CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

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MNI Renewable Energy Plant
10th July 2008
Version 01

A.2. Description of the project activity:

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Malaysian Newsprint Industries, MNI is an established Malaysian company producing premium grade newsprint primarily for newspaper publishers in Malaysia and Asia. The company's paper mill is located in Mentakab, Pahang. The mill recycles approximately 330,000 tonnes of old newspapers to produce up to 280,000 tonnes of newsprint per annum.

The paper mill owns and operates a combined heat and power plant, CHPP to produce steam and electricity for the mill's own consumption. The CHPP uses MFO to generate heat and power and in addition the paper mill imports electricity from the national electricity grid. The paper mill would have continued this current practice in the absence of the project activity. The existing system has sufficient capacity to supply up to cater for the consumption and maximum demand of the paper mill.

The project is to implement a renewable energy project, which implies installation of a 66 t/hr, 42 bar_g biomass boiler to displace the steam and electricity generation from the fuel oil fired CHPP for the paper mill's own consumption. The boiler will be connected to an existing steam turbine to generate electricity. It is expected that the biomass energy plant can generate and displace 7 MW of electric power.

The biomass boiler will use biomass waste from palm oil industries as the primary fuel source. The biomass waste from a typical palm oil mill will consists of empty fruit bunches, EFB's, fibres and palm kernel shells, PKS. Some of the biomass source may also come from wood industries in the form of wood waste. Generally, EFB is excessively available at the palm oil mills as the energy demand at the palm oil mills is fulfilled mainly from fibres and PKS. Thus, the primary source of biomass for the paper mill's energy plant will be from EFB's.

Environmental sustainability

This project is in line with the Malaysian Government's decision to intensify the development of Renewable Energy as the fifth fuel resource under the country's Fuel Diversification Policy, as stipulated in the objectives of the Third Outline Perspective Plan for 2001-2010 (OPP3) and the Ninth Malaysia Plan.

Utilizing Biomass energy as the fifth fuel resource in this project has the potential of reducing the use of fossil fuel to generate steam for own consumption and increase the use of renewable energy resources such as biomass waste from palm oil mills.

Efficient use of the biomass waste will lead to a better waste management practices and gives a positive impact to the environment. The project will comply with established local environmental standards on boiler and waste handling.

Social sustainability

The new biomass boiler will require additional man power in terms boiler operation, fuel preparation and mainly fuel transport. The project will also require more skilled staff compare to a conventional boiler operator whom need to be trained in biomass fuel preparation system. The current workforce will be trained to operate the new plant and new qualified staff will be employed.

The biomass will be sourced from palm oil mills in Malaysia, which will benefit from the revenue from selling the biomass, which could otherwise cause expenses for disposal and waste management. Preparation of the biomass such as shredding and dewatering will potentially create additional jobs at the mills.

Furthermore the transportation of biomass will provide jobs for drivers and transportation companies.

Economic sustainability

The project will lead to economic sustainability as the fuel source is a sustainable, indigenous resource, which reduces fuel imports and negative impact on the foreign exchange.

This project will provide a show-case of working biomass energy plant designed for newsprint industries utilising biomass waste from palm oil mills which are located in a far distance. This will provide an important reference for technology providers when promoting similar technologies locally and abroad to other industries outside the circle of palm oil mills. This will eventually lead to increased exports for Malaysia on biomass technologies utilising palm oil mill's waste.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Malaysia, (host)	Private entity: Malaysian Newsprint Industries Sdn. Bhd.	No
Denmark	Nordjysk Elhandel A/S	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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The project location is at Temerloh Industrial Park, Mentakab in the state of Pahang.

