will no longer be stockpiled and allowed to produce methane by decomposing anaerobically. The avoidance of methane will result in emission reductions.

3. The plantation waste is also left to decay in the plantation under anaerobic conditions. This plantation waste will be collected and pelletized.
4. The freshly generated off-cuts are currently chipped and sold to Novoboard. If these off-cuts are used in the project activity then the volume of off-cuts used in the project will be monitored and no methane avoidance carbon credits will be claimed for the use of these off-cuts. Electricity generation credits will still be claimed as the off-cuts are from a renewable source and avoid the use of grid electricity.

The biomass pelletizing process is as follows:

- The wood waste will be milled using hammer mills. The milling is only a requirement for the larger wood waste off-cuts and not for the sawdust.
- The wood will then be dried in dryers using hot exhaust gas from the combustion engines.
- The dried wood waste will be fed to the pelletizer via conveyor belt. The pelletizer compresses the wood material, causing the lignin to liquefy. The lignin then acts as “natural glue” and holds the pellet together when it cools and sets.

Generation of Electricity

This section of the project will be registered in Sectoral Scope 1 under AMS I. D: “*Grid connected renewable electricity generation*” (Version 14).

The pellets will be used to generate electricity; which will be fed into the electricity grid. The production of electricity is as follows:

- The pellets are gasified in downdraft gasifiers to form a carbon monoxide and hydrogen gas mixture called the producer gas.
- The producer gas is then combusted directly in the internal combustion engines. A number of internal combustion engines will be installed; each having an installed capacity of 500kW.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
2010	17,865
2011	18,222
2012	18,573
2013	18,916
2014	19,252
2015	19,552
2016	19,846
Total estimated reductions (tonnes of CO2e)	**132,244**
Total number of crediting years	**7 (renewable twice)**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**18,889**

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

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No public funding has been used or will be used in the development or the implementation of this project.

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

This project is not a debundled component of a large project activity. There are no other projects in the area that use the same technology or have the same project participant. This is the first CDM project by EECO Fuels. Evaluation of this project against the debundling criteria is contained in the table below:

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 an application to register another small-scale CDM project activity:	**The Lowpal Timbers Wood Waste to Energy Project**
(a) With the same project participants	This is the first CDM project in which EECO Fuels is the project participant. There have been no other CDM projects implemented at Lowpal Timbers.
(b) In the same project category and technology/measure; and	This is the first EECO Fuels project that generates electricity from wood waste.
(c) Registered within the previous 2 years, and	No small-scale CDM project activity with the same technology has been registered within the previous two years of the expected start date of this project.
(d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point?	The project at Lowpal Timbers will be the first CDM project in the area. There are no other CDM projects within 1km of this project.

The text in italics is from the *Compendium of guidance on the debundling for SSC project activities* (Annex 27, EB 36).

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 can be divided into two sections: Methane Avoidance and Electricity Generation. Each section will use a separate methodology:

The following approved consolidated methodologies are applied to this project:

Methane Avoidance
AMS III. E: "Avoidance of methane production from decay of biomass through controlled combustion, gasification, or mechanical/thermal treatment" (Version 16)

Electricity Generation
AMS I. D: "Grid connected renewable electricity generation" (Version 14)

Tools
The following tools were used:

- Tool for the demonstration and assessment of additionality (Version 05.2), and
- The tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site (Version 4)
- Tool to calculate the emission factor for an electricity system (Version 01.1)

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

>> The project fits the applicability criteria of both methodologies as set out below:

Methane Avoidance

The methodology AMS III E is applicable under the following conditions:	Lowpal Timber Wood Waste to Energy Project
The project comprises measures that avoid the production of methane from biomass or other organic matter that: *a) would have been left to decay under clearly anaerobic conditions* *b) is already deposited in a waste disposal site without methane recovery*	This project avoids methane production through the use of existing stockpiles, freshly generated waste and plantation waste: The existing stockpiles do not have methane recovery. The freshly generated sawdust would have been stockpiled and left to decay under anaerobic conditions. The plantation waste is also left to decay under anaerobic conditions. The freshly generated off-cuts are currently chipped and sold to Novoboard. If these off-cuts are used in the project activity then the volume of off-cuts used in the project will be monitored and no methane avoidance carbon credits will be claimed for the use of these off-cuts. Electricity

The methodology AMS III E is applicable under the following conditions:	**Lowpal Timber Wood Waste to Energy Project**
	generation credits will still be claimed as the off-cuts are from a renewable source and the use of grid electricity is avoided.
Due to the project activity, decay of the wastes of type referred to in the eligibility criteria stated in (a) or (b) above is prevented through one of the following measures: *a) Controlled combustion;* *b) Gasification to produce syngas/producer gas;* *c) Mechanical/thermal treatment to produce refuse-derived fuel (RDF) or stabilized biomass*	The wood waste is pelletized under high mechanical pressure. This process is described in more detail in Section A.4.2. The pellets are gasified in internal combustion engines to generate producer gas.
The produced RDF/SB shall be used for combustion either on site or off-site	The pellets will be gasified to generate producer gas. The producer gas will be combusted in engines to generate electricity. The electricity will be generated on site and tie into the national grid. The emission reductions from displacing gird electricity will be covered in this project under AMS I.D.
In the case of stockpiles of wastes baseline emission calculations as described in the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" shall be adjusted.	The avoided methane emissions from the existing stockpiles on site will be calculated by using the adjusted "Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" (Version 4).
Measures are limited to those resulting in emission reductions of less than or equal to 60kt CO_2 equivalent annually.	The emission reductions from both the methane avoidance and the electricity generation are less than 60kt CO_2 equivalent annually.
Where in the baseline usually there is a reduction in the amount of waste through regular open burning or removal for other applications, the use of the "tool to determine methane emissions avoided from dumping waste at a solid waste disposal site" shall be adjusted to take account of this burning or removal in order to estimate correctly the baseline emission.	There is no regular open burning of the waste as Lowpal Timbers was not granted the permit needed to burn the waste. Therefore, they had to stockpile the sawdust and off-cuts. A sprinkler system has been installed to prevent the combustion of the off-cuts. The freshly generated sawdust is currently stockpiled. The freshly generated off-cuts are currently chipped and sold to Novoboard. If

The methodology AMS III E is applicable under the following conditions:	**Lowpal Timber Wood Waste to Energy Project**
	these off-cuts are used in the project activity then no methane avoidance carbon credits will be claimed for the use of these off-cuts.
The project activity does not recover or combust methane unlike AMS III.G. Nevertheless, the location and characteristics of the disposal site in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions.	The project activity will not involve recovering or combusting methane. The location and characteristics of the disposal sites are known as the wood waste is stockpiled on site and the plantation waste is allowed to decompose in-situ (in the plantations).
If the project activity involves combustion, gasification or mechanical/thermal treatment of partially decayed waste mined (i.e. removed) from a solid waste disposal site in addition to freshly generated waste the project participants shall demonstrate that there is adequate capacity of the combustion, gasification or mechanical/thermal treatment facility to treat the newly generated wastes in addition to the partially decayed wastes removed from the disposal site. Alternately justifications for combusting, gasifying or mechanically/thermally treating the partially decayed wastes instead of the newly generated wastes shall be provided.	The project will make use of the stockpiled waste, freshly generated sawdust and the plantation waste initially. The freshly generated off-cuts will only be used once the existing stockpiles are consumed. The reason for this is that the freshly generated off-cuts are currently chipped and sold to Novoboard. Lowpal Timbers will most likely continue to supply this chipped wood to Novoboard until such time as the waste wood on site is consumed.
If the combustion facility, the produced syngas, producer gas or RDF/SB is used for heat and electricity generation within the project boundary, that component of the project activity shall use a corresponding methodology under Type I project activities.	The electricity generation will be developed under AMS I.D.
In case of RDF/SB production, project proponents shall provide evidence that no GHG emissions occur, other than biogenic CO_2, due to chemical reactions during the thermal treatment process for example limiting the temperature of thermal treatment to prevent the occurrence of pyrolysis and/or the stack gas analysis.	No other GHG emissions occur due to chemical reactions during pellitizing. The wood waste is pelletized under high mechanical pressure. No pyrolysis can occur under the design specifications of the equipment. This process is described in detail in Section A.4.2.
In case of gasification, the process shall ensure that all the syngas produced, which may contain non-CO_2 GHG, will be combusted and not released unburned	The wood waste is pelletized. The pellets are gasified to generate producer gas. The generation of electricity is covered under AMS

The methodology AMS III E is applicable under the following conditions:	**Lowpal Timber Wood Waste to Energy Project**
to the atmosphere. Measures to avoid physical leakage of the syngas between the gasification and combustion sites shall also be adopted.	I.D in accordance with the project boundary.
In case of RDF/SB processing, the produced RDF, SB should not be stored in such a manner as resulting in high moisture and low aeration favouring anaerobic decay. Project participants shall provide documentation showing that further handling storage of the produced RDF/SB does not result in anaerobic conditions and do not lead to further absorption of moisture.	The pellets will be used for electricity generation. If there are excess pellets then they will be stored for a short period of time in such a manner as to avoid decomposition.
In case of RDF/SB processing, local regulations do not constrain the establishment of RDF/SB production plants/thermal treatment plants nor the use of RDF/SB as fuel or raw material.	There are no local regulations that constrain either the establishment of pelletizing plants or the use of pellets as fuel.
During the mechanical/thermal treatment to produce RDF/SB no chemical or other additives shall be used.	No chemicals or other additives will be used to produce the pellets during the project activity.
In case residual waste from controlled combustion, gasification or mechanical/thermal is stored under anaerobic conditions and/or delivered to a landfill emissions from the residual waste shall be taken into account using the first order decay model (FOD) described in AMS III.G.	The residual waste arising from the project will not be stored anaerobically or delivered to a landfill.

