MONDI BUSINESS PAPER BIOMASS PROJECT

Richards Bay, SOUTH AFRICA
March 2005

Prepared by

Ciska Terblanche
Environmental Manager
Mondi Business Paper, Richards Bay

With facilitation from

SouthSouthNorth
South Africa

Clean Development Mechanism
DRAFT SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-PDD)
Version 13 March 2005

TABLE OF CONTENTS

Diagrams

Notation

PDD	Project Design Document	
GWP	Global warming potential	
CV_C	Lower heating value of coal	MJ/kg
CV_B	Lower heating value of biomass	MJ/kg
EF_C	Emissions factor for coal	
EF_B	Emissions factor for biomass	
$_B$	denotes biomass	
$_C$	denotes coal	
$_E$	denotes electricity	

A GENERAL DESCRIPTION OF PROJECT ACTIVITY

A.1 Title of the project activity

Mondi Richards Bay Biomass Project

A.2 Description of the project activity

Collection and recovery of biomass waste at Mondi Business Paper, Richards Bay mill, for use in the generation of renewable energy as an alternative fuel to coal. The proposed project consists of two activities:

- Project activity 1: Recovery of biomass waste that consists of fines, wood chips, logs etc. presently landfilled at a Richards Bay Municipal Landfill site and some plantation waste currently left in the plantations to decay.

- Project activity 2: The generation of steam at the operation by utilisation of biomass waste in a power boiler as an alternative fuel to coal.

Mondi SilvaCel and other timber processors (chippers) in the area of Richards Bay presently transport and landfill their biomass waste at a local municipal landfill site. With the implementation of the project activity 1, these operations will no longer landfill biomass waste. In addition, other potential sources of biomass waste from surrounding plantations (stumps, off-cuts and branches) normally left in the plantations could be recovered and used as a fuel.

Comment on plantation waste

Methane formation from the decay of plantation waste has been included in the scope of the Project Design Document. Methane emission factors for plantation waste have not been confirmed, but if confirmed these will be included and be subjected to verification prior to issuance of credits. The PDD makes provision for this.

Coal fired boilers are presently used at Mondi Richards Bay to generate heat and electricity for the production of pulp and linerboard. If necessary, modifications will be done to existing precipitators in order to handle particulate emissions from the additional biomass load in the boiler and to ensure that emissions from the biomass boiler complies with national legislation.

Recovered biomass waste, which is currently being landfilled and other potential recovered biomass from plantations will be used as a renewable energy resource in a co-fired boiler thereby eliminating coal consumption during normal operations. The biomass boiler is being utilised below capacity and can accommodate an additional 250 tonnes per day. This will result in the reduction of Greenhouse gas emissions from fossil fuel for the boiler. In addition, methane emissions from landfilling biomass waste and methane emissions generated by plantation waste will be avoided. The resulting emission reductions will be monitored and verified against the proposed project activity baselines.

A.2 Sustainable Development Screen

The project team used the two following related sustainable development screens to assess the project, i.e.:

- The SouthSouthNorth Sustainable Development Appraisal and Ranking Matrix Tool**,** and
- The Gold Standard Sustainable Development Assessment

These assessments both indicate a positive contribution by the project toward local and national sustainable development. Table 3 illustrates the outcome of the assessments:

Table 2: [1]The SouthSouthNorth Sustainable Development Appraisal and Ranking Matrix Tool

Sustainability Indicators	Score	Comments
Indicator 1 - Contribution to the mitigation of Global Climate Change	3	Against a baseline, the estimated reduction of emissions is approximately 1217 kilotonnes $CO_{2\ equivalent}$. Changes in CH_4 and N_20 because of the shift in fuel from coal to biomass are taken into account.
Indicator 2 - Contribution to local environmental sustainability	3	The improvement in local air quality by reducing SO_2 and N_2O emissions from coal as the consumption of coal is reduced by replacement by biomass. In the Richards Bay area, there will be a reduction in methane emissions from landfill due to a reduction in biomass landfilled.
Indicator 3 - Contribution to net employment generation	1	There will be a minimal increase in employment due to construction and commissioning the systems, as well in the supply of the additional transport needs. This will occur specifically in the small to medium sized Enterprises (SMME).
Indicator 4 - Contribution to the sustainability of the balance of payments	1	Both project activities will mainly use local technology with some new technology implementation in the wood yard.
Indicator 5 - Contribution to macroeconomic sustainability	1	There will be no impact on national imports or exports. Minor impact expected on regional import of coal to the KZN area as the amount of coal reduction compared to the total amount of coal transported by rail from other regions is small. The project activity will also result in more efficient production processes at Mondi.
Indicator 6 - Cost Effectiveness	2	The project is only cost-effective if the carbon financing is included. In such a case the internal rate of return makes the project cost effective for the project participant to finance.
Indicator 7 - Contribution to technological self-reliance	0	Technological self-reliance stays similar to the baseline case. Additional electricity will be imported from the national grid, but will be offset by the reduced amount of coal that has to be imported from other regions by rail. Biomass is accessible locally.
Indicator 8 - Contribution to the sustainable use of natural resources	2	Energy efficiency improvement and the use of renewable energy reduce the use of natural resources.

The matrix above has been developed by Helio International and adapted by the **South***South*North project team to appraise projects against sustainable development indicators. The indicators are qualitatively rated –3 to 3 for least to most contribution to the indicator. As a threshold or ceiling, indicators 2 and 3 must provide positive contributions to distinguish the

[1] The Southsouthnorth Sustainable Development Appraisal & Ranking Matrix Tool, the Southsouthnorth Project, 2003.

project from business-as-usual in the South African context. For further explanation of the SD matrix tool, visit www.southsouthnorth.org

The project scores 14 out of a possible maximum of 24, which indicates that the project activity will have a positive impact towards Sustainable Development rather than a negative one. The self-imposed sustainable development eligibility threshold that includes positive scores for indicators 2 and 3 is met.

A.3 Project participants

1. Mondi Business Paper (project participant)
2. South Africa (Party)

Official contact:

Ciska Terblanche
Mondi Business Paper
Richards Bay
South Africa
(09) 27 35 9022322

ciska.terblanche@mondibp.com

A.4 Technical description of the project activity

The biomass boiler at the Richards Bay Mill is currently operated under its designed capacity in terms of biomass utilisation. The project aims to extend the operation of this boiler to utilise an additional quantity of biomass as fuel. Only modifications to the existing boiler technology to accommodate more biomass are envisaged. New technology will be introduced in the wood yard where equipment will be introduced to remove contaminants from the discarded chips. The project results in an increase of road based transport for biomass and a decrease for ash and rail based coal transportation.

A.4.1 Location of the project activity:

A.4.1.1 Host country Party(ies): The host country is South Africa

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

A.4.1.3 City/Town/Community etc: Richards Bay

A.4.1.4 Detailed description of the physical location, including information allowing the unique identification of this project activity

The Richards Bay Mill is located in Richards Bay, a harbour and industrial town that developed during the early 1980's. The mill is approximately 180 km north of Durban. The Mill site has a spacious layout with ample space for large-scale expansions. It has good road and rail connections, and is located only a few kilometres from the Richards Bay harbour. The Richards Bay Pulp and Linerboard Mill were commissioned during October 1984.

A.4.2 Type and category(ies) and technology of project activities

The suggested project is comprised of a bundle across two project activities utilising different technological typologies [2]with two distinct project boundaries.

They are:

1. <u>Project Activity 1:</u> Type III Other Project Activities: Category III E: Methane avoidance

Biomass currently being landfilled and that left to decay in plantations will be transported to the Richards Bay mill to be burnt (in a boiler) for energy purposes. Production of methane from biomass and other organic matter will be avoided because of the project activity.

2. <u>Project Activity 2:</u> Type I Renewable Energy: Category I C: Thermal energy for the user

Recovered biomass from the landfill and plantation residues collected and transported to the paper mill will replace coal as energy source in one power boiler that provides thermal energy to the operations. The biomass is to be collected, transported to the mill, separated, cleaned, shredded and conveyed to the biomass boiler. The proposed technology includes new equipment to separate, shred, clean and convey the biomass to the boiler. The reduction or elimination of coal used in the power boiler will reduce GHG emissions.

A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

The avoidance of methane emissions formation associated with landfill and plantations will result from Project Activity 1. Project activity 2 will result in the reduction of GHG emissions due to the replacement of coal by biomass as an energy resource in the boiler. There will be a reduction in GHG emissions from transport of coal by train to the mill and coal ash by road from the mill to landfill. The reduction of GHG emissions from transport will be in proportion to the reduction in coal use. To handle additional incoming biomass new equipment will be installed in the wood yard to shred and sort biomass waste received from nearby industries and farmers. The new equipment will require additional electricity from the grid and hence result in GHG emissions.

[2] The small-scale project activity typologies can be found as Appendix B to the Small-Scale CDM simplified modalities and procedures found on www.unfccc.int/cdm.

A.4.4 Public funding of the project activity

No public funding is involved in the proposed project.