A.4.1.1. Host Party(ies):

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Malaysia

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

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Pahang Darul Makmur

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

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Mentakab

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

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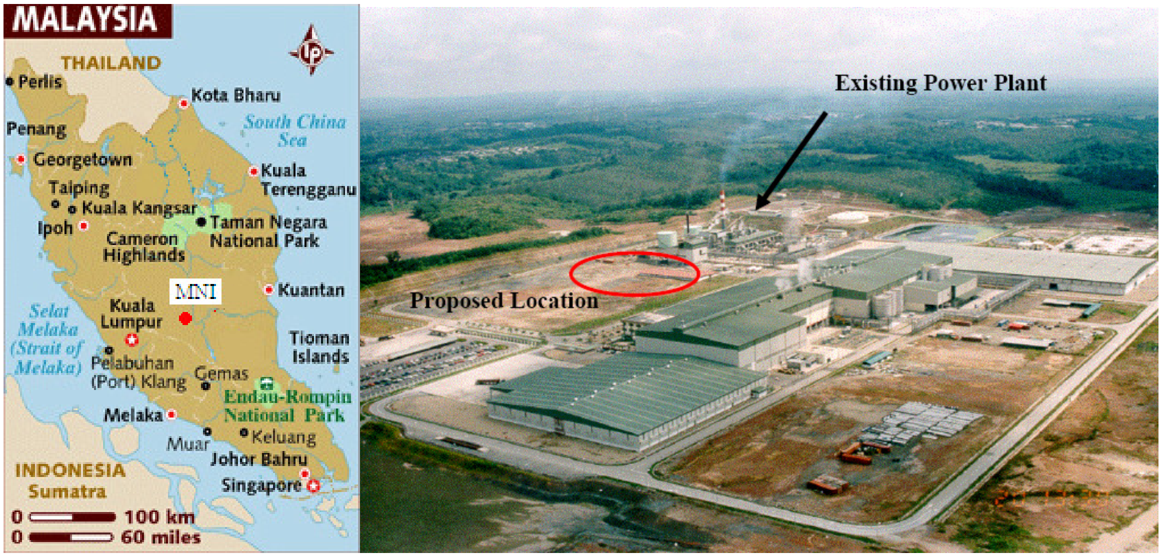
The paper mill headquarters location addresses are as given below;

Paper mill
Lot 3771, Temerloh Industrial Park,
28400 Mentakab,
Pahang Darul Makmur,
Malaysia.

Headquarters
Level 7, Wisma Hong Leong,
18 Jalan Perak,
50450 Kuala Lumpur

The location map of the paper mill is given below.



A.4.2. Category(ies) of project activity:

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The project falls under the category of large scale project activity under the sectoral scope 1 using ***"Approved consolidated baseline and monitoring methodology ACM0006, Version 06"***. This project activity will be displacing process steam from fossil fuel and electricity from the national grid with biomass source.

A.4.3. Technology to be employed by the project activity:

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This project will displace the existing 3 units of MFO fired cogeneration systems (1 unit :120 t/hr, 90 Bar_g & 515°C MFO boiler and 25.8 MW steam turbine) with one unit of 66 t/hr, 42 Bar_g & 410°C, water tube biomass boiler with 7 MW of electricity generation capacity. One of the existing steam turbines will be modified to generate electricity using comparatively lower pressure superheated steam from the biomass boiler.

The biomass handling system is unique and specially designed for this project activity to handle high moisture and fibrous biomass in order to get a steady steam supply for the process steam and power generation.

The biomass boiler layout is given in Annex 6.

The plant will have sufficient capacity to displace the steam supply fully and partially the electricity supply. As the paper mill has a 45 MW substation with the supply from the national electricity grid the balance of the power demand will be supplied from the grid.

The existing CHPP will be maintained in order to supply steam and power in periods where the biomass plant is unable to supply due to maintenance.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

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Year	Annual estimation of emission reductions in tonnes of CO2 e
1*	54,143
2	54,143
3	54,143
4	54,143
5	54,143
6	54,143
7	54,143
8	54,143
9	54,143
10	54,143
Total estimated reductions (tonnes of CO_2 e)	541,430
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	54,143

**Please refer to section C.2.2.1 for the starting date of the crediting period.*

Detailed calculation is given in annex 3.