The project meets all the conditions set forth in the approved small-scale methodology III E. Hence, the selected methodology is appropriate for the project activity.

Electricity Generation

The methodology AMS I D is applicable under the following conditions:	**Lowpal Timber Wood Waste to Energy Project**
This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass, that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit.	Renewable biomass pellets will be gasified to generate producer gas; which will be combusted in internal combustion engines to generate electricity. The electricity will be generated on site and will tie into the national grid. The electricity will displace fossil-fuel based electricity from the national grid. In 2008, there were 12 coal-fired power stations supplying electricity to the grid.
If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The gasifiers and engines do not have a non-renewable component. They do not co-fire fossil fuel. There will be electricity and LPG used for the start-up of the plant. This will be included in the project emissions.
Combined heat and power (co-generation) systems are not eligible under this category.	The electricity generation plant will only export electricity.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The project activity does not include the addition of a renewable energy generating unit at an existing renewable power generating facility. This is the first electricity generation plant on site. There is a generator that is used only when there are power cuts from the national grid.
Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small-scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15MW.	The project does not involve retrofitting or modifying an existing facility. The project activity is a new facility.

The project meets all the conditions set forth in the approved small-scale methodology I D. Hence, the selected methodology is appropriate for the project activity.

B.3. Description of the project boundary:

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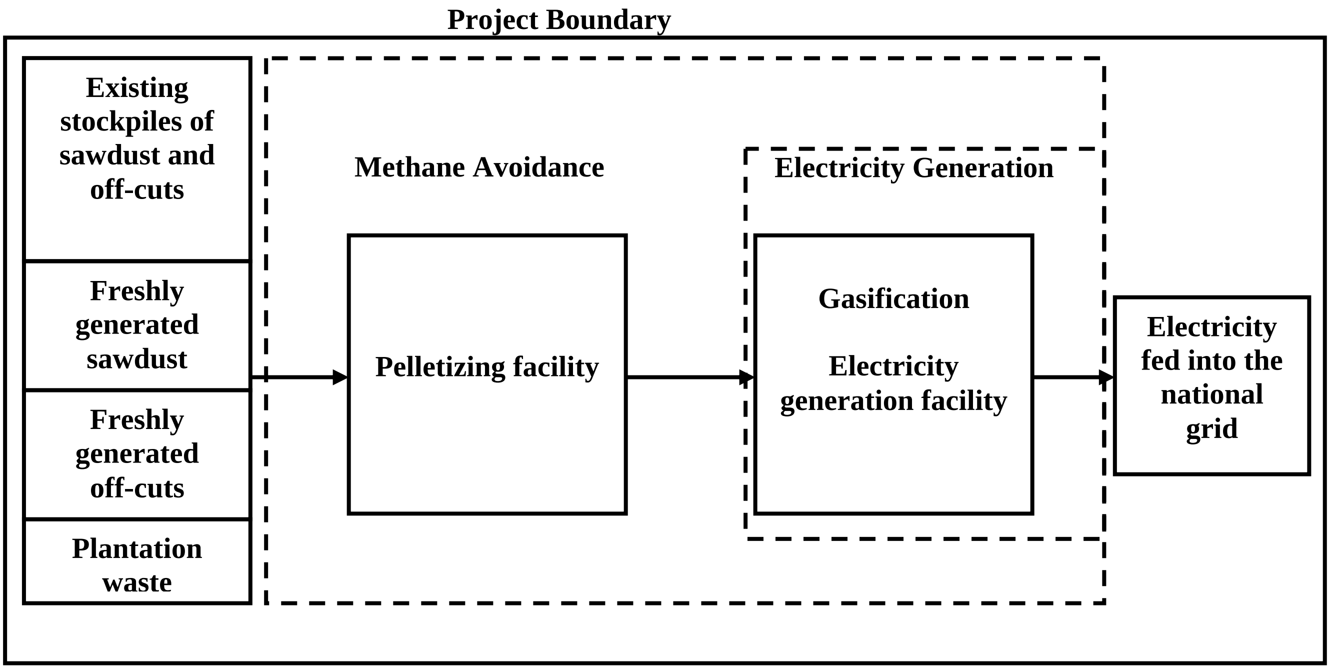
In accordance with both methodologies, the spatial extent of the project boundary includes the following:

- The collection points for the raw materials:
  - Stockpile of sawdust;
  - Stockpile of wood off-cuts;
  - Freshly generated sawdust;
  - Freshly generated wood-off-cuts that has not been stockpiled;
  - Plantation and forest waste from the surrounding plantations. Only plantations, from which Lowpal Timbers have been collecting timber for at least a year prior to the start date of the project activity, will be included.
- The waste disposal site where the raw material would have been left to decompose in the absence of the project activity.
- The pelletizing plant.
- The power generation plant including the gasifiers and engines.
- The national grid for the purpose of determining the grid emission factor.



B.4. Description of baseline and its development:

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The development of an appropriate baseline scenario is done through the identification of alternative scenarios and barrier analysis on those scenarios.

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

Sub-step 1a: Define alternatives to the project activity

Alternative scenarios for the raw material

For the purpose of determining the baseline, the various raw materials have been considered individually:

Stockpiled off-cuts and sawdust

1. Leave to decompose anaerobically and generate methane (do nothing scenario);
2. Leave to decompose and capture the methane;
3. Burn the waste on the stockpiles; or
4. Pelletize stockpiled waste and use pellets for electricity generation.

Freshly generated sawdust

5. Stockpile on site and leave to decompose anaerobically and generate methane (do nothing scenario);
6. Stockpile on site and leave to decompose anaerobically and capture the methane;
7. Burn the sawdust; or
8. Pelletize the sawdust and use the pellets for electricity generation.

Freshly generated off-cuts

9. Stockpile on site and leave to decompose anaerobically and generate methane;
10. Stockpile on site and leave to decompose anaerobically and capture the methane;
11. Burn the off-cuts
12. Chip the off-cuts and sell them to a third party; or
13. Pelletize the off-cuts and use the pellets for electricity generation.

Plantation waste

14. Leave to decompose anaerobically in the plantations and generate methane;
15. Leave to decompose anaerobically in the plantations and capture the methane;
16. Pelletize the plantation waste and use the pellets for electricity generation.

Alternative scenarios for electricity generation:

17. Fossil fuel based electricity from the South African national grid (business as usual);
18. New fossil fuel based power plant; or

19. New renewable energy power plant using other renewable energy sources

Alternative scenarios for the project:

20. The proposed project undertaken as a CDM project
21. The proposed project not undertaken as a CDM project

Sub-step 1b: Consistency with mandatory laws and regulations:

The following alternative scenarios do not comply with mandatory laws and regulations:

Stockpiled off-cuts and sawdust

3. Burn the waste on the stockpiles

Freshly generated sawdust

7. Burn the sawdust

Freshly generated off-cuts

11. Burn the off-cuts

Lowpal Timbers were not granted the necessary permit to burn the waste. Hence, they are not legally allowed to burn the waste. Therefore, scenario 3, 7 and 11 can be eliminated as feasible baseline options.

Step 3: Barrier analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the alternative scenarios

The barriers to the alternative scenarios are identified below:

Stockpiled off-cuts and sawdust

1. Leave to decompose anaerobically and generate methane (do nothing scenario)

This option faces no barriers as can be seen from the fact the Lowpal Timbers has been stockpiling the waste since 1996. This is current practice at Lowpal Timbers. Hence, this is a plausible baseline option for the stockpiled off-cuts and sawdust.