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

The project size is within the limits described in the modalities and procedures of small-scale CDM project activities and not a portion of a larger project. Mondi can confirm that the proposed project activity is not a debundled component of a larger project activity.

B. BASELINE METHODOLOGY

B.1 Title and reference for the project category applicable to the project activity:

The bundled project activity will consist of **two** identifiable project activities:

Project Activity 1: Methane avoidance (Type III Other Project Activities: Category III E: Methane avoidance)

The fines and woodchips contaminated with rocks, sand and metal are currently being landfilled in a Richards Bay landfill site where they ferment over time, emitting methane. Plantation waste currently left in plantations to decay will be collected. Both sources of biomass will be transported to the boiler, where it will be used to generate heat and power, instead of being landfilled. Methane emissions will be avoided due to this project activity. As the landfill gas does not currently have to be managed, all of the methane that would have been produced by the wood chips is therefore included in the baseline. Changes in the licensing requirements will be monitored and the implications of LFG management included in the baseline at the time this would have been introduced.

Project Activity 2: Thermal energy for the user (Type I Renewable Energy: Category I C: Thermal energy for the user)

The plantation residues and the fines and woodchips contaminated with rocks, sand and metal will be cleaned and shredded. Together the two streams of biomass will replace coal for the generation of heat and power for the manufacturing process. The project activity excludes the average 235 to 300 tonnes per day biomass (average for 2003 and running average for 2004) currently being fed into the boiler (Reference: P Kotze pers. comms. 2004).

B.2 Project category applicable to the project activity

Both project activities fall within the small-scale size limits and therefore qualify for simplified procedures.

Project Activity 1: Type III Other Project Activities: Category III E: Methane avoidance

The project category comprises measures that avoid the production of methane from biomass that would have otherwise been left to decay because of anthropogenic activity (landfilling or left to decay in plantations).

Biomass is a renewable resource, thus its treatment (burning) in the project activity results in zero CO_2 emissions. However, the amount of N_2O and CH_4 emissions that are generated in the treatment (burning) of the fines and cleaned woodchips is less than 15 kilotonnes per annum.

Project Activity 2: Type I Renewable Energy: Category I C: Thermal energy for the user

The category includes biomass-based co-generation systems that produce heat and electricity for use on site.

Project activity 2 results in the production of 13.2MW equivalent of thermal power in the biomass boiler. This is below the 15 MW for renewable energy and/or less than 45MWe for cogeneration projects. The rated capacity of the boiler is 65MWe for co-firing coal and bark, however the validated limit of the quantity of biomass that the boiler can take is 25.98 tonnes per hour (623 tonnes per day).

When calculating the boiler output including the calorific value of the biomass, the efficiency of the boiler and the combustion of the biomass, the boiler is rated at 44MWe. The steam produced by the boiler is used for the generation of electricity and the provision of process heat for the pulp and paper mill.

$$\Rightarrow (25.98) * (8) * (0.8371) * (0.91) / 3.6 = 43.98 \text{ MW of steam}$$

(This is in (25.98 tonnes/hour biomass) * (8 MJ/kg) * (0.8371 combustion efficiency) * (0.91 heat transfer efficiency) / (3600 secs/hr)/1000kgs/tonne)

The heat transfer efficiency is 91% that gives an overall boiler efficiency of 76%. Independent consultants (ESP Consultants cc) have verified these figures and these reports should be available at Power & Recovery Department of the Mondi Richards Bay Mill.

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity *(i.e. explanation of how and why this project is additional and therefore not the baseline scenario)*

A number of options were considered:

1. Coal will be utilised as fuel on a continuous basis in the existing Power Boiler. Mondi Richards Bay will landfill biomass not burnt in the boiler in the Mondi owned landfill site. Other entities will continue to be landfill biomass in the regional landfill site. (Status Quo)
2. Export of the biomass is not feasible without pelletisation as the quality of the bark is not good enough for export purposes – it is contaminated with sand, metal etc. The investigation regarding pelletisation possibilities has been done and currently the quality of this particular biomass being considered is substandard and not suitable for pelletisation. The internal policy of the Richards Bay mill is to utilise all biomass possible for paper and pulp production.

Both alternatives will comply with all South African regulations. The proposed project activity is not the only alternative amongst the ones considered by Mondi that comply with all regulations.

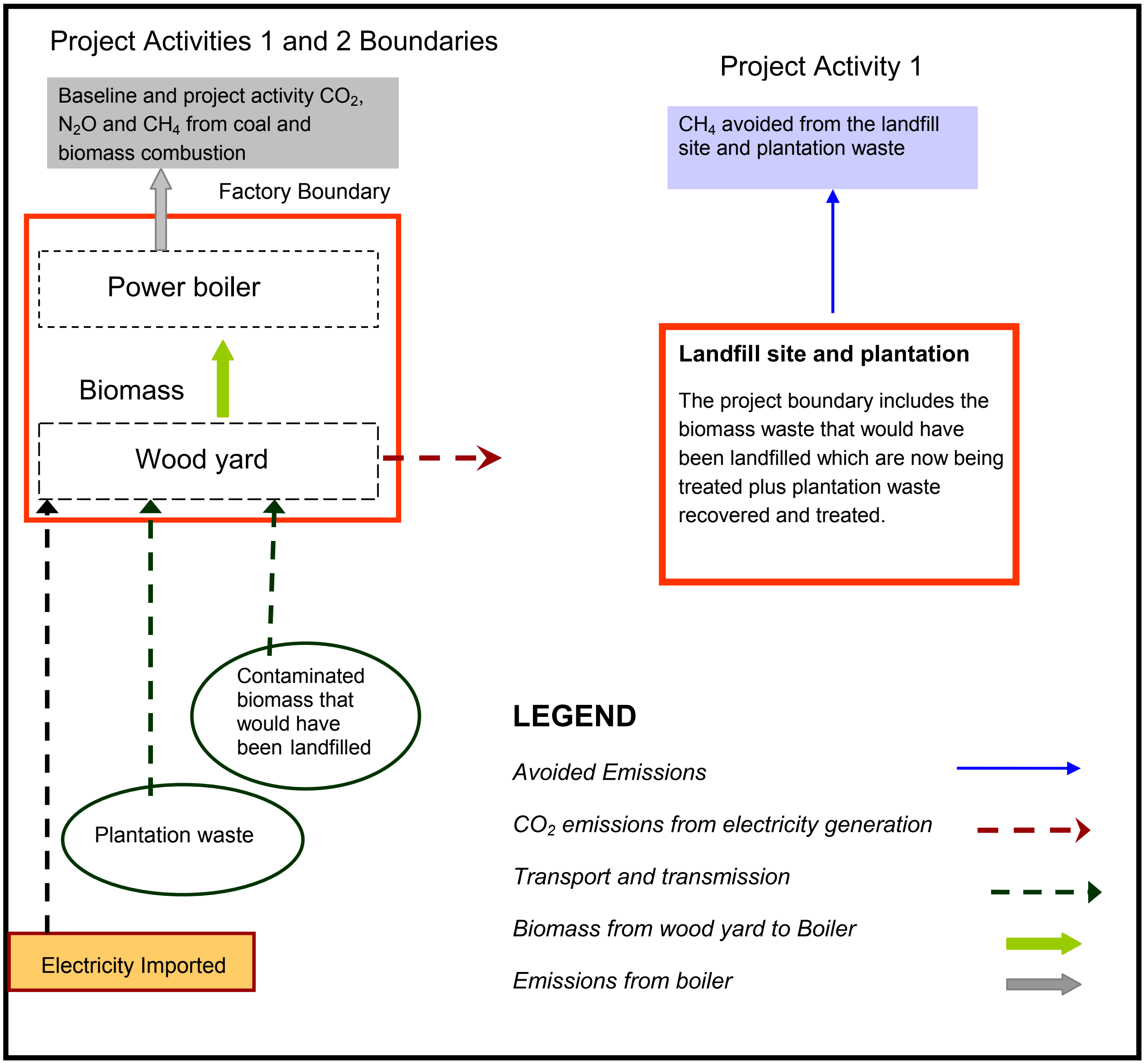
Mondi Business Paper South Africa has specific requirements in terms of return on investment of a proposed project in order to approve the project. Any small scale to medium scale project has to meet a minimum of between 17-20% IRR for approval, if the project is a stand-alone one (Mondi Executive Board guidelines).

The project activity does not meet this IRR requirement without income from the CDM component.

Based on financial calculations the annual cash flow without income from the sale of credits, produces a pre-tax internal rate of return of below 10% per annum (after-tax this is negative) well below the Mondi requirement for the project to go ahead. In the calculations, an inflation rate of 5.5% was used.

B.4 Description of the project boundary for the project activity

The project activities, which make up this project, have to have separate and distinct boundaries:



Project Activity 1: The project boundary is defined as "the physical, geographical site where the treatment takes place". In this case, the project boundary is set in this case by the biomass waste that would have been landfilled plus plantation waste that would have decayed there, that is now recovered and treated in the second project activity. The boundary for project activity 1 is therefore the same boundary as the boundary defined for project activity 2.