A.4.5. Public funding of the project activity:

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There is no Public Funding involved in this project.

SECTION B. Application of a baseline and monitoring methodology

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

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Title of baseline and monitoring methodology: ***"Approved consolidated baseline and monitoring methodology ACM0006, Version 06"***.

ACM0006 draws upon the "Combined tool to indentify the baseline scenario and demonstrate additionality, Version 02.1", to demonstrate additionality for this projects activity.

The national grid emission factor is calculated using: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources, ACM0002".

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

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The applicability conditions stipulated in the ACM0006 are presented in table format below to justify the choice of the methodology.

Methodology : ACM0006	Applicability to Project Activity
Biomass residue fired electricity generation project activities, including cogeneration plant.	Yes. This project can be categorised as a cogeneration plant utilising biomass residues from palm oil and wood industries.
Power capacity expansion project.	Yes. The project is to install a new biomass residue fired cogeneration plant which operates next to existing cogeneration plant fired with fossil fuel (MFO)
No other biomass types than biomass residues, as defined in ACM0006, are used in the project plant and these biomass residues are the predominant fuel used in the project plant.	Yes. The predominant biomass residues used in this project activity are (EFB, Fibres, PKS and wood chips) which comes mainly from palm oil industry and wood industry.
The biomass residues used by the project facility should not be stored for more than one year	Yes. The biomass will not be stored for more than one year for this project activity.
No significant energy quantities, except from transportation or mechanical treatment of the biomass residues, are required to prepare the biomass residues for fuel combustion, i.e. projects that process the biomass residues prior to combustion	Yes. The transportation of biomass fuel and the fuel handling system are the identified sources which will increase the energy utilization in this project activity. No other significant energy quantities are required to prepare the biomass residues prior to combustion.

Key information and data to determine the baseline scenario and the project scenario is given in the table below.

Characteristics	Baseline Scenario	CDM Project Scenario
Fuel Input	Medium Fuel Oil (MFO)	Biomass (e.g EFB, Fibres, PKS, wood)
Cogeneration Unit	3 units of MFO fired cogeneration units inclusive of water tube boilers and steam turbines. (Normal Operation : 1 unit running)	1 unit of 66 t/h, 42 Bar_g, biomass fired, water tube boiler and steam turbine.
Electricity input	The past 3 years historical figures (2005-2007) of electricity consumption are given in Annex 3. The paper mill generate power by the CHPP and draw additional power from the national grid.	Power supply from the biomass energy plant and additional power supply from the national electricity grid.

B.3. Description of the sources and gases included in the project boundary:

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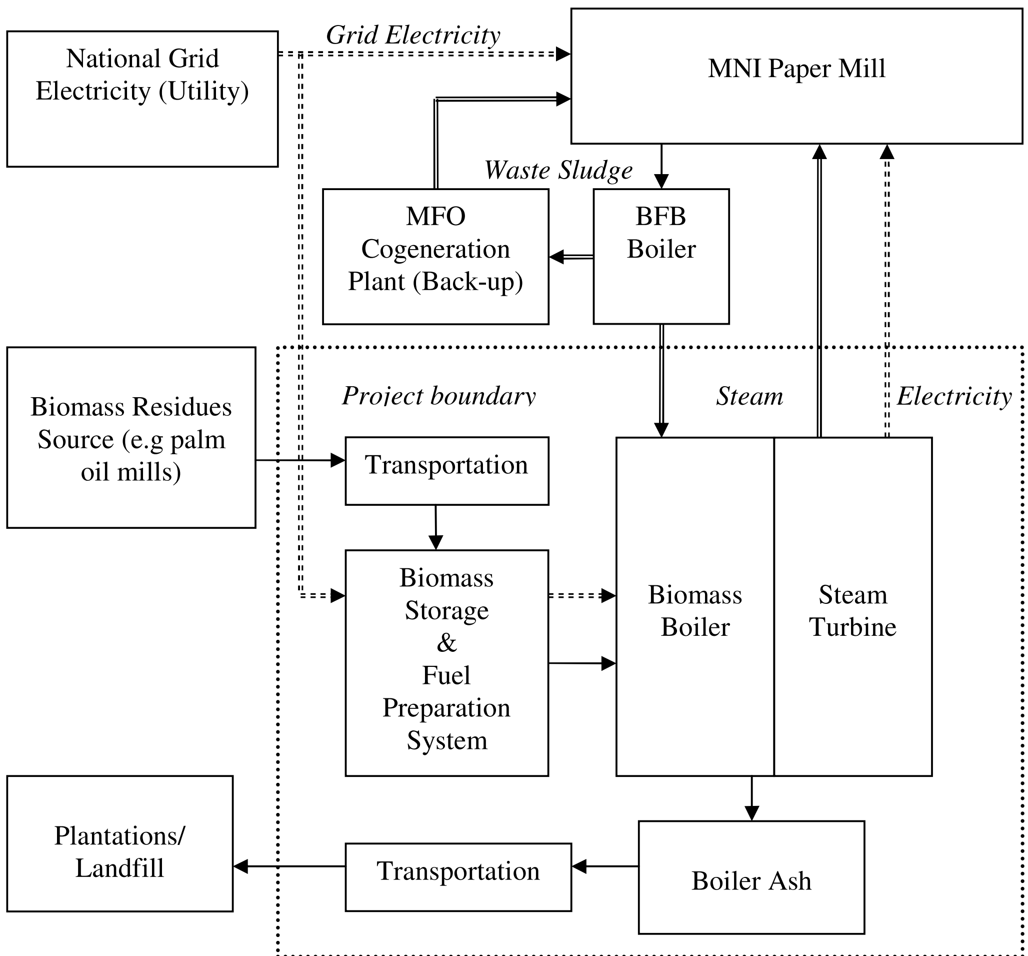
The project boundary refers to the new biomass boiler supplying steam for the paper mill's consumption including the biomass fuel storage and handling systems, and transportation of biomass residues from palm oil industries.

The diagram below depicts the project boundary and the sources of project emissions.



MNI Paper Mill
The paper mill is outside the project boundary and will receive steam from the biomass boiler as per the project activity. The electricity will be mainly purchased from the grid or using the existing MFO cogeneration system.

MFO Cogeneration Plant and BFB Boiler
The MFO cogeneration plant and the Bubbling Fluidised Bed (BFB) boiler are outside the project boundary. The MFO cogeneration plant will be used as a back up system. However the BFB boiler is currently incinerating waste sludge from the paper mill and is used to generate saturated steam for the existing CHPP plant i.e. feed water heating. This will be changed so the BFB in the future will supply saturated steam to the new biomass residue cogeneration plant.

Biomass Boiler

The new 66 t/h biomass boiler will be installed in an empty plot of land next to the existing CHPP. Please refer to the picture in section A.4.1.4. The new biomass boiler will generate steam to meet the steam demand at the MNI paper mill. The fuel for the boiler may consist of biomass residues/ waste from palm oil mills and saw mills. However the predominant fuel source is expected to be the EFB from palm oil mills.

Steam Turbine

An Existing steam turbine will be modified to generate approximately 7 MW_e of electricity using the comparatively low pressure steam from the biomass boiler.

Biomass Storage & Fuel Preparation System

The biomass fuel will be transported from palm oil mills and processed before storing in the designated storage area. The fuel will be shredded and dried if necessary before storing. The storage capacity is sufficient for 3 days of biomass boiler operation without interruptions.