2. Leave to decompose and capture the methane

The capturing of the methane would require capital investment. The methane would need to be concentrated and piped to a central point. In addition, there are safety concerns about capturing and using methane. The dangers of methane are elaborated: "*Methane can be dangerous because the mixture of methane and air in a confined area can create explosive conditions! If the amount of methane in the air reaches 5 to 15 percent, an explosion can occur. If the amount of methane in the air increases even more, it can be flammable...Higher concentrations of methane in the air can also be dangerous because there is* *not enough oxygen for people to breathe*[1]." This safety risk is increased by the lack of experience of personnel at Lowpal Timbers with methane gas. Hence, this is not a plausible baseline alternative.

3. Burn the waste on the stockpiles

This has been eliminated as a plausible baseline alternative as it is not in compliance with mandatory laws and regulations.

4. Pelletize stockpiled waste and use pellets for electricity generation

Pelletizing the wood waste is not business as usual. This option would require capital investment in the form of milling and pelletizing equipment. Hence, this is not a plausible baseline alternative.

Hence, the baseline for the stockpiled sawdust and off-cuts is option 1; which is to leave to the stockpiled waste to decompose anaerobically and generate methane (do nothing scenario).

Freshly generated sawdust

5. Stockpile on site and leave to decompose anaerobically and generate methane (do nothing scenario)

This is common practice at Lowpal Timbers. The sawdust that is generated as a result of the sawmilling operation has been stockpiled since 1996. This is a possible baseline scenario.

6. Stockpile on site and leave to decompose anaerobically and capture the methane

As can be seen in option 2 above, the capturing of methane is not common practice and creates a safety risk. Hence, this option can be eliminated as a baseline alternative.

7. Burn the sawdust

This has been eliminated as a plausible baseline alternative as it is not in compliance with mandatory laws and regulations.

8. Pelletize the sawdust and use the pellets for electricity generation

Capital investment for the pelletizing plant will be required. It is not common practice for a sawmilling operation to generate electricity as can be demonstrated by a letter from the sawmilling association of South Africa.

Hence, the baseline for the freshly generated sawdust is option 5; which is to stockpile the sawdust on site and leave the waste to decompose anaerobically and generate methane (do nothing scenario).

Freshly generated off-cuts

9. Stockpile on site and leave to decompose anaerobically and generate methane

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[1] Study Hall Webmaster. 21/6/2004. *Methane Background Information*. Available online from http://education.arm.gov/studyhall/globalwarming/methane.stm. [Accessed 11 August 2009].

A few years ago, Lowpal Timbers started chipping the freshly generated off-cuts and selling them to Novoboard. The purchase of the freshly generated off-cuts can be confirmed with Novoboard. Hence, stockpiling the freshly generated off-cuts on site is not a possible baseline scenario.

10. Stockpile on site and leave to decompose anaerobically and capture the methane
As can be seen in option 2 and 6 above, the capturing of methane is not common practice and creates a safety risk. Hence, this option can be eliminated as a baseline alternative.

11. Burn the off-cuts
This does not comply with mandatory laws and regulations. Hence, this is not a plausible baseline scenario.

12. Chip the off-cuts and sell them to a third party
The freshly generated off-cuts are currently chipped and sold to Novoboard. This contract has been in place for over three years. This is a possible baseline scenario.

13. Pelletize the off-cuts and use the pellets for electricity generation
Lowpal Timbers will need to purchase the pelletizing and the electricity generation equipment. This would require capital investment. This would also result in a diversification of the operation at Lowpal Timbers to include electricity generation. The operation of the equipment would require training and additional maintenance costs. This is not a baseline option.

Hence, the baseline for the freshly generated off-cuts is option 12; which is to chip the off-cuts and sell them to a third party.

Plantation waste
14. Leave to decompose anaerobically in the plantations and generate methane
The plantation waste is not collected from the plantation. The collection of the waste would require additional labour and cost. Historically, this waste has had no use, but Lowpal Timbers could use it in the project activity. Hence, this is a possible baseline alternative.

15. Leave to decompose anaerobically in the plantations and capture the methane
The capturing of methane on land that is not owned by Lowpal Timbers would require additional costs and labour. The plantation waste is left in the plantations to decompose. The methane that is generated is not captured. Methane is also a safety risk and if concentrated and not handled properly, it could result in fire in the plantations. This is not a baseline option.

16. Pelletize the plantation waste and use the pellets for electricity generation
The pelletizing and electricity generation equipment would require capital investment. The plantation waste would need to be collected and brought to the site. This will result in additional labour and cost. This is not a baseline option.

The baseline for the plantation waste is option 13; which is to leave the waste to decompose anaerobically in the plantations; generating methane.

Alternative scenarios for electricity generation:

17. Fossil fuel based electricity from the South African national grid (business as usual)
Lowpal Timbers already receives all of its electricity from the national grid and only has an emergency generator on site. Sourcing all the electricity from the national grid is common practice and, hence, this option is a plausible baseline scenario. Lowpal Timbers already has all equipment in place to receive electricity from the grid. There are no technological barriers associated with this scenario and no capital investment would be required. Since this scenario does not face any barriers, it is considered a plausible baseline scenario.

18. New fossil fuel based power plant
The possible fossil fuel options would be coal, diesel and HFO.

Electricity generation from coal, diesel and HFO would require equipment like gasifiers and engines. This equipment is costly as can be seen by the cost of the gasifiers and the internal combustion engines that will be used in the project activity.

It is not common practice for sawmills to generate electricity. The generation of electricity hinges on the supply of waste wood for fuel. Hence, the construction of a new fossil fuel power plant can be excluded as a possible baseline scenario.

19. New renewable energy power plant using other renewable energy sources
The electricity could be generated from wind or solar power. However, Lowpal Timbers has no experience in the generation of electricity from renewable energy. All electricity is sourced from the national grid.

In addition, there are no solar power plants in South Africa. Eskom are looking in to developing a 100MW solar power plant; which could be built in two years. If the plant is built, it will be the first solar power plant in South Africa and it will be built in Upington; which has the best solar resource[2]. Hence, solar power is not a feasible alternative for the sawmill.

Wind is also not a feasible option for the sawmill as the wind power potential in the area is rated as low.

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[2] Treevolution. 6 March 2009. *Eskom decision on solar power plant imminent*. Available from http://www.treevolution.co.za/?p=2621. [Accessed on 11 August 2009].

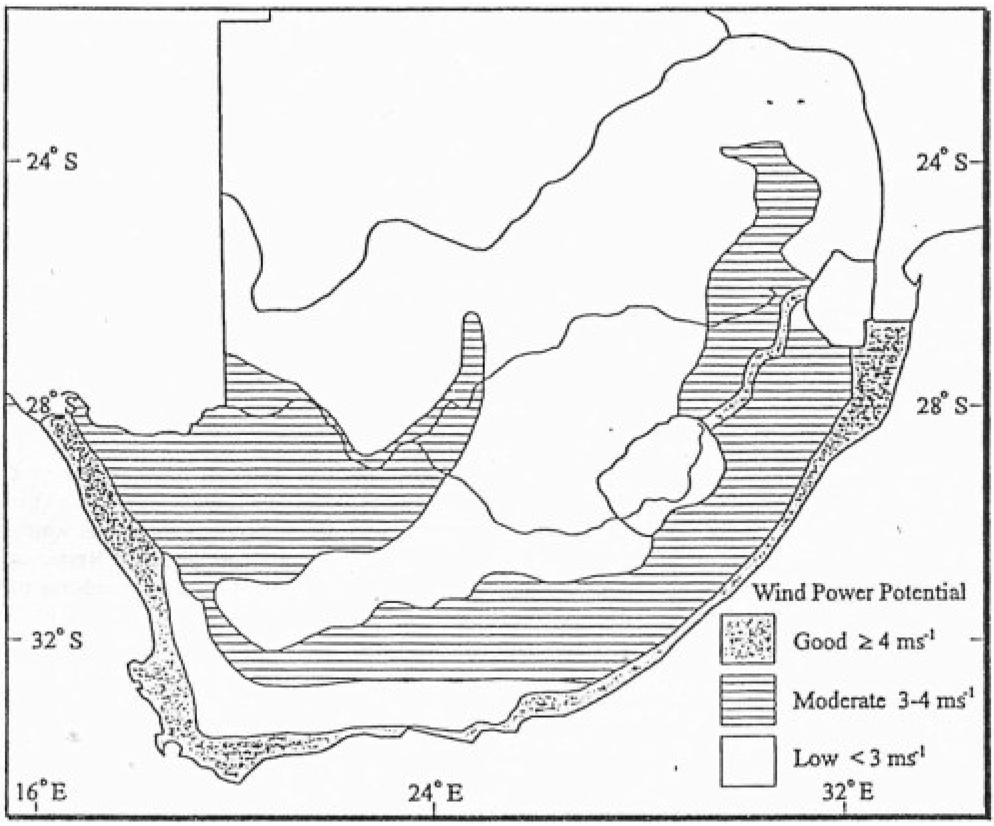

Figure 16: Wind Atlas of South Africa[3]

Generating electricity is not the core business of the sawmill and building and operating a renewable energy plant would require sourcing people with the right expertise. Generating electricity from renewable energies other than biomass would not use the wood waste on the site. Therefore, this alternative is not a credible and reliable alternative.