Project Activity 2: The project boundary is defined as "The physical, geographical site of the renewable energy technologies generating the thermal energy that delineates the project boundary." (Ref: Annex 2 to the minutes from the 12th meeting of the Methodology Panel of the Executive Board of the CDM.

The boundary, therefore, includes the biomass boiler at Mondi in Richards Bay and all new or retrofitted equipment in the wood yard implemented to handle the additional biomass fuel.

For a detail outlay of the equipment that fall within the project boundary, please refer Diagram 1.

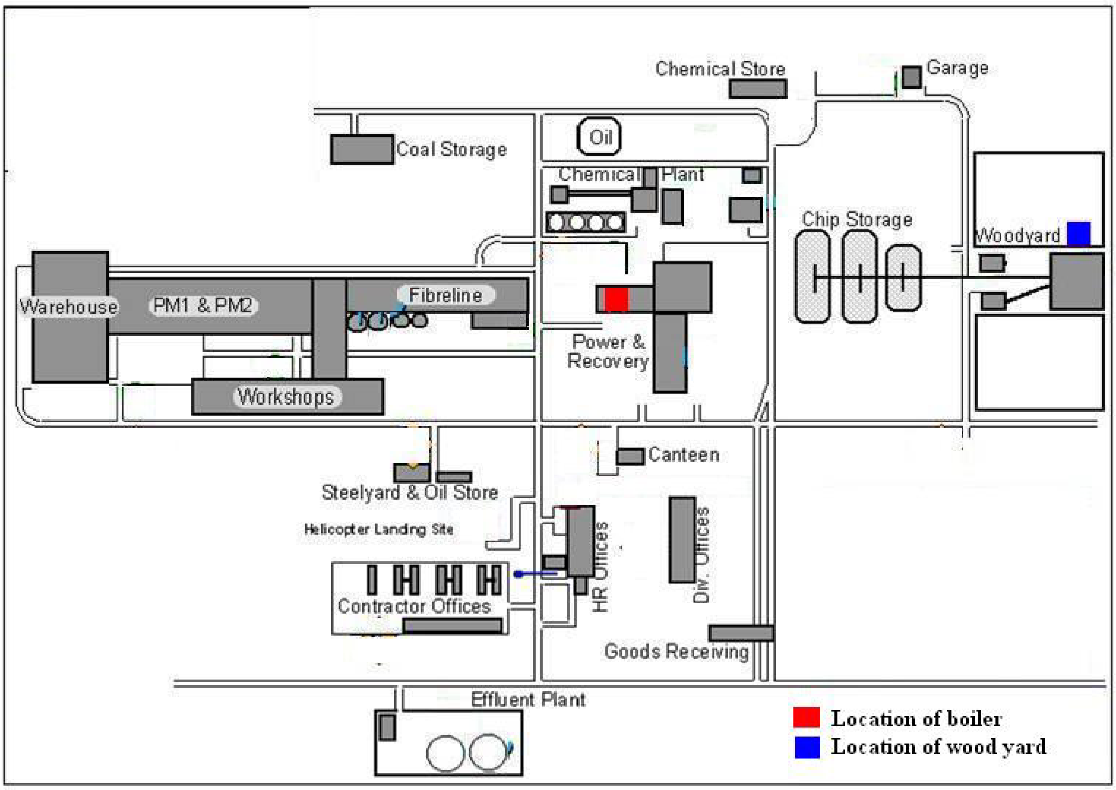


Diagram 1: Layout of the Mondi operation with project activity

B.5 Details of the baseline and its development

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

For Type IIIE biomass waste would have been landfilled at a municipal landfill site to decay resulting in methane emissions. Methane emissions generated from landfill would have percolated into the atmosphere without recovery. The landfill is managed and is deeper than 5 metres. There are currently no requirements by the landfill licensing authority (South African Government Department of Water Affairs and Forestry) to manage the landfill gas, but in 6 years time monitoring may be initiated leading to the possibility of landfill gas extraction according to licensing agreements (Clive Oosterhuizen, Richards Bay landfill manager Pers comm. 5 October 2004). For this purpose, landfill gas licensing arrangements will be monitored and their impact on the baseline calculated from the date that compliance is required.

Plantation waste would have decayed in the plantation, releasing methane emissions over time.

For Type IC coal would have been used to provide thermal energy to the paper manufacturing process. GHG emissions result from the burning of fossil fuel (coal) in the coal fired power boiler. In the project activity, an estimated extra average amount of 250 tonnes of biomass per day will be burnt, roughly equivalent to 71.4 tonnes of coal per day. Currently the boiler burns an amount of biomass and this will continue in future. This amounts to 235 tonnes per day (2003 average) to 300 tonnes per day 2004 running average, but being biogenic and renewable there are no CO_2 emissions attributed to its burning. The baseline calculations account for N_2O and CH_4 emissions generated from biomass burning in the boiler.

B.5.2 Date of completing the final draft of this baseline section
March 2005

B.5.3 The baseline is determined by a Project Design Team comprising the following persons/entities::

Ms Ciska Terblanche, Mondi Business Paper, Richards Bay (project participant)
Mr Steve Thorne, SouthSouthNorth (not a project participant)

C. DURATION OF THE PROJECT ACTIVITY / CREDITING PERIOD

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity

May 2005

C.1.2 Expected operational lifetime of the project activity:

The operational lifetime of the technology is in excess of 10 years but the crediting period will be limited to a maximum of 10 years.

C.2 Choice of the crediting period and related information: (Please underline the selected option (C.2.1 or C.2.2.) and provide the necessary information for that option)

C.2.1 Renewable crediting period (at most seven (7) years per period)
Not selected

C.2.1.1. Starting date of the first crediting period *(DD/MM/YYYY)*:

C.2.1.2. Length of the first crediting period *(in years and months, e.g. two years and four months would be shown as: 2y-4m)*:

C.2.2 Fixed crediting period (at most ten (10) years):

C.2.2.1 Starting date

May 2005

C.2.2.2 Length (max 10 years):

10y-0m

D. Monitoring methodology and plan

(The monitoring plan shall incorporate a monitoring methodology specified for the applicable project category for CDM small-scale project activities contained in Annex B of the simplified M&P for CDM small-scale project activities and represent good monitoring practice appropriate to the type of project activity.

The monitoring plan shall also provide information on the collection and archiving of the data specified in Annex B of the simplified M&P for CDM small-scale project activities to:
- Estimate or measure emissions occurring within the project boundary;
- Determine the baseline;
- Estimate leakage, where this needs to be considered.

Project participants shall implement the registered monitoring plan and provide data, in accordance with the plan, through their monitoring reports.

Operational entities will verify that the monitoring methodology and plan have been implemented correctly and check the information in accordance with the provisions on verification. This section shall provide a detailed description of the monitoring plan, including an identification of the data to be collected, its quality with regard to accuracy, comparability, completeness and validity, taking into consideration any guidance contained in the methodology, and archiving of the data collected.

Please note that monitoring data required for verification and issuance are to be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

An overall monitoring plan that monitors performance of the constituent project activities on a sample basis may be proposed for bundled project activities. If bundled project activities are registered with an overall monitoring plan, this monitoring plan shall be implemented and each verification/certification of the emission reductions achieved shall cover all of the bundled project activities.)

D.1 Name and reference of approved methodology applied to the project activity

(Please refer to the UNFCCC CDM web site for the most recent version of the indicative list of CDM small-scale project activities contained in Annex B of the simplified M&P for CDM small-scale project activities.)

1. <u>Project Activity 1:</u> Type III Other Project Activities: Category III E: Methane avoidance

2. <u>Project Activity 2:</u> Type I Renewable Energy: Category I C: Thermal energy for the user

(If a national or international monitoring standard has to be applied to monitor certain aspects of the project activity, please identify this standard and provide a reference to the source where a detailed description of the standard can be found.)

D.2 Justification of the choice of the methodology and why it is applicable to the project activity

(Justify the choice of the monitoring methodology applicable to the project category as provided for in Annex B.)

The methodology addresses all the necessary parameters to estimate emissions from the two project activities. The frequency of verification of the monitored parameters will be left to the project participant to decide based on verification costs and cash flow requirements. Both Type IC and Type IIIE monitoring protocols have been specified as outlined in Appendix B to the small-scale M&P.

D.3 Data to be monitored

The table below specifies the minimum information to be provided for monitored data. Please complete the table for the monitoring methodology chosen for the proposed project activity from the simplified monitoring methodologies for the applicable CDM small-scale project activity category contained in Annex B of the simplified M&P for CDM small-scale project activities.

Please note that for some project categories it may be necessary to monitor the implementation of the project activity and/or activity levels for the calculation of emission reductions achieved.