Boiler Ash

The boiler ash will be transported back to the plantation as it is rich in potash which can be a substitute in organic fertiliser. If no plantations are willing to use the boiler ash as fertiliser, it will be transported to the nearest landfill

Electricity drawn from the grid

The biomass boiler, fuel handling and storage systems will consume approximately 1.5 MW of power will be be supplied from the grid..

Below is the table summarising on the emission sources included in or excluded from the project boundary.

Overview on emission sources included in or excluded from the project boundary

	Source	**Gas**		**Justification/Explanation**
Baseline	Electricity Generation	**CO_2**	**Included**	Main emission source from grid and MFO cogeneration electricity
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Heat generation	**CO_2**	**Included**	Main emission source from boilers generating steam using MFO
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Uncontrolled burning or decay of surplus biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	There might be emissions from decay from

	Source	Gas		Justification/Explanation
				biomass residues dumped in disposal sites in palm oil plantation. However this emission source is excluded due to high level of uncertainty in baseline data. This is very conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative. Note also that emissions from natural decay of biomass are not included in GHG inventories as anthropogenic sources.
Project Activity	On-Site fossil fuel and electricity consumption due to project activity (stationary or mobile)	**CO_2**	**Included**	There will be two emission sources under this category : a) Electricity from the grid This emission source comes from electricity drawn from the national grid for the biomass cogeneration plant operation during schedule maintenance of the cogeneration plant or unplanned stoppages. Electricity consumption for the equipments (e.g shredders, conveyors, moving floor, etc) used for biomass fuel handling and storage will also include under this category. b) On-Site Diesel Consumption This emission source comes from consumption of diesel for the trucks and front loaders or shovels used at the biomass fuel handling, storage area and boiler ash removal site.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Off-Site transportation of biomass residues	**CO_2**	**Included**	This emission source comes from transportation of biomass residues to the biomass cogeneration plant and transportation of ashes from the cogeneration plant to plantations or landfills.
		CH_4	Excluded	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Combustion of biomass residues for electricity and/or heat generation	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.

	Source	Gas		Justification/Explanation
		CH_4	Excluded	This emission source is excluded as CH_4 emission from uncontrolled burning or decay of biomass residues in the baseline scenario is excluded.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Storage of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded for simplification. Since biomass residues are stored for not longer than one year, this emission source is assumed to be small.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.
	Waste water from the treatment of biomass residues	CO_2	Excluded	It is assumed that CO_2 emissions from surplus biomass residues do not lead to changes of carbon pools in the LULUCF sector.
		CH_4	Excluded	Excluded as the waste water from biomass plant will be treated aerobically at the palm oil mills.
		N_2O	Excluded	Excluded for simplification. This emission source is assumed to be very small.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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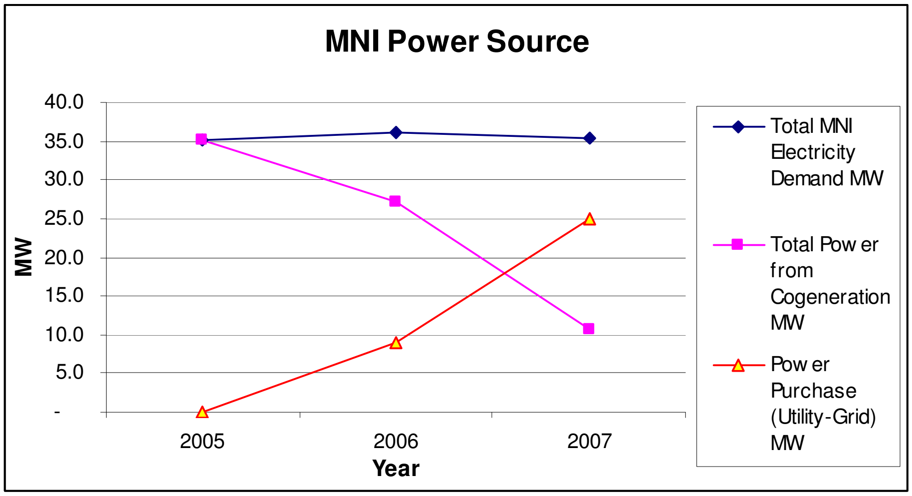
The baseline for the project activity is identified using the Table 1 and Table 2 in ACM0006. The best combination of baseline scenario applicable for this project is scenario number 7. Below are the justifications for selecting the combination of baseline scenario number 7 in a table format.