The baseline for the electricity generation is option 16; which is to obtain all electricity from the national grid.

Alternative scenarios for the project:

20. The proposed project undertaken as a CDM project

The project will require capital investment for the equipment (pelletizing plant and power generation plant). Hence, this cannot be considered a plausible baseline alternative.

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[3] Diab, R. (1995). *Wind Atlas of South Africa.* Department of Mineral and Energy Affairs, Pretoria, 136 pp.

21. The proposed project not undertaken as a CDM project

This alternative will also require capital investment as with the above option. Hence, this is not a plausible baseline alternative.

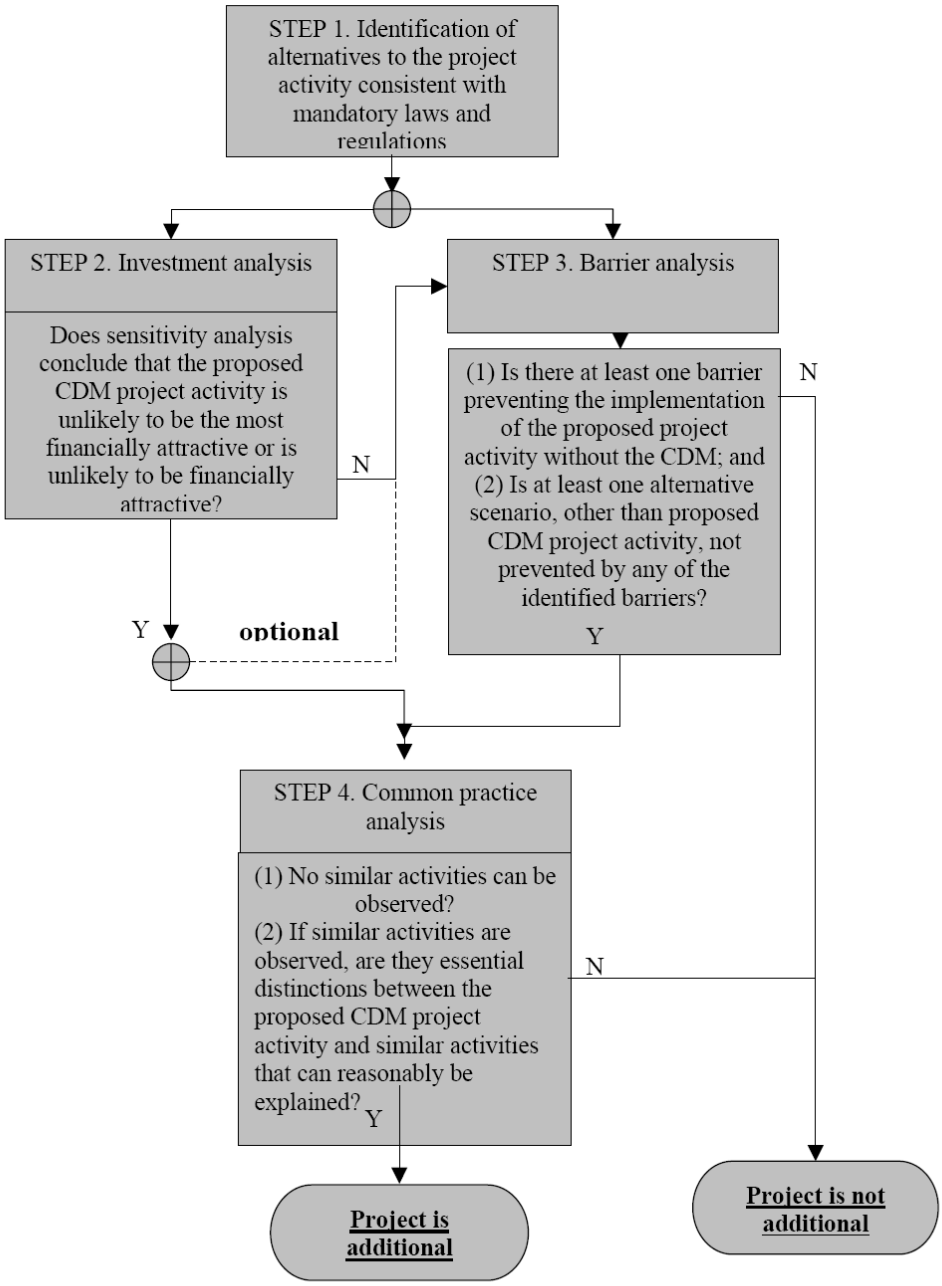
Conclusion

The baseline for the project is the following:

- The stockpiled sawdust and off-cuts would have been allowed to decompose anaerobically in the absence of the project.
- The freshly generated sawdust would have been stockpiled on the existing stockpiles and left to decompose; generating methane.
- The freshly generated off-cuts would have been chipped and sold to Novoboard; which will result in no methane generation in the absence of the project. Hence, the freshly generated off-cuts are not eligible for methane avoidance carbon credits.
- In the absence of the project activity, the electricity would have been imported from the national electricity grid.

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:

The stepwise approach of the methodological tool for demonstration and assessment of additionality was used, as shown in the diagram below, using step 1, step 3 and step 4.



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

<u>Sub-step 1a: Define alternatives to the project activity</u>

Alternative scenarios for the raw material

For the purpose of determining the baseline, the various raw materials have been considered individually:

<u>Stockpiled off-cuts and sawdust</u>

1. Leave to decompose anaerobically and generate methane (do nothing scenario);
2. Leave to decompose and capture the methane;
3. Burn the waste on the stockpiles; or
4. Pelletize stockpiled waste and use pellets for electricity generation.

<u>Freshly generated sawdust</u>

5. Stockpile on site and leave to decompose anaerobically and generate methane (do nothing scenario);
6. Stockpile on site and leave to decompose anaerobically and capture the methane;
7. Burn the sawdust; or
8. Pelletize the sawdust and use the pellets for electricity generation.

<u>Freshly generated off-cuts</u>

9. Stockpile on site and leave to decompose anaerobically and generate methane (do nothing scenario);
10. Stockpile on site and leave to decompose anaerobically and capture the methane;
11. Burn the off-cuts
12. Chip the off-cuts and sell them to a third party; or
13. Pelletize the off-cuts and use the pellets for electricity generation.

<u>Plantation waste</u>

14. Leave to decompose anaerobically in the plantations and generate methane;
15. Leave to decompose anaerobically in the plantations and capture the methane;
16. Pelletize the plantation waste and use the pellets for electricity generation.

Alternative scenarios for electricity generation:

17. Fossil fuel based electricity from the South African national grid (business as usual);
18. New fossil fuel based power plant; or
19. New renewable energy power plant using other renewable energy sources

Alternative scenarios for the project:

20. The proposed project undertaken as a CDM project
21. The proposed project not undertaken as a CDM project

<u>Sub-step 1b: Consistency with mandatory laws and regulations</u>

The following alternative scenarios do not comply with mandatory laws and regulations:

Stockpiled off-cuts and sawdust

3. Burn the waste on the stockpiles

Freshly generated sawdust

7. Burn the sawdust

Freshly generated off-cuts

11. Burn the off-cuts

Step 2: Investment analysis

A barrier analysis is performed in step 3.

Step 3: Barrier analysis

Section B.4 discusses the alternative scenarios and the barriers faced by each alternative. In addition, the project activity faces the following barriers:

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity

Investment barrier:

- The project requires funding of approximately R20 million for the purchasing of the pelletizing plant and the electricity generation plant.
- The cost of maintenance of the plant is an additional cost that is not incurred when purchasing electricity from the grid.

Technology barrier:

- Training will need to take place as it is not common practice for sawmills to operate power generation equipment.
- The engines are sourced internationally as is the pelletizing plant. The gasifiers are South African technology; which have been developed and patented by EECO Fuels. This patented technology has never been used in South Africa before and hence there are technology risks.