Table 3: *Monitoring and verification data*

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1(a) Quantity of Biomass not landfilled (avoided)	*Flow*	*Mass/time*	*Tonnes/da y*	*M*	*Continuous*	*All*	*Electronic*	*Duration of project*	*Weighed at weighbridge*
1(b) Quantity of biomass received from plantation owners	*Flow*	*Mass/time*	*Tonnes/da y*	*M*	*Continuous*	*All*	*Electronic*	*Duration of project*	*Weighed at weighbridge*
1(c) Energy content of biomass burnt in boiler	*Flow*	$CV_{biomass}$	*MJ/kg*	*M*	*Bi-annually*	*n/a*	*Electronic*	*Duration of project*	*At conveyor to boiler*
2(a) Historic quantity of biomass burnt in boiler	*Flow*	*Mass/time*	*Tonnes/da y*	*M*	*From records*	*Averages*	*Electronic*	*Duration of project*	*Documented records*
2(b) Period of burning coal during normal operation burnt in boiler	*Duration /time*	*Mass/time*	*Hours*	*M*	*From records and continuous*	*All*	*Electronic*	*Duration of project*	*Documented records (Pi-system) from conveyor to boiler*
2(c) SA Electricity emissions	*Emissions intensity*	*Mass/unit of energy*	*Kg* CO_2*/kWh*	*C*	*Annually*	*N/a*	*Electronic*	*Duration of project*	*Annual reports of electricity regulator/utilities IPCC guidelines used in calculating emissions*
2(d) Biomass combustion efficiency	*Efficiency*	*N/A*	*%*	*M/c*	*Annually*	*All*	*Electronic*	*Duration of project*	*Ratio between CV of Biomass in and CV of spent biomass fuel*

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
2(e) Coal combustion efficiency	*Efficiency*	*N/A*	*%*	*C*	*As per records*	*All*	*Electronic*	*Duration of project*	*Historical data*
2(f) Boiler biomass burning thermal efficiency	*Efficiency*	*N/A*	*%*	*C*	*Annually*	*All*	*Electronic*	*Duration of project*	*Ratio between thermal energy (steam) out and thermal energy provided by the burning of biomass*
2(g) Energy delivered by boiler	*Flow*	*Mass steam/unit of time*	*kgs/sec*	*M*	*Continuously*	*All*	*Electronic*	*Duration of project*	*Quantity of steam at to steam header from boiler*
2(h) Enthalpy of steam	*Heat*	*Heat*	*MJ/kg*	*M*	*Continuously*	*All*	*Electronic*	*Duration of project*	*Measured temperature and pressure provides enthalpy*
2(i) enthalpy of boiler feed water	*Heat*	*Heat*	*MJ/kg*	*M*	*Continuously*	*All*	*Electronic*	*Duration of project*	*Measured temperature provides enthalpy*
2j) Electricity to new equipment installed in the wood yard	*Flow*	*Energy*	*kWh*	*M*	*Continuously*	*All*	*Electronic*	*Duration of project*	*New equipment will be installed with metering equipment*
3(a) Emissions policy	*Policy implications*			*M*	*Annually*	*All*	*Paper*	*Duration of project*	*Interpretation of national and/or local policy with respect to emissions from boilers*
4(a) Landfill policy	*Policy implications*			*E*	*Annually*	All	*Paper*	*Duration of project*	*Interpretation of national and/or local policy with respect to emissions from landfills*

D.4 Name of person/entity determining the monitoring methodology

Ciska Terblanche Mondi Business Paper

Table 4: *Responsibilities in terms of monitoring of information*

Parameters	Where monitored	Capacity	Procedure
1a& b	Weighbridge	Wood Yard Business Manager	Record weight of all trucks entering the mill with biomass
1c	Internal laboratory	Laboratory Manager	Standard CV test
2a & b	On the conveyor system to the boiler - Stored in the internal *PI system	Power and Recovery Manager/ Environmental Engineer	Record biomass/coal burnt on *PI system. Access information from PI system
2c	Technical Department	Environmental Engineer	Internet search/information supplied by Eskom or National Energy Regulator
2d, e, f, g, h, i	Power Boiler 1	Power and Recovery Manager	Monitoring of on-line data. Tests done where applicable. Standard calculations done to determine efficiencies
2j	Stored in the internal *PI system	Environmental Engineer/Electrical engineer Wood Yard	Access information from *PI system
3a, 4a	Internet/ Applicable authorities (local, provincial or national)	Environmental Engineer/ Environmental Manager	Information requested from the relevant authorities

*PI system – On-line Process information system at the mill

E. CALCULATION OF GHG EMISSION REDUCTIONS BY SOURCES

Uncertainties

Calculations done for this project are ex-ante calculations based on conservative projections on the availability of biomass, and hence the replacement of coal as a fuel. During the monitoring of parameters, the ex-ante estimates of emissions will be corrected ex-post as applicable.

E.1 Formulae used

In E.1.1 please provide the formula used to calculate the GHG emission reductions by sources in accordance with the applicable project category of CDM small-scale project activities contained in Annex B of the simplified M&P for CDM small-scale project activities.

In case the applicable project category from Annex B does not specify a specific formula to calculate the GHG emission reductions by sources please complete E.1.2 below.

E.1.1 Selected formulae as provided in Annex B

Appendix B of the Small-Scale Modalities and procedures has provided type IIIE (Methane Avoidance) and Type IC (Renewable Energy- Thermal Energy of the user) formulae for the estimation of emissions for project baseline emissions and project activity emissions.

Assumptions used in calculations:

- The boiler will combust an estimated additional maximum of 250 tonnes of biomass per day. The biomass can be a mixture of fines and woodchips contaminated with rocks, sand and metal, and plantation residues.
- The biomass that would have gone to landfill (avoided) is assumed at least 25% of the biomass burnt in the boiler from year 4 onwards. From year 1 onwards, the full amount of contaminated biomass that would have gone to landfill, will be burnt in the boiler. The amount of biomass not being landfilled will be monitored.

Table 5: *Figures used in calculations for Project Activity 1: Avoided methane emissions from landfill and plantation waste*

Global warming potential (GWP) of methane	21 (IPCC, 2001)
Landfill Methane correction factor (MCF)	Default is 1 for a managed landfill waste site deeper than 5 metres (IPCC, 2004)
Landfill Degradable organic carbon (DOC)	0.3 Default value (IPCC, 2004)
Fraction DOC dissimilate to landfill gas (DOC_F)	0.77 Default value (IPCC, 2004)
Fraction of CH_4 in landfill gas (F)	0.5 Default value (IPCC, 2004)
Plantation Methane correction factor (MCF)	0.4 Default (IPCC, 2004)
Plantation Degradable organic carbon (DOC)	0.3 Default value (IPCC, 2004)

Table 6: *Figures used in calculations for Project Activity 2: Reduction in coal consumption*

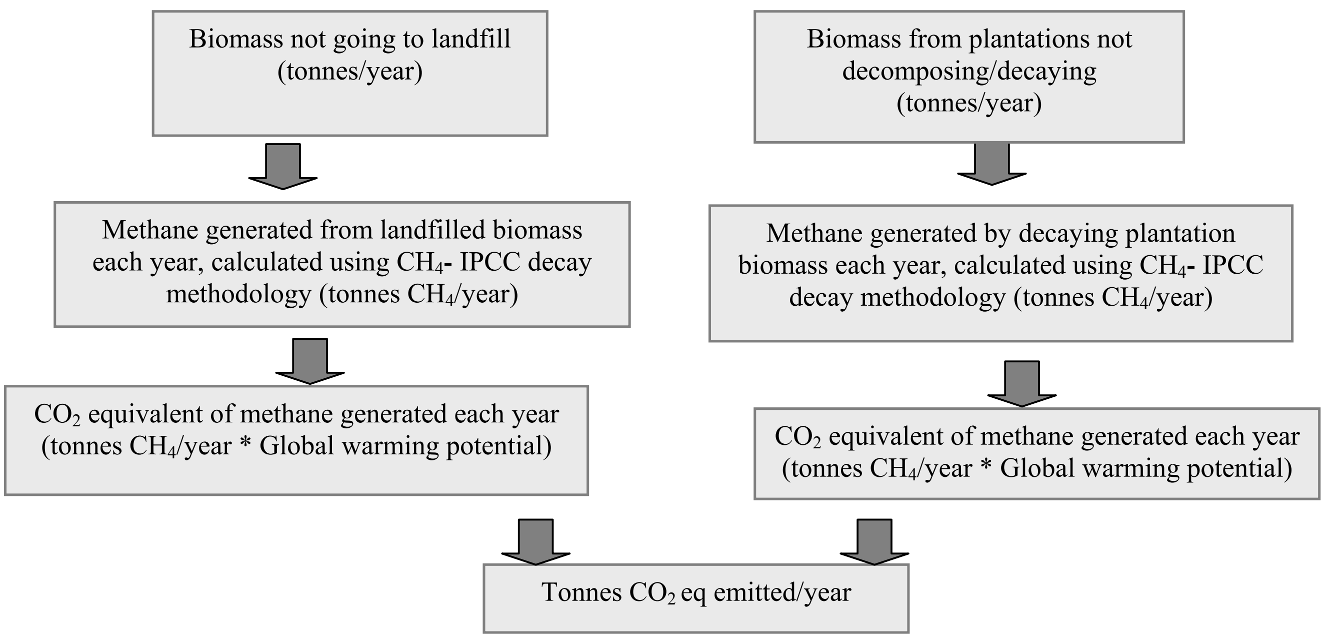
Calorific Value (CV) - Bituminous coal	27.5 MJ/kg	Mondi Richards Bay laboratory
Calorific Value - Biomass	8 MJ/kg	Mondi Richards Bay laboratory
Combustion efficiency of biomass (CE_B)	83.7%	Mondi Richards Bay
Combustion efficiency of coal (CE_C)	85.3%	Mondi Richards Bay
Thermal efficiency of boilers (TE)	91%	Mondi Richards Bay
Plant operation	350 days/year	
CO_2 emission factor for bituminous coal	2465 kg CO_2/tonne coal	NCASI spreadsheets developed for Climate Change Working Group of the International Council of Forest and Paper Associations (ICFPA): Direct Fuel Combustion Source emissions (GHG Protocol, Sector specific tool for pulp and paper mills, www.ghgprotocol.org)
CH_4 emission factor for biomass and waste combustion	0.012 kg/GJ fuel	
N_2O emission factor for biomass and waste combustion	0.004 kg/GJ fuel	
CH_4 emission factor for coal combustion	0.0016 kg/GJ fuel	
N_2O emission factor for coal combustion	0.001 kg/GJ fuel	
Weighted average CO_2 emissions for Electricity imported from national grid	0.89kg CO_2/kWh (Eskom)	Eskom publicly reported for the year 2002 that for every kWh it produced, 0.89 kg of CO2 were emitted (Eskom Annual Report 2002 page 133.
Global warming potential (GWP) of N_2O	310 tonne CO_2/tonne N_2O	IPCC
Global warming potential (GWP) of (CH_4)	21 tonne CO_2/tonne CH_4	IPCC
Enthalpy of boiler feed water	0.5 MJ/kg	Mondi Richards Bay