Baseline Scenario	Description in the Methodology	Applicability to Project Baseline
P3 and P4	P3: The generation of power in an existing captive power plant, using only fossil fuel. P4: The generation of power in the grid.	A fossil fuel (Medium Fuel Oil,MFO) fired cogeneration plant is in operation in the baseline scenario. After the implementation of the project activity, the MFO fired cogeneration plant continues to operate next to the new biomass residue fired cogeneration plant as a back-up plant. The power generated by the biomass residue cogeneration plant would in the absence of project

Baseline Scenario	Description in the Methodology	Applicability to Project Baseline
		activity be purchased from the grid or generated from MFO boiler.
B1 or B2 or B3	B1: The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields. B2: The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled or left to decay on fields. B3: The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.	The biomass residues (EFB, fibres, PKS, wood), used in the project plant would in the absence of project activity are dumped or left to decay under aerobic or anaerobic conditions (e.g Excess EFB : mulching or dumped in disposal sites or incinerated).
H3	The generation of heat in an existing captive cogeneration plant, using only fossil fuels.	The heat generated by the biomass residue cogeneration plant would in the absence of the project activity be generated in the existing MFO fired cogeneration plant.

Description of Baseline Scenario
The paper mill is equipped with integrated 3 units of (120 t/hr, 90 Bar_g) MFO boilers, 1 unit of Bubbling Fluidized Bed Boiler (BFB) and 3 units of 25.8 MW steam turbines in a combined heat and power plant, CHPP. Only one unit of MFO boiler and BFB boiler operates to cater the steam demand for the paper mill. The details of the existing BFB boiler will not be discussed in this section as the equipment is outside the project boundary (Please refer to section B.3). The details of the baseline scenarios for power, heat and biomass residues are discussed separately in the sub-sections below.

Baseline for Power Generation
In the past the paper mill was not able to get supply from the electricity grid and thus had to generate all power in the cogeneration plant. This required a large quantity of steam for the generation of power by using extraction steam turbines. In order to produce the power it was not possible to balance the power generation with the process steam demand and waste heat was generated in the condensers. Since the installation of a 45 MW substation and grid electricity supply the existing plant has gradually changed the operation towards full cogeneration mode, where power is generated and steam is extracted according to the process steam requirement. This has lead to reduced electricity generation from MFO from year 2005 to 2007 and import of electricity from the national grid. The past 3 years historical records of electricity generation, purchase and consumption is given in the graph below.



The project proponent will draw more electricity from the grid after the full implementation of the project activity in order to balance the cogeneration of power with the process steam requirement. The main power intake at 132kV/33kV substation in MNI has a maximum forced cooling capacity of $45MW_{electric}$ to cater for all the electricity demand of the paper mill. The substation was fully installed and commissioned in Aug 2006 which was before any decision made to embark on a CDM project. From the past 3 year's historical records, the total electricity demand is stable at approximately 36 $MW_{electric}$. This indicates that, the existing electrical substation is capable of handling the total energy demand of the paper mill.