Barriers due to prevailing practice:

- Lowpal Timbers will be the first sawmill to generate electricity in South Africa.
- It is not common practice for a sawmill to generate its own electricity from wood waste.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of one of the alternatives (except the proposed project activity).

Step 4: Common Practice Analysis

This project is the first-of-its-kind in South Africa. There are no other sawmill that supply electricity to the grid. This is confirmed by a letter from the Sawmilling Association of South Africa.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The project is divided into two sections. The first section is the avoidance of methane from the use of wood waste. The second section is the generation of electricity from a renewable source.

The emission reductions for the first section were calculated using *“Type III.E. Avoidance of methane production from decay of biomass through controlled combustion, gasification, or mechanical/thermal treatment”.*

The second section emission reductions were calculated using *“Type I. D Grid connected renewable electricity generation”.*

Baseline Emissions

Section 1: Avoidance of methane

The baseline scenario is the situation where, in the absence of the project activity, organic waste matter is left to decay within the project boundary and methane is emitted to the atmosphere. The yearly baseline emissions are the amount of methane that would have been emitted from the decay of the cumulative quantity of the waste used by the project activity. These emissions were calculated using the “*Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*”.

The baseline emissions were calculated using Equation 4 (III.E):

$$BE_{y,1} = BE_{CH4,SWDS,y} \qquad (4)$$

Where:

$BE_{y,1}$ Baseline emissions at year “y” during crediting period (tCO_2e)

$BE_{CH4,SWDS,y}$ Yearly Methane Generation Potential of the wastes diverted to be disposed in the landfill from the beginning of the project (x=1) up to the year “y”, calculated according to the “*Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site*” (tCO_2e).

For the proposed project there are three sources of methane emissions: sawdust, wood off-cuts and plantation waste. Hence; the yearly methane generation potential from all the waste types combined can be calculated using Equation 4.1:

$$BE_{CH4,SWDS,y} = BE_{CH4,SWDS,y,SD} + BE_{CH4,SWDS,y,OC} + BE_{CH4,SWDS,y,PW} + BE_{CH4,SWDS,1,y} \qquad (4.1)$$

Where:

$BE_{CH4,SWDS,y,SD}$	Yearly Methane Generation Potential of the sawdust (tCO_2e)
$BE_{CH4,SWDS,y,OC}$	Yearly Methane Generation Potential of the off-cuts (tCO_2e)
$BE_{CH4,SWDS,y,PW}$	Yearly Methane Generation Potential of the plantation waste (tCO_2e)

$BE_{CH4,SWDS,y}$ is calculated using Equation 1 from the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site":

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

("Tool" Equation 1)

Where:

$BE_{CH4,SWDS,y}$	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_2e)
φ	Model correction factor to account for model uncertainties (0.9)
f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH4}	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose
MCF	Methane correction factor
$W_{j,x}$	Amount of organic waste type *j* prevented from disposal in the SWDS in the year *x* (tons)
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type *j*
k_j	Decay rate for the waste type *j*
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

The raw materials used in this project are wood off-cuts and sawdust as well as plantation waste. Emission reductions for methane avoidance can be claimed for the existing stockpiles of sawdust and off-cuts, the freshly generated sawdust and the plantation waste. No emission reductions for methane avoidance can be claimed for freshly generated off-cuts as these off-cuts were being chipped and sold to Novoboard.

Stockpiled Waste:

According to the methodology, in the case of stockpiles of waste an adjusted version of Equation 1 from the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (Equation 1.1) should be used to calculate the baseline emissions.

$$BE_{CH4,SWDS,1,y} = \varphi \times (1-f) \times GWP_{CH4} \times (1-OX) \times \frac{16}{12} \times F \times DOC_f \times MCF_{stockpiled} \times$$
$$\sum_{x=1}^{y} W_{stockpiled,x} \times DOC_{wood} \times e^{-k_{stockpiledwood}(y-x+\bar{a})} \left(1-e^{-k_{stockpiledwood}}\right)$$

("Tool" Equation 1.1)

Where:

$\bar{a}$	Weighted mean age of the wastes present in the SWDS prior to the project start

Equation 5 from the methodology can be used to calculate the arithmetic mean age of the waste:

$$\bar{a} = 0.5 \times a\max$$

Where:

$a\max$	The maximal age of the wastes contained in the stockpile at the project start

Freshly Generated Waste and Plantation Waste

Equation 1 from the "Tool" is used for waste that is not in an existing stockpile.

Section 2: Generation of electricity from renewable source

The baseline emissions for the electricity is the product of electrical energy baseline $EG_{BL,y}$ expressed in kWh of electricity produced by the renewable generating unit multiplied by the electricity grid emission factor.

The baseline emissions were calculated using Equation 1:

$$BE_{y,2} = EG_{BL,y} \times EF_{CO2} \quad (1)$$

Where

$BE_{y,2}$	Baseline emissions in year "y"; (tCO_2e)
$EG_{BL,y}$	Energy baseline in year "y"; (kWh)
EF_{CO2}	CO_2 Emission Factor in year "y"; (tCO_2e/kWh)

Total Baseline Emissions:

The total emissions are the sum of both the baseline emissions from the methane avoidance and the baseline emissions from the electricity generation:

$$BE_y = BE_{y,1} + BE_{y,2}$$

Where:

BE_y	Total baseline emissions for the entire project in year "y"; (tCO_2e)
$BE_{y,1}$	Baseline emissions for methane avoidance at year "y" during crediting period (tCO_2e)
$BE_{y,2}$	Baseline emissions for renewable electricity generation in year "y"; (tCO_2e)

Project Emissions:

Section 1: Avoidance of methane

According to the methodology, the project emissions are associated with

- the combustion of non-biomass carbon content of the waste used
- auxiliary fuel used in combustion
- transportation
- fossil fuel and/or electricity consumed by the project activity facilities

The project emissions are given by Equation 1 (from methodology III.E):

$$PE_{y,1} = PE_{y,comb} + PE_{y,transp} + PE_{y,power} \quad (1)$$

Where:

$PE_{y,1}$	Project activity direct emissions from the avoidance of methane in the year "y" (tCO2e)
$PE_{y,comb}$	Emissions through combustion and gasification of non-biomass carbon of waste and RDF/SB in the year "y"(tCO2e)
$PE_{y,transp}$	Emissions through incremental transportation in the year "y"(tCO2e)
$PE_{y,power}$	Emissions through electricity or diesel consumption in the year "y"(tCO2e)

There are no emissions from the combustion and gasification of non-biomass carbon of waste as the pellets are wood waste from the timber operations. Hence:

$$PE_{y,comb} = 0$$

The emissions associated with transport can be calculated using Equation 3 from methodology III.E:

$$PE_{y,transp} = \left(\frac{Q_y}{CT_y}\right) \times DAF_w \times EF_{CO2} + \left(\frac{Q_{y,ash}}{CT_{y,ash}}\right) \times DAF_{ash} \times EF_{CO2} + \left(\frac{Q_{y,RDF/SB}}{CT_{y,RDF/SB}}\right) \times DAF_{RDF/SB} \times EF_{CO2}$$

(3)

Where:

Q_y	Quantity of waste combusted, gasified or mechanically/thermally treated in the year "y" (tonnes)
CT_y	Average truck capacity for waste transportation (tonnes/truck)
DAF_w	Average incremental distance for waste transportation (km/truck)
EF_{CO2}	CO2 emission factor from fuel use due to transportation (tCO2/km, IPCC default values or local values)
$Q_{y,ash}$	Quantity of combustion and gasification residues and residues from mechanical/thermal treatment produced in the year "y" (tonnes)
$CT_{y,ash}$	Average truck capacity for residues transportation (tonnes/truck)
DAF_{ash}	Average distance for residues transportation (km/truck)
$Q_{y,RDF/SB}$	Quantity of RDF/SB produced in the year "y" (tonnes)
$CT_{y,RDF/SB}$	Average truck capacity for RDF/SB transportation (tonnes/truck)
$DAF_{RDF/SB}$	Aggregate average distance for RDF/SB transportation to the storage in the production site as well as to the end user sites (km/truck)

The current plan is to do all transportation via conveyor belts. The electricity consumption of the conveyor belts is included in the project emissions ($PE_{y,power}$). If at any stage there are other forms of transportation of the ash, the pellets or the raw biomass then this transportation will be included under $PE_{y,transp}$. This will be monitored in the project activity.