Enthalpy of steam from boiler	3.344 MJ/kg	Mondi Richards Bay

Algorithm for calculating emissions from Project Activity 1 (Methane Avoidance)

The following schematic algorithm describes the calculation steps for estimating the emissions reductions that are attributable to project activity 1. The calculation steps do not consider the increment between the baseline and project activity.

Calculation methodology for avoided methane release from landfilled biomass and plantation biomass. The calculation used is referred to in Appendix B of the simplified modalities and procedures for small-scale CDM project activities.



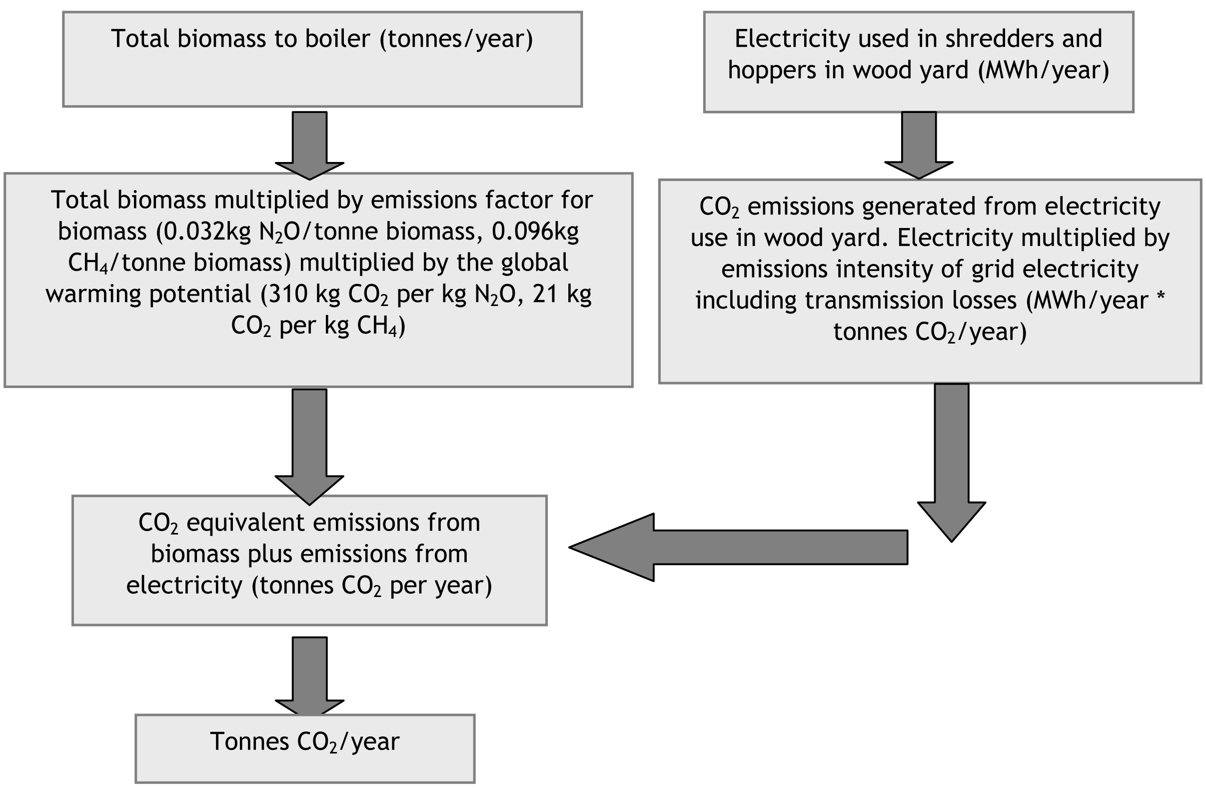
Notes:

- Biomass in project activity 1 will be burnt ("treated") in the second project activity i.e. overlapping project boundaries.
- The CH_4 and N_2O emissions from the treatment of the biomass are less than 15 kilotonnes of CO_2 equivalent.

Algorithm for calculating emissions Project Activity 2 (Thermal energy of the user)

The following algorithm describes the calculation steps for estimating the emission reductions that are attributable to the baseline and project activity 2. The calculation steps consider the increment between the baseline and project activity.

The amount of coal being fired in the coal/bark boilers was 130 (in 2003) and 121 (in 2004 so far) tonnes coal per day. "If we fire 500+ t/d biomass there will not be enough combustion air capacity to fire coal as well" Piet Kotze pers comm. October 15 2004.



Notes:

- In project activity 2, biomass waste that would have gone to landfill plus plantation waste will be burnt to provide heat and power.
- CO_2 emissions from electricity use in the wood yard will be accounted for in the project activity emissions.
- The project activity includes baseline biomass of 235 tonnes (2003 average), to 300 tonnes (2004 average) being burnt per day.

- N_2O and CH_4 emissions in both the baseline and the project activities, are excluded for the 235 to 300 tonnes biomass per day.

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

Formulae for calculating emissions from Project Activity 2

In this project activity, biomass will be exclusively burnt in the boiler under normal operational conditions. Below are the equations for calculating GHG emissions from the burning of biomass.

(Equation 1) CO2 emissions from biomass

$$CO_2\ emissions_B\left(\frac{tonne}{year}\right) = Biomass\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF\left(\frac{tonne\, CO_2}{tonne\, biomass}\right)$$

(Equation 2) CO2 equivalent of N2O emissions from biomass

$$\begin{matrix} CO_2\ eq\ of\ N_2O \\ emissions\ _B \end{matrix}\left(\frac{tonne}{year}\right) = Biomass\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF\left(\frac{tonne\, N_2O}{tonne\, biomass}\right) \times GWP\ for\ N_2O$$

(Equation 3) CO2 equivalent of CH4 emissions from biomass

$$\begin{matrix} CO_2\ eq\ of\ CH_4 \\ emissions\ _B \end{matrix}\left(\frac{tonne}{year}\right) = Biomass\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF\left(\frac{tonne\, CH_4}{tonne\, biomass}\right) \times GWP\ for\ CH_4$$

(Equation 4) CO2 emissions from electricity

$$CO_2\ emissions\ _E\left(\frac{tonne}{year}\right) = Electricit\ y\ consumptio\ n\,(MWh) \times SA\ grid\ EF\left(\frac{tonne\ \ CO_2}{MWh}\right)$$

(Equation 5) Total CO2 equivalent emissions from biomass per tonne

$$\begin{matrix} Tonnes\ \ CO_2 \\ eq\ emissions\ \ per\ \ year \end{matrix} = CO_2\ eq\ emissions\ _B\left(\frac{tonne}{year}\right) + CO_2\ emissions\ _E\left(\frac{tonne}{year}\right)$$

(Equation 6) Tonne N2O emissions per tonne biomass

$$\frac{Tonne\ \ N_2O}{tonne\ \ biomass} = N_2O\ EF_B\left(\frac{kilogramme}{GJ}\right)\ x\ \ CV_B\left(\frac{GJ}{kilogramme}\right) x\ \frac{tonne}{kilogramme}$$

(Equation 7) Tonne CH_4 emissions per tonne biomass

$$\frac{Tonne\ \ CH_4}{tonne\ \ biomass} = CH_4\ EF_B\left(\frac{kilogramme}{GJ}\right)\ x\ CV_B\left(\frac{GJ}{kilogramme}\right) x\ \frac{tonne}{kilogramme}$$

<u>Calculation example for emissions from Project Activity 2:</u>

There may be occasions when coal is used for example during start-up conditions. This will be monitored and these emissions will be added to the project activity emissions. For the purpose of this calculation, incidental use of coal is not included.

From equation 6:

$$\frac{Tonne\ \ N_2O}{tonne\ biomass} = 0.004\left(\frac{kilogramme}{GJ}\right)\ x\ \ 0.008\left(\frac{GJ}{kilogramme}\right)$$

$$0.000032 = \left(\frac{tonne\ N_2O}{tonne\ biomass}\right) ......6a$$

From equation 7:

$$\frac{Tonne\ \ CH_4}{tonne\ biomass} = 0.012\left(\frac{kilogramme}{GJ}\right) + 0.008\left(\frac{GJ}{kilogramme}\right) ......$$

$$= 0.0000\,96\ \left(\frac{\text{Tonne}\ \ CH_4}{tonne\ biomass}\right) ......7a$$

Note: the total quantity of biomass used in the emissions calculated above can be checked against the energy produced by the boiler if wood were burnt using the following equations:

Energy out: "283-FI-1123" {kg/s SH} * 3.344 {MJ/kg enthalpy steam} = X MW out (see 2g,h,i) in section D, table 3 above.)

Energy in: "283-FC-1001" {PB1 feed water flow} * 0.5 {MJ/kg enthalpy of feed water} = Y MW in

- ⇨ Energy from biomass = E out - E in = (X - Y) MW

This can be a daily figure. This figure can then, over a longer period, be cross checked with the amount of biomass measured by the weightometer sitting on the conveyor:

Ton biomass/month * Z {GJ/ton bio CV (we will use 8 for example)} = Q GJ => Q/30/24/3.6 = MW biomass feed.

Boiler efficiency = (X -Y)/Q*100. (This will be between 76 and 82%)

The amount of energy delivered by the boiler less that provided by biomass in the baseline is used to calculate the quantity of coal replaced in the baseline from the calorific value of coal and the efficiency of its combustion and the heat transfer efficiency of the boiler. From this quantity the project baseline emissions can be calculated.

From equation 1 for year 4:

It is estimated that by year 4 an additional 250 tonnes of biomass per day will be burnt in the boiler. That amounts to 87500 tonnes of biomass for year 4.

$$CO_2\ emissions\ _B\left(\frac{tonne}{year}\right) = Biomass\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_B\left(\frac{tonne\,CO_2}{tonne\,biomass}\right)$$

$$= 87500\left(\frac{tonne\ biomass}{year}\right) \times 0\left(\frac{tonne\,CO_2}{tonne\ \ biomass}\right)$$

$$= 0\ \left(\frac{tonne\ \ CO_2}{year}\right) \quad ......1a$$

From equation 2:

$$CO_2eq\ of\ N_2O\ _B\left(\frac{tonne}{year}\right) = \frac{Biomass}{burnt}\left(\frac{tonne}{year}\right) \times IPCC\ EF_B\left(\frac{tonne\,N_2O}{tonne\,biomass}\right) \times GWP\ for\ N_2O$$

$$= 87500\left(\frac{tonne\ biomass}{year}\right) \times 0.000032\left(\frac{tonne\ N_2O}{tonne\ \ biomass}\right) \times 310 \quad (GWP\ for\ N_2O)$$

$$= 868\left(\frac{tonneCO_2}{year}\right) \quad ......2a$$

From equation 3:

$$CO_2\ eq\ of\ CH_4\ _B\left(\frac{tonne}{year}\right) = Biomass\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_B\left(\frac{tonne\,CH_4}{tonne\,biomass}\right) \times GWP\ \ for\ CH_4$$

$$= 87500\left(\frac{tonne\ biomass}{year}\right) \times 0.000096\left(\frac{tonne\ CH_4}{tonne\ biomass}\right) \times 21$$

$$= 176\left(\frac{tonne\ CO_2}{year}\right) \quad ......3a$$

From equation 4:

$$CO_2\ emissions_E \left(\frac{tonne}{year}\right) = Electricity\ consumption\ (MWh) \times SA\ grid\ EF \left(\frac{tonne\ CO_2}{MWh}\right)$$

$$= 627\left(\frac{MWh}{year}\right) \times 0.89\left(\frac{tonne\,CO_2}{MWh}\right)$$

$$= 558\ \left(\frac{tonne\,CO_2}{year}\right)$$

T&D losses 10%)

$$= 620\ \left(\frac{tonne\,CO_2}{year}\right) \ldots\ldots\ldots\ldots\ldots 4a$$

Table 7: *Summary of Project Activity 1 and Project Activity 2 emissions*

Project Activities				
Emission Source	*Quantity*	*Energy equivalent*	*Emissions intensity*	*CO_2 emissions*
				Tonnes
Project Activity 1				
Biomass to landfill year 1	0	0	0	0
Biomass to landfill year 2	0	0	0	0
Biomass to landfill year 3	0	0	0	0
Biomass to landfill years 4 to 10	0	0	0	0
Subtotal				**0**
Project Activity 2				
Biomass to boiler year 1	35 000 tonnes/year	280 000 GJ/year	310 tonnes CO_2 equivalent /tonne N_2O/year	347+
			21 tonnes CO_2 equivalent /tonne CH_4/year	71
Biomass to boiler year 2	52 500 tonnes/year	420 000 GJ/year	310 tonnes CO_2 equivalent /tonne N_2O/year	521+
			21 tonnes CO_2 equivalent /tonne CH_4/year	106
Biomass to boiler Year 3	70 000 tonnes/year	560 000 GJ/year	310 tonnes CO_2 equivalent /tonne N_2O/year	694+
			21 tonnes CO_2 equivalent /tonne CH_4/year	141
Biomass to boiler Years 4 to 10	87 500 tonnes/year	700 000 GJ/year	310 tonnes CO_2 equivalent /tonne N_2O/year	868+
			21 tonnes CO_2 equivalent /tonne CH_4/year	176
Coal[2]	0 t/a	0	0	0
Electricity consumption from year 1 to 10	MWh/year	627 MWh/year	0.89 tonnes CO_2/MWh /0.9* 10 years	620
Subtotal for years 1 to 10				**15.39 kilotonnes**

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

Leakage – not applicable to either project type because of small-scale methodologies, however, leakage from transport is calculated and included in Annex 3. Negative leakage will be ignored on the grounds of conservatism.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the Project Activity emissions

Table 8: *Summary of Project Activity emissions*

Source	*CO_2 emissions Kilotonnes*
Project Activity 1	**0**
Project Activity 2	**15.39**
Leakage	**n/a**
Total project activities and leakage CO_2 emissions	**15.39**

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the **baseline** using the baseline methodology for the applicable project category in Annex B to the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulae/algorithm, emissions in units of CO_2 equivalent)*

Formulae for calculating emissions from Project Activity 1 Baseline: Methane Avoidance

Baseline emissions are the amount of methane from the decay of the biomass treated in the project activity (in this case treated in the 2nd project activity). This biomass includes biomass that goes to landfill and plantation biomass.

Equation 8

$$CH_4 IPCC\,decay = MCF \quad x \quad DOC \,x\, DOCf \quad x \quad F \quad x \quad \frac{16}{12}$$

For the calculation of CH_4 IPCC decay the IPCC default values have been used

Where;

- **CH_4 IPCC decay** refers to the emission factor for decaying biomass in the region of the project activity (tonnes of CH_4 /tonne of biomass or organic waste);
- **MCF** refers to the methane correction factor (fraction)(default is 1 as the landfill site is managed and 10 metres deep); For plantation waste the MCF default is 0.4 (for unmanaged shallow waste sites under 5 meters)
- **DOC** refers to the degradable organic carbon 0.4 ((percent waste that is paper and textiles) + 0.17 (per cent waste that is garden waste, park waste or other non-food organic petruscibles +

0.15 (per cent waste that is food waste) + 0.30 per cent waste that is wood or straw; For plantation waste the DOC is 0.3 for 100% wood

- **DOC_F** refers to the fraction DOC dissimilate to landfill gas (IPCC default value is 0.77); and
- **F** refers to the fraction of CH_4 in landfill gas (IPCC default value is 0.5)

Therefore, the baseline methane emissions from biomass decay (tonnes of CO_2 equivalent) is equal to the quantity of biomass treated under the project activity (in this case treated in project activity 2) x CH_4 IPCC decay x CH_4 GWP (tonnes of $CO_{2\ \text{equivalent}}$ / tonne CH_4)