The emissions from electricity and diesel consumption are calculated below:

$$PE_{y,power} = EC_y \times EF_{grid} + FC_y \times EF_{FF,y} \quad (1.1)$$

Where

$PE_{y,power}$	Emissions from electricity and diesel consumption (t CO2e)
EC_y	Consumption of electricity (MWh)
$EF_{grid,y}$	Grid emission factor (t CO2e/MWh)
FC_y	Fossil fuel consumption (litres)
$EF_{FF,y}$	Emission factor for the fossil fuel (tons CO2e/litre)

The electricity used for the conveyors and other equipment will be sourced from the electricity generated in the project activity. This is not accounted for in project emissions as the baseline for the electricity generation is net electricity supplied to the grid. However, any grid electricity used by the plant will be accounted for under project emissions. This will include grid electricity used for plant start-up. Fuel used for plant start-up is also included in the project emissions.

Section 2: Generation of electricity from renewable source

This methodology only accounts for project emissions in geothermal plants. Hence, the project emissions from this project are considered zero:

$$PE_{y,2} = 0$$

Total Project Emissions

$$PE_y = PE_{y,1} + PE_{y,2}$$

Where:

PE_y	Total project emissions of the entire proposed project in the year “y” (tCO2e)
$PE_{y,1}$	Project activity direct emissions from the biomass manufacturing in the year “y” (tCO2e)
$PE_{y,2}$	Project activity direct emissions from renewable energy genartion in the year “y” (tCO2e)

Leakage Emissions

There is no leakage associated with this project.

Emission Reductions:

Section 1: Avoidance of methane

Emission reductions were calculated using Equation 8 (from methodology III.E):

$$ER_{y,1} = BE_{y,1} - \left(PE_{y,1} + Leakage_y\right) \qquad (8)$$

Where:

$ER_{y,1}$	Emission reduction in the year “y” (tCO2e)
$BE_{y,1}$	Baseline emissions at year “y” during crediting period (tCO2e)
$PE_{y,1}$	Project activity direct emissions in the year “y” (tCO2e)
$Leakage_y$	Leakage emissions in year “y” (tCO2e)

Section 2: Generation of electricity from renewable source

Emission reductions were calculated using Equation 10 (from the methodology I.D):

$$ER_{y,2} = BE_{y,2} - PE_{y,2} - LE_y \qquad (10)$$

Where:

$ER_{y,2}$	Emission reduction in the year "y" (tCO2e)
$BE_{y,2}$	Baseline emissions at year "y" during crediting period (tCO2e)
$PE_{y,2}$	Project emissions in the year "y" (tCO2e)
LE_y	Leakage emissions in year "y" (tCO2e)

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

Data / Parameter:	φ
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	Methodological tool: "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value applied:	0.9 for all waste types
Justification of the choice of data or description of measurement methods and procedures actually applied :	Oonk et el. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.
Any comment:	

Data / Parameter:	OX
Data unit:	-
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:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0 for all waste types
Justification of the choice of data or description of measurement methods and procedures actually applied :	None of the sites are covered with oxidising material. Hence, zero was selected as the oxidation factor.
Any comment:	

Data / Parameter:	F
Data unit:	-
Description:	Fraction of methane in the SWDS gas (volume fraction)
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5 for all waste types
Justification of the choice of data or description of measurement methods and procedures actually applied :	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.
Any comment:	

Data / Parameter:	DOC_f
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	0.5 for all waste types
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Any comment:	

Data / Parameter:	$MCF_{stockpiled}$
Data unit:	-
Description:	Methane correction factor for stockpiled waste
Source of data used:	Methodology III.E.
Value applied:	0.28 for the stockpiled off-cuts and stockpiled sawdust
Justification of the choice of data or description of measurement methods and procedures actually applied :	This is the MCF value for an unmanaged shallow SWDS minus the 30% uncertainty range as specified in 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Any comment:	

Data / Parameter:	$MCF_{notstockpiled}$
Data unit:	-
Description:	Methane correction factor for waste that is not stockpiled
Source of data used:	Methodology Tool: "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"
Value applied:	0.4 for the plantation waste and freshly generated sawdust
Justification of the choice of data or description of measurement methods and procedures actually applied :	For unmanaged-shallow solid waste disposal sites. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres.
Any comment:	

Data / Parameter:	DOC_{wood}
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) in the wood
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value applied:	0.43 for all waste types
Justification of the choice of data or description of measurement methods and procedures actually applied :	Value from IPCC 2006 Guidelines for wood and wood products as a fraction of wet waste.
Any comment:	

Data / Parameter:	k_{wood}
Data unit:	-
Description:	Decay rate for the wood that was stockpiled
Source of data used:	Methodology III.E.
Value applied:	0.02 for stockpiled off-cuts and stockpiled sawdust and freshly generated sawdust and plantation waste
Justification of the choice of data or description of measurement methods and procedures actually applied :	The k value for the relevant waste type is the lower value from the range provided for the Boreal and Temperate Climate Zone as listed in Table 3.3 in Chapter 3, volume 5 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories.
Any comment:	

Data / Parameter:	amax
Data unit:	years
Description:	The maximal age of the wastes contained in the stockpile at the project start
Source of data used:	
Value applied:	16 for the stockpiled off-cuts and the stockpiled wood waste
Justification of the choice of data or description of measurement methods and procedures actually applied :	Proof of the start date of the stockpile based on not being granted the a permit to burn the waste.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

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Baseline Emissions

Section 1: Avoidance of methane

Equation 4

$$BE_{y,1} = BE_{CH4,SWDS,y}$$

Year	BE_{y1}	$BE_{CH4,SWDS,y}$
1	366	366
2	723	723
3	1,074	1,074
4	1,417	1,417
5	1,753	1,753
6	2,053	2,053
7	2,347	2,347

The current plan is to use the following volumes of waste:

Waste Usage

Year	Sawdust	Stockpiled Off-cuts	Freshly Generated Off-cuts	Plantation Waste
2010	50%	50%	0%	0%
2011	50%	50%	0%	0%
2012	50%	50%	0%	0%
2013	50%	50%	0%	0%
2014	50%	50%	0%	0%
2015	40%	30%	10%	20%
2016	40%	30%	10%	20%

Sawdust

	Sawdust	
Year	Stockpiled	Freshly Generated
2010	67%	33%
2011	67%	33%
2012	67%	33%
2013	67%	33%
2014	67%	33%
2015	50%	50%
2016	50%	50%

This plan is subject to change depending on the availability of waste. However, a portion of the freshly generated sawdust and the stockpiled sawdust will be used.

Stockpiled Waste

Equation 1 (adjusted from the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" to apply to stockpiles)

The decay model for the stockpiled waste:

$$BE_{CH4,SWDS,1,y} = \varphi \times (1-f) \times GWP_{CH4} \times (1-OX) \times \frac{16}{12} \times F \times DOC_f \times MCF_{stockpiled} \times \sum_{x=1}^{y} W_{stockpiled,x} \times DOC_{wood} \times e^{-k_{stockpiledwood}(y-x+\bar{a})}\left(1-e^{-k_{stockpiledwood}}\right)$$

Stockpiled Sawdust

Year	y	1	2	3	4	5	6	7	Total
1	1	64							64
2	2	63	64						127
3	3	62	63	64					189
4	4	60	62	63	64				249
5	5	59	60	62	63	64			308
6	6	58	59	60	62	63	32		334
7	7	57	58	59	60	62	31	32	360

Year	$BE_{CH4,SWDS,1,y}$	φ	*f*	GWP_{CH4}	OX	F	DOC_f	$MCF_{stockpiled}$	Decay model
1	113	0.9	0	21	0	0.5	0.5	0.28	64
2	224	0.9	0	21	0	0.5	0.5	0.28	127
3	333	0.9	0	21	0	0.5	0.5	0.28	189
4	439	0.9	0	21	0	0.5	0.5	0.28	249
5	544	0.9	0	21	0	0.5	0.5	0.28	308
6	589	0.9	0	21	0	0.5	0.5	0.28	334
7	634	0.9	0	21	0	0.5	0.5	0.28	360

Stockpiled Off-Cuts

Year	y	1	2	3	4	5	6	7	Total
1	1	96							96
2	2	94	96						190
3	3	92	94	96					283
4	4	91	92	94	96				373
5	5	89	91	92	94	96			462
6	6	87	89	91	92	94	58		511
7	7	85	87	89	91	92	57	58	558

Year	$BE_{CH4,SWDS,1,y}$	φ	*f*	GWP_{CH4}	OX	F	DOC_f	$MCF_{stockpiled}$	Decay model
1	170	0.9	0	21	0	0.5	0.5	0.28	96
2	336	0.9	0	21	0	0.5	0.5	0.28	190
3	499	0.9	0	21	0	0.5	0.5	0.28	283
4	659	0.9	0	21	0	0.5	0.5	0.28	373
5	815	0.9	0	21	0	0.5	0.5	0.28	462
6	901	0.9	0	21	0	0.5	0.5	0.28	511
7	985	0.9	0	21	0	0.5	0.5	0.28	558

Freshly Generated Waste and Plantation Waste

Freshly Generated Sawdust

Year	y	1	2	3	4	5	6	7	Total
1	1	47							47
2	2	46	47						93
3	3	45	46	47					137
4	4	44	45	46	47				181
5	5	42	44	45	46	47			223
6	6	41	42	44	45	46	56		274
7	7	40	41	42	44	45	55	56	324

Year	$BE_{CH4,SWDS,1,y}$	φ	*f*	GWP_{CH4}	OX	F	DOC_f	$MCF_{stockpiled}$	Decay model
1	83	0.9	0	21	0	0.5	0.5	0.4	47
2	163	0.9	0	21	0	0.5	0.5	0.4	93
3	242	0.9	0	21	0	0.5	0.5	0.4	137
4	319	0.9	0	21	0	0.5	0.5	0.4	181
5	394	0.9	0	21	0	0.5	0.5	0.4	223
6	483	0.9	0	21	0	0.5	0.5	0.4	274
7	571	0.9	0	21	0	0.5	0.5	0.4	324

Plantation Waste

Year	y	1	2	3	4	5	6	7	Total
1	1	0							-
2	2	0	0						-
3	3	0	0	0					-
4	4	0	0	0	0				-
5	5	0	0	0	0	0			-
6	6	0	0	0	0	0	38		38
7	7	0	0	0	0	0	38	38	76

Year	$BE_{CH4,SWDS,1,y}$	φ	*f*	GWP_{CH4}	OX	F	DOC_f	$MCF_{stockpiled}$	Decay model
1	-	0.9	0	21	0	0.5	0.5	0.4	-
2	-	0.9	0	21	0	0.5	0.5	0.4	-
3	-	0.9	0	21	0	0.5	0.5	0.4	-
4	-	0.9	0	21	0	0.5	0.5	0.4	-
5	-	0.9	0	21	0	0.5	0.5	0.4	-
6	68	0.9	0	21	0	0.5	0.5	0.4	38
7	134	0.9	0	21	0	0.5	0.5	0.4	76

Section 2: Generation of electricity from renewable source

Equation 1

$$BE_{y,2} = EG_{BL,y} \times EF_{CO2}$$

Year	$BE_{y,2}$	$EG_{BL,y}$	EF_{CO2}
1	17,503	17,160,000	0.00102
2	17,503	17,160,000	0.00102
3	17,503	17,160,000	0.00102
4	17,503	17,160,000	0.00102
5	17,503	17,160,000	0.00102
6	17,503	17,160,000	0.00102
7	17,503	17,160,000	0.00102

Total Baseline Emissions

$$BE_y = BE_{y,1} + BE_{y,2}$$

Year	BE_y	$BE_{y,1}$	$BE_{y,2}$
1	17,869	366	17,503
2	18,226	723	17,503
3	18,577	1,074	17,503
4	18,920	1,417	17,503
5	19,256	1,753	17,503
6	19,556	2,053	17,503
7	19,850	2,347	17,503

Project Emissions

Section 1: Avoidance of methane

Equation 1

$$PE_{y,1} = PE_{y,comb} + PE_{y,transp} + PE_{y,power}$$

Year	$PE_{y,1}$	$PE_{y,comb}$	$PE_{y,transp}$	$PE_{y,power}$
1	4.23	0	0	4.23
2	4.23	0	0	4.23
3	4.23	0	0	4.23
4	4.23	0	0	4.23
5	4.23	0	0	4.23
6	4.23	0	0	4.23
7	4.23	0	0	4.23

Equation 2

$$PE_{y,comb} = Q_{y,non-biomass} \times \frac{44}{12} + Q_{y,fuel} \times EF_{y,fuel}$$

Year	$PE_{y,comb}$	$Q_{y,non\text{-}biomass}$	$Q_{y,fuel}$	$EF_{y,fuel}$
1	0	0	0	-
2	0	0	0	-
3	0	0	0	-
4	0	0	0	-
5	0	0	0	-
6	0	0	0	-
7	0	0	0	-

Equation 3

$$PE_{y,transp} = \left(\frac{Q_y}{CT_y}\right) \times DAF_w \times EF_{CO2} + \left(\frac{Q_{y,ash}}{CT_{y,ash}}\right) \times DAF_{ash} \times EF_{CO2} + \left(\frac{Q_{y,RDF/SB}}{CT_{y,RDF/SB}}\right) \times DAF_{RDF/SB} \times EF_{CO2}$$

Year	$PE_{y,transp}$	Q_y	CT_y	DAF_w	EF_{CO2}	$Q_{y,ash}$	$CT_{y,ash}$	DAF_{ash}
1	0	26,512	-	0	-	772	-	0
2	0	26,512	-	0	-	772	-	0
3	0	26,512	-	0	-	772	-	0
4	0	26,512	-	0	-	772	-	0
5	0	26,512	-	0	-	772	-	0
6	0	26,512	-	0	-	772	-	0
7	0	26,512	-	0	-	772	-	0

Year	$Q_{y,RDF}$	$CT_{y,RDF}$	DAF_{RDF}

1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	0
7	0	0	0

Equation 1.1

Year	$PE_{y,power}$	EC_y	$EF_{grid,y}$	FC_y	$EF_{FF,y}$
1	4.229	4	1.02	0.05	2.98
2	4.229	4	1.02	0.05	2.98
3	4.229	4	1.02	0.05	2.98
4	4.229	4	1.02	0.05	2.98
5	4.229	4	1.02	0.05	2.98
6	4.229	4	1.02	0.05	2.98
7	4.229	4	1.02	0.05	2.98

<u>Section 2: Generation of electricity from renewable source</u>

This is a small-scale renewable energy from biomass project, therefore the GHG emissions from the project activity is considered zero:

Year	$PE_{y,2}$
1	0
2	0
3	0
4	0
5	0
6	0
7	0

<u>Total Project Emissions</u>

$$PE_y = PE_{y,1} + PE_{y,2}$$

Year	PE_y	$PE_{y,1}$	$PE_{y,2}$
1	4.23	4.23	0
2	4.23	4.23	0
3	4.23	4.23	0
4	4.23	4.23	0
5	4.23	4.23	0
6	4.23	4.23	0
7	4.23	4.23	0

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

>>

Year	**Estimation of project activity emissions (tonnes of CO_2 e)**	**Estimation of baseline emissions (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of overall emission reductions (tonnes of CO_2 e)**
1	4.23	17,869	0	17,865
2	4.23	18,226	0	18,222
3	4.23	18,577	0	18,573
4	4.23	18,920	0	18,916
5	4.23	19,256	0	19,252
6	4.23	19,556	0	19,552
7	4.23	19,850	0	19,846
Total (tonnes of CO_2 e)	**30**	**132,254**	**0**	**132,224**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	f
Data unit:	-
Description:	Fraction of methane captured at the SWDS and flared, combusted or used in another manner – for the stockpiled off-cuts and sawdust, the freshly generated sawdust and the plantation waste
Source of data to be used:	Written information from the operator of the solid waste disposal site and/or site visits at the solid waste disposal site
Value of data	0
Description of measurement methods and procedures to be applied:	The stockpiles are controlled by Lowpal Timbers. These stockpiles will be checked annually to ensure that methane is not being captured and utilised. There will be an agreement with the owners of the plantations from which the plantation waste is sourced. This agreement will ensure that no other company is removing wood waste from the same area or capturing methane.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	GWP_{CH4}
Data unit:	tCO_2e / t CH_4
Description:	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
Source of data to be used:	Decisions under UNFCCC and the Kyoto Protocol (a value of 21 is to be applied for the first commitment period of the Kyoto Protocol)
Value of data	21
Description of measurement methods and procedures to be applied:	Monitor annually if the value has been updated.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	W_x and Q_y
Data unit:	tons
Description:	Total amount of organic waste prevented from disposal in year *x* (tons)
Source of data to be used:	Measurements by project participants on a scale or weighbridge.
Value of data	**Waste Usage** (see table below)

Waste Usage

Year	Sawdust	Stockpiled Off-cuts	Freshly Generated Off-cuts	Plantation Wa
2010	50%	50%	0%	0%
2011	50%	50%	0%	0%
2012	50%	50%	0%	0%
2013	50%	50%	0%	0%
2014	50%	50%	0%	0%