Equation 9:

$$\begin{array}{c}CO_2\ eq\ of\ CH_4\ formation\\ from\ biomass\ decay\\ for\ landfill\end{array} = \begin{array}{c}Amount\ of\ Biomass\ burnt\\ in\ project\ activity\\ previously\ landfilled\end{array} \times \begin{array}{c}CH_4\ IPCC\ decay\\ (landfill)\end{array}\ x\ \ GWP\ for\ CH_4$$

Equation 10

$$\begin{array}{c}CO_2\ eq\ of\ CH_4\\ from\ plantation\\ waste\ decay\end{array} = \begin{array}{c}Amount\ of\ Biomass\ burnt\\ in\ project\ activity\\ previously\ left\ t\\ in\ plantations\end{array} \times \begin{array}{c}CH_4\ IPCC\ decay\\ (plantation)\end{array}\ x\ \ GWP\ for\ CH_4$$

Equation 11

$$\begin{array}{c}Total\ CO_2\ eq\ of\ CH_4\\ formation\ \ from\ biomass\ \ decay\end{array} = \begin{array}{c}CO_2\ eq\ of\ CH\ 4\\ formation\ \ from\\ plantation\ \ waste\end{array} + \begin{array}{c}CO_2\ eq\ of\ CH\ 4\ formation\\ from\ biomass\ \ decay\\ in\ landfill\end{array}$$

<u>Calculation example for baseline emissions from Project Activity 1:</u>

For landfill from equation 8:

$$\begin{array}{c}CH_4\ IPCC\\ decay\end{array} = 1\ (MCF\ ) \times\ 0.3\ (DOC\ )\ \ x\ \ 0.77\ \left(\begin{array}{c}DOC\ \ dissimilat\ \ ed\\ to\ landfill\ \ gas\end{array}\right) x\ 0.5 \left(\begin{array}{c}CH_4\ fraction\\ in\ landfill\ \ gas\end{array}\right) x\ \frac{16}{12}$$

$$= 0.154\ \left(\frac{tonne\ CH_4}{tonne\ biomass}\right) \textbf{....8a}$$

Therefore baseline methane emissions (in year 1) from equation 9:

$$\begin{matrix} CO_2\ eq\ of\ Methane\ formation \\ from\ biomass\ decay\ for\ landfill \end{matrix} = 21875 \left(\frac{tonnes}{year} \right) \times 0.154 \quad x \quad 21$$

$$= 70.7 \left(\frac{kilo\,tonne\ CO_2}{year} \right) \textbf{....9a}$$

For plantation waste decay from equation 8:

$$CH_{4\ IPCC\ decay} = 0.4\ (MCF) \times 0.3\ (DOC)\ x\ 0.77\ (DOC\ dissimilated_{to\ landfill\ gas})\ x\ 0.5 \left(\begin{matrix} CH_4\ fraction \\ in\ landfill\ gas \end{matrix} \right) x\ \frac{16}{12}$$

$$= 0.0616 \left(\frac{tonne\ CH_4}{tonne\ biomass} \right) \textbf{....8b}$$

Therefore, baseline methane emissions from plantation waste (in year 1) from equation 10:

$$\begin{matrix} CO_2\ eq\ of\ Methane\ formation \\ from\ biomass\ decay\ for\ plantations \end{matrix} = 13125 \left(\frac{tonnes}{year} \right) \times 0.0616 \quad x \quad 21$$

$$= 16.9 \left(\frac{kilo\,tonne\ CO_2}{year} \right) \textbf{...10a}$$

From equation 11:

$$\begin{matrix} Total\ CO_2\ eq\ of\ Methane\ formation \\ from\ biomass\ decay \end{matrix} \left(\frac{kilotonnes}{year} \right) = 28.29 \left(\frac{kilo\ tonnes}{(from\ landfill)\ year} \right) + 16.9 \left(\frac{kilo\ tonnes\ C(}{(from\ plantation} \right.$$

$$= 45.2 \left(\frac{kilo\ tonnes}{year} \right) ....11a$$

Equation 11a will only be applicable when the methane emission factors for plantation waste are confirmed. The conservative approach is taken in the PDD whereby the methodology and equations for calculating the equivalent CO2 emissions from plantation waste are described, but the figures are not included in the tables until confirmation is received (during verification).

Table 9: *Summary of Project activity 1 Baseline emissions*

Project Activity 1 Baseline				
Emission Source	*Quantity of biomass not going to landfill or plantations*	CH_4 IPCC decay (IPCC default values have been used)	*Emissions intensity*	*Baseline CO_2 equivalent emissions*
	tonnes $_{biomass}$ /annum	*tonnes CH_4/year*	*tonnes CO_2/tonne*	*Kilotonnes*
Avoided methane from landfill years 1 to 10	21875	3369	21 tonnes CO_2 $_{equivalent}$ /tonne CH_4/year	70.74
Avoided methane from plantations years 1	13125	808	21 tonnes CO_2 $_{equivalent}$ /tonne CH_4/year	*0
Avoided methane from plantations years 2	30625	1887	21 tonnes CO_2 $_{equivalent}$ /tonne CH_4/year	*0
Avoided methane from plantations years 3	48125	2965	21 tonnes CO_2 $_{equivalent}$ /tonne CH_4/year	*0
Avoided methane from plantations years 4 to 10	65625	4043	21 tonnes CO_2 $_{equivalent}$ /tonne CH_4/year	*0
Electricity consumption	MWh/a	0	0.89 tonnes CO_2/MWh*/0.9 *10 years	0
Subtotal				707.4

*Reference: Comment regarding plantation waste in text box on page 4

Therefore, total avoided emissions from this project activity for a 10 year crediting period are 707 kilotonnes of CO_2 $_{equivalent}$.

Formulae for calculating emissions from Project Activity 2 Baseline:_Thermal energy of the user

Notation:

Combustion Efficiency = CE

Thermal Efficiency = TE

Emissions Factor = EF

Equation 12

$$Coal\ burnt\left(\frac{tonne}{day}\right) = Biomass\left(\frac{tonne}{day}\right) * \frac{CV_{biomass}\left(\frac{MJ}{kg}\right)}{CV_{coal}\left(\frac{MJ}{kg}\right)} \times \frac{(CE \times TE)_{biomass\ boiler}}{(CE\ x\ TE)_{coal\ boiler}}$$

Equation 13

$$CO_2\ emissions_C\left(\frac{tonne}{year}\right) = Coal\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_C\left(\frac{tonne\ CO_2}{tonne\ coal}\right)$$

Equation 14

$$CO_2\ eq\ of\ N_2O\ emissions_C\left(\frac{tonne}{year}\right) = Coal\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_C\left(\frac{tonne\ N_2O}{tonne\ coal}\right) \times GWP\ of\ N_2O$$

Equation 15

$$CO_2\ eq\ of\ CH_4\ emissions_C\left(\frac{tonne}{year}\right) = Coal\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_C\left(\frac{tonne\ CH_4}{tonne\ coal}\right) \times GWP\ of\ CH_4$$

Assumptions:

- It is estimated that by year 4 an additional 250 tonnes of biomass per day will be burnt in the boiler.
- For the purpose of this calculation, it is assumed that 71.4 tonnes of coal per day would have continued to be burnt. The biomass replaces all the coal currently being used.

Calculation example for baseline emissions from Project Activity 2:

From equation 23:

$$Coal\ burnt\left(\frac{tonne}{day}\right) = 250\left(\frac{tonne}{day}\right) * \frac{8\left(\frac{MJ}{kg}\right)}{27.5\left(\frac{MJ}{kg}\right)} \times \frac{(83.7 \times 91)_{biomass\ boiler}}{(85.3\ x\ 91)_{coal\ boiler}}$$

$$= 71.4\left(\frac{tonne}{day}\right) \ldots\ldots 27$$

From equation 24:

$$CO_2\ emissions\ _C\left(\frac{tonne}{year}\right) = Coal\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_C\left(\frac{tonne\ CO_2}{tonne\ coal}\right)$$

$$= 71.4\left(\frac{tonne}{day}\right) x\ 350\left(\frac{days}{year}\right) \times 2.465\left(\frac{tonne\ CO_2}{tonne\ coal}\right)$$

$$= 61616\left(\frac{tonne}{year}\right) \ldots\ldots 28$$

From equation 25:

$$CO_2\ eq\ of\ N_2O\ emissions\ _C\left(\frac{tonne}{year}\right) = Coal\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_C\left(\frac{tonne\ N_2O}{tonne\ coal}\right) \times GWP\ of\ N_2O$$

$$= 71.4\left(\frac{tonne}{day}\right) x\ 350\left(\frac{days}{year}\right) \times 0.000\ 0275\left(\frac{tonne\ N_2O}{tonne\ coal}\right) \times 310\ (GWP\ of\ N_2O)$$

$$= 213\left(\frac{tonne}{year}\right) \ldots\ldots 29$$

From equation 26:

$$CO_2\ eq\ of\ CH_4\ emissions\ _C\left(\frac{tonne}{year}\right) = Coal\ burnt\left(\frac{tonne}{year}\right) \times IPCC\ EF_C\left(\frac{tonne\ CH_4}{tonne\ coal}\right) \times GWP\ of\ CH_4$$

$$= 71.4\left(\frac{tonne}{day}\right) x\ 350\left(\frac{days}{year}\right) \times 0.000\ 044\left(\frac{tonne\ CH_4}{tonne\ coal}\right) \times 21\ (GWP\ of\ CH_4)$$

$$= 23\left(\frac{tonne}{year}\right) \ldots\ldots\ldots\ldots 28$$

Table 10: *Summary of Project activity 2 Baseline emissions*

Project Activity 2 Baseline				
Emission Source	*Quantity*	*Energy equivalent*	*Emissions intensity*	*CO_2 emissions*
		GigaJoules	*tonnes CO_2/tonne*	*kilotonnes*
Coal used in boiler year 1	9646 tonnes/year	27.5 GJ/tonne coal	2.465 from CO_2 2.75E-05 from N_2O 4.4E-05 from CH_4	23.7 0.082 0.009
Coal used in boiler year 2	14469 tonnes/year	27.5 GJ/tonne coal	2.465 from CO_2 2.75E-05 from N_2O 4.4E-05 from CH_4	35.7 0.123 0.013
Coal used in boiler year 3	19292 tonnes/year	27.5 GJ/tonne coal	2.465 from CO_2 2.75E-05 from N_2O 4.4E-05 from CH_4	47.6 0.164 0.018
Coal used in boiler years 4 to 10	24115 tonnes/year	27.5 GJ/tonne coal	2.465 from CO_2 2.75E-05 from N_2O 4.4E-05 from CH_4	59.5 0.206 0.022
Subtotal (for 10 years)				525.234

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period. The reduction is estimated at **1217 kilotonnes CO_2 equivalent.**

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

Table 11: *Summary of emissions for Project Activities and Baselines*

Total CO_2 equivalent emissions	
Source	*CO_2 emissions kilotonnes*
Project Activity 1	**0**
Project Activity 1 Baseline	**707**
Project Activity 2	**15.39**
Project Activity 2 Baseline	**525**
Leakage	**-**
Total emissions reductions over 10 years	**1217**

F. ENVIRONMENTAL IMPACTS

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

1. Reduction in GHG emissions from fossil fuel (coal) burning
2. Reduction in fly and coarse ash to landfill resulting in longer lifespan of the landfill site
3. Less biomass to municipal landfill site which will prevent CH_4 emissions from landfill
4. No significant impact on water consumption or water disposal
5. Opportunities for job creation (SMME)

Confirmation was received from the Department of Agriculture and Environmental Affairs that in terms of the Environmental Conservation Act Section 21 and Section 22, a full EIA is not necessary. Mondi Richards Bay has embarked on a public participation exercise where stakeholders were invited to attend a presentation on the project and to deliver comments for discussion and follow up. Representatives from the local authorities (including the Health Department and the Air Quality Department), the Richards Bay Clean Air Association and the ratepayers attended the presentation. The scope and technicalities of the project were discussed and questions from the stakeholders were answered. The only comment received was that Mondi should present the impact of the project after implementation to stakeholders to serve as an example to other industries in the area. Mondi agreed to implement this recommendation.

G. STAKEHOLDERS COMMENTS

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled

An advertisement was placed in the local newspaper to invite stakeholders to participate in a presentation of the biomass project that was held at the Mondi Forum meeting. Comments were invited and recorded. Representatives from the ratepayers association, the local authority including the health department attended. The Department of Agriculture and Environmental Affairs confirmed that the scope of the project is such that a full EIA is not required.

G.2 Summary of the comments received

The only comment received was from the ratepayers representative who indicated that the project sets an example for industry in the area. A request was received from the local authority that a presentation should be given to the Form members once the project has been implemented. Mondi Richards Bay agreed to deliver a presentation after completion of the project.

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

Refer to the comments in Section F

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Mondi Business Paper Ltd
Street/P.O.Box:	Box 1551
City:	Richards Bay
State/Region:	KwaZulu Natal
Postfix/ZIP:	3901
Country:	South Africa
Telephone:	+2735 902 2111
FAX:	+2735 902 2229
E-Mail:	Ciska.terblanche@mondibp.com
URL:	
Represented by:	
Title:	Environmental Manager
Last Name:	Terblanche
First Name:	Ciska
Department:	Technical
Mobile:	+2782 898 5750
Direct FAX:	+2735 902 2229
Direct tel:	+2735 902 2322
Personal E-Mail:	Ciska.terblanche@mondibp.com

Project Facilitator

Organization:	**South***South*North trust (Project facilitator)
Street/P.O.Box:	138 Waterkant Street
Building:	
City:	Greenpoint, Cape Town
State/Region:	Western Cape
Postfix/ZIP:	8001
Country:	South Africa
Telephone:	+2721-4251465
FAX:	+2721-4251463
E-Mail:	steve@southsouthnorth.org
URL:	
Represented by:	
Title:	South African Team Leader and SSN Technical Co-ordinator (facilitating the project)
Last Name:	Thorne
Middle Name:	James
First Name:	Steve
Department:	South African and Central office
Mobile:	+2782 5752056
Direct FAX:	+2721-4251463
Direct tel:	+2721-4251465
Personal E-Mail:	steve@southsouthnorth.org

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

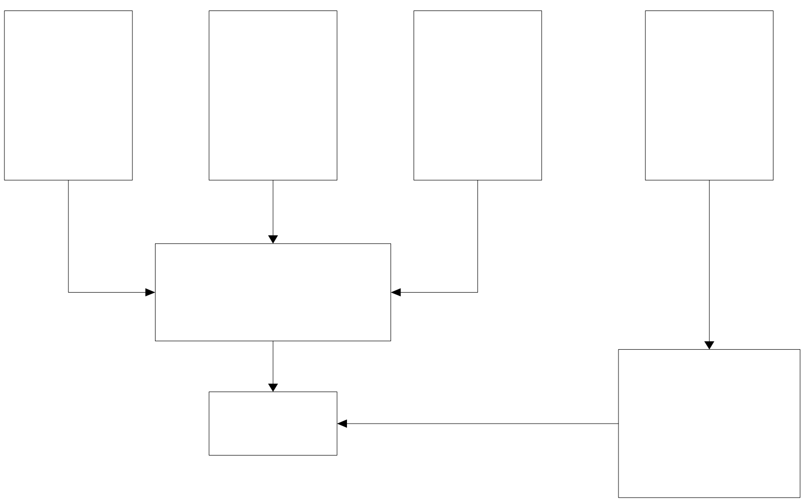
There is no public funding involved in the project.

Annex 3

LEAKAGE CALCULATIONS (estimations of leakage – not required in the small-scale type included here)

1. It is assumed that 25% of the biomass will be coming from local sources in Richards Bay and 75% of the sources will be from farmers situated up to 40 to 50 kilometres from Richards Bay – an average of 25 kilometres will be used in calculations.
2. Landfill emissions related to transporting ash from Richards Bay mill to the Mondi owned landfill site are disregarded because the amount of ash landfilled will reduce as biomass produces less ash than coal would. Disregarding these emissions is in keeping with the conservative baseline.

The calculation steps below estimates the emissions attributable to changes in road and rail transport because of the project activity.



Fuel for

Fuel for

Calculation of transport emissions

Table 12: *Information for calculating transport emissions*

CO_2 emission factor for diesel	3.77kgs CO_2/litre (86.3% by mass Carbon and Specific gravity of 0.84) (Ref: Kinsky, R. (1997): Thermodynamics: Advanced Applications, McGraw-Hill, Sydney, p.66)
Ash in bituminous coal	13-16% (ref: Carbon Fuels, Paarl)
Diesel consumption	0.56 litres/tonne/km (ref: Mondi contractors)
Electricity consumption for coal transport	12.86 Wh/tonne/km (For the Coalline these figures are 18,82 and 12,86 for the DC and AC sections respectively, For the leakage the lower of the two values were used, JP du Plessis Pr Eng, Principal Engineer, Valuation, Acquisition and Review) Spoornet, pers comms, Feb 27, 2003.
Specific Gravity of Diesel	0.84
Carbon content of Diesel	86.3%

Table 13: *Emissions from Leakage*

Project Leakage					Reference
Emission Source	*Quantity (tonnes)*	*Distance travelled*	*Emissions intensity*	*CO_2 emissions*	
	tonnes	*kms*	*l/tonne km*	*Kilotonnes*	
Leakage description					
Transport of coal ash from boiler to landfill	123200	30	0.56	2,070	
Transport of biomass from farms to Mondi	577500	25	0.56	8,085	See assumptions above
Transport of fines and contaminated biomass to wood yard	577500	20	0.56	6,468	
Transport of waste biomass to landfill	-577500	20	0.56	(6,468) -	
Rail transport of coal from mine to Mondi	219798	280	12.86 Wh/tonne/km (ref. Spoornet)	775	
Subtotal				**10.93**	