2015	40%	30%	10%	20%
2016	40%	30%	10%	20%

Sawdust

	Sawdust	
Year	Stockpiled	Freshly Generated
2010	67%	33%
2011	67%	33%
2012	67%	33%
2013	67%	33%
2014	67%	33%
2015	50%	50%
2016	50%	50%

Description of measurement methods and procedures to be applied:	Monitored on an on-going basis as the waste is used. Daily records of the amount of waste and type waste used will be kept on-site. This will be aggregated monthly and records of these monthly value will be kept on and off site.
QA/QC procedures to be applied:	The amount of waste used to generate the electricity will be checked against the theoretical calculati and process design. If there are any significant (+10% or –10%) differences then these differences m be explained/clarified during verification.
Any comment:	

Data / Parameter:	$Q_{y,fuel}$
Data unit:	tons
Description:	Quantity of auxiliary fossil fuel used in the year “y”
Source of data to be used:	
Value of data	0
Description of measurement methods and procedures to be applied:	Keep written records of any auxiliary fossil fuel consumption. Check these records during verification.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$Q_{y,non\text{-}biomass}$
Data unit:	Tons of carbon
Description:	Non-biomass carbon of the waste and RDF/SB combusted/gasified in the year "y"
Source of data to be used:	
Value of data	0
Description of measurement methods and procedures to be applied:	Keep written records of any waste and RDF/SB combusted and the carbon content thereof. Check these records during verification.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	CT_y and $CT_{y,RDF}$
Data unit:	Tons/truck
Description:	Average truck capacity for waste and pellet transportation
Source of data to be used:	
Value of data	0
Description of measurement methods and procedures to be applied:	Check annually the waste and pellet transportation capacity of the trucks used and keep written records. The current plan is to transport by conveyor. However, if at any stage trucks are used for transportation then the capacity of the trucks will be recorded.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	DAF_w and DAF_{RDF}
Data unit:	km/truck
Description:	Average incremental distance for waste and pellet transportation
Source of data to be used:	
Value of data	0
Description of measurement methods and procedures to be applied:	The current plan is to transport the waste and pellets by conveyor. However, if at any stage the waste or pellets are transported by trucks then records of the distance travelled will be kept.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$Q_{y,RDF}$
Data unit:	tons
Description:	Quantity of RDF/SB produced in the year "y"
Source of data to be used:	Measurements by project participants of the quantity of pellets transported by truck in the project. The quantity of pellets transported by truck will be measured on a weighbridge.
Value of data	0
Description of measurement methods and procedures to be applied:	This is only applicable for pellets that are transported by truck. The pellets transported by truck will be weighed. Daily records will be kept on site. Daily values will be aggregated monthly and monthly records will be kept on and off site.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$EF_{y,fuel}$ and EF_{CO2}
Data unit:	t CO_2 per tonne fuel
Description:	CO_2 emission factor for the combustion of the auxiliary fossil fuel
Source of data used:	IPCC Guidelines
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The emission factor of any fossil fuels used in the project activity will be taken from the IPCC default values. The emission factor will be monitored for any updates by the IPCC.
Any comment:	

Data / Parameter:	$Q_{y,ash}$
Data unit:	tonnes
Description:	Quantity of combustion and gasification residues and residues from mechanical/thermal treatment produced in the year y
Source of data to be used:	Measurements by project participants of the quantity of ash transported by truck in the project. The quantity of ash transported by truck will be measured on a weighbridge.
Value of data	0
Description of measurement methods and procedures to be applied:	This is only applicable for ash that is transported by truck. The ash transported by truck will be weighed. Daily records will be kept on site. Daily values will be aggregated monthly and monthly records will be kept on and off site.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$CT_{y,ash}$
Data unit:	tonnes/truck

Description:	Average truck capacity for residues transportation
Source of data to be used:	
Value of data	0
Description of measurement methods and procedures to be applied:	Check annually the ash transportation capacity of the trucks used and keep written records. The current plan is to transport by conveyor. However, if at any stage trucks are used for transportation then the capacity of the trucks will be recorded.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	DAF_{ash}
Data unit:	km/truck
Description:	Average distance for residues transportation
Source of data to be used:	
Value of data	0
Description of measurement methods and procedures to be applied:	The current plan is to transport the ash by conveyor. However, if at any stage the ash is transported by truck then records of the distance travelled will be kept.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	EC_y
Data unit:	MWh
Description:	Grid electricity consumption of the pelletizing plant and electricity generation plant in year "y"
Source of data to be used:	Electricity meter will be installed to monitor the grid electricity consumption of the plant.
Value of data	4 - This is the electricity consumed during start-up.
Description of measurement methods and procedures to be applied:	The grid electricity consumption of the pelletizing plant and the electricity generation plant will be monitored continuously using electricity meter/s. The data will be logged electronically, integrated hourly. The hourly data will be summed to obtain monthly data. Records of the monthly data will be kept on and off site.
QA/QC procedures to be applied:	No recalibration is required if the meters remain undisturbed.
Any comment:	

Data / Parameter:	$EF_{grid,y}$ or EF_{CO2}
Data unit:	Tons CO_2/MWh or tons CO_2e/kWh
Description:	Emission factor for the national grid
Source of data to be used:	Calculated from the "Tool to calculate the emission factor for an electricity system"

Value of data	1.02
Description of measurement methods and procedures to be applied:	As per the tool. Please see separate document with the calculation of the emission factor.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	FC_y
Data unit:	litres
Description:	Fuel consumption in litres
Source of data to be used:	Invoices for fossil fuels used during the year
Value of data	LPG consumption = 0.05 LPG is used as start up fuel
Description of measurement methods and procedures to be applied:	Record of the invoices for the purchase of the fuels.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	EF_{FFy}
Data unit:	Emission factor for fossil fuel consumed
Description:	Tons CO2/litre
Source of data to be used:	Emission factors for the fossil fuels from IPCC
Value of data	LPG emission factor = 0.00269
Description of measurement methods and procedures to be applied:	Check annually for update IPCC values
QA/QC procedures to be applied:	
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The monitoring of the waste volumes and types used and the electricity supplied to the grid will be performed by Lowpal Timbers. Lowpal Timbers and EECO Fuels will also be responsible for monitoring the auxiliary fossil fuel and grid electricity consumption of the pelletizing plant and the electricity generation plant. The quality control and subsequent calculations will be the responsibility of both Lowpal Timbers and EECO Fuels.

The onsite monitoring as well as calibration/verification of measurement equipment will be the responsibility of Lowpal Timbers. Instruments will be installed and calibrated in accordance with international standards and checked during onsite inspections. Routine maintenance on the monitoring equipment will be the responsibility of Lowpal Timbers and EECO Fuels.

Data will be recorded daily and aggregated monthly. The monthly data will be stored on and off site. The monthly data will populate a spreadsheet in which the equations to calculate the emission reductions are programmed. The calculation of the emissions reductions will be the responsibility of Lowpal Timbers and EECO Fuels. Any exceptions or plant downtime will be recorded in the spreadsheet and made available at verification.

Development of the monitoring report and preparation for verification audits will be the responsibility of Lowpal Timbers and EECO Fuels.

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: 10 October 2009
Entity: Promethium Carbon (Pty) Ltd

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
01/01/2010

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

>>
Exceeds the crediting period of the project

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:

>>
01/03/2010 (not prior to project registration)

C.2.1.2. Length of the first crediting period:

>>
7 years (renewable twice)

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Not applicable

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

>>

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

>>
According to the National Environmental Management Act, 1998 (Act No. 107 of 1998) the project will not need an Environmental Impact Assessment. The project has positive environmental impacts.

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:

>>

The project has a positive impact on the environment. The waste that was left to decompose and generate methane is used to make biomass pellets, hence the emissions of methane is avoided. The stockpiled waste posed a fire risk, which is reduced as a result of the project activity. The biomass pellets are used to generate electricity. The electricity generated will replace electricity from the national grid.

The production of the biomass pellets is environmentally friendly as there is:

- No release of toxic gases, fumes or chemicals;
- No air pollution;
- The process does not involve any hazardous chemicals and compounds;
- There is no release of solid or liquid effluent;
- The process does not create any noise pollution that can be heard outside the factory premises;
- The process does not cause any underground water pollution or contamination.

The reduction in electricity consumption from the national grid will result in a reduction of coal-based electricity and all the negative impacts associated with coal mining, such as the impact of the actual mining process, the utilisation of water resources, SO_2 emissions and the impacts associated with the disposal of coal ash

SECTION E. Stakeholders' comments

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

>>

E.2. Summary of the comments received:

>>

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

>>

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	EECO™ Fuels Renewable Energy Company
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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