Historical 3 Years Records of Electricity Generation, Purchase and Demand

No	Description	Unit	2005	2006	2007	Average
1a	Electricity Generation, ST 1	MWh	102,358	107,516	50,128	-
1b	Electricity Generation, ST 2	MWh	94,081	41,231	23,199	-
1c	Electricity Generation, ST 3	MWh	97,073	77,004	14,896	-
1d	Electricity Purchase (Utility-Grid)	MWh	-	73,922	207,070	-
2	Total MNI Electricity Consumption	MWh	293,512	299,673	295,293	296,159
3	Total MNI Electricity Demand*	MW	35.3	36.0	35.5	***35.6***
4	Total Power from Cogeneration*	MW	35.3	27.1	10.6	-
5	Power Purchase (Utility-Grid)*	MW	-	8.9	24.9	-

**Based on running hours of the cogeneration plant with availability of 95%*
ST 1, 2 and 3 refers to the 3 cogeneration lines in the existing CHPP

Baseline for Heat Generation
The past 3 years average steam demand of the paper mill is stable at approximately 50.6 t/hr. Steam is generated from MFO fired boilers and BFB boiler. The BFB boiler alone has contributed an average of 19.2 t/h of the paper mills steam demand in the past 3 years (2005-2007). The steam production in the baseline includes the generation of steam for the generation of power in the steam turbines.

Please refer to the table below with the past 3 years records of steam production and consumption which will substantiate the arguments presented above.

Historical 3 Years Records of Paper Production, Steam Consumption and Steam Demand

ID	Description		Unit	2005	2006	2007	Average
A	Production of Paper		tonnes	242,398	256,218	264,049	254,222
B	Steam for paper mill at 4 barg, 140 °C		tonnes	388,348	443,663	431,675	421,229
C	Steam Production from Oil Fired Boiler, B1		tonnes	372,149	396,046	-	-
D	Steam Production from Oil Fired Boiler, B2		tonnes	476,663	356,343	192,128	-
E	Steam Production from Oil Fired Boiler, B3		tonnes	445,944	340,853	372,347	-
F	Total Steam Production From MFO	C+D+E	tonnes	1,294,756	1,093,242	564,475	984,158
G	Steam Production from BFB		tonnes	155,209	158,879	166,109	160,066
H	Paper Mill Operation Hours based on 95% availability		hr/yr	8,322	8,322	8,322	8,322
I	Total Steam Demand at Paper Mill	B/H	t/h	46.7	53.3	51.9	50.6
J	BFB Steam	G/H	t/h	18.7	19.1	20.0	19.2
K	Steam Demand Excluding BFB	I - J	t/h	28.0	34.2	31.9	31.4
L	Steam Consumption factor	B/A	Tonnes of steam/ tonnes of paper	1.60	1.73	1.63	1.66

Baseline for Biomass Residue

Biomass residue for this project comes from palm oil mills and wood industries. However the predominant fuel used in this project activity will be EFB and fibres from the palm oil mills. The EFB is either sent for mulching in the plantations or disposed in disposal sites, where it would decompose aerobically or anaerobically. Due to uncertainty in the baseline data, and to be conservative the emissions from anaerobic decay of biomass residues are excluded in this project activity, which is very conservative.

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 CDM project activity (assessment and demonstration of additionality):

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This section describes how the emissions are reduced below those that would have occurred in the absence of the project activity using the "*Combined tool to indentify the baseline scenario and demonstrate additionality, Version 02.1*". and "*Tool for the demonstration and assessment of additionality, Ver 05 dated 16th May 2008* **".**

The "*Guidance on the Assessment of Investment Analysis, Annex 35*" from EB 39 is also applied as an compliment to the existing additionality tools.

Step 1. Identification of alternative project scenarios

Sub-step 1a. Define alternative scenarios to the proposed CDM project activity:

For power generation, the realistic and credible alternatives may include, inter alia:

P1	The proposed project activity not undertaken as a CDM project activity.	**Plausible**
P2	The continuation of power generation in an existing biomass residue fired power plant at the project site, in the same configuration, without retrofitting and fired with the same type of biomass residues as (co-)fired in the project activity.	**N/A** *(as there is no existing biomass power plant at the project site)*
P3	The generation of power in an existing captive power plant, using only fossil fuels.	**Plausible**
P4	The generation of power in the grid.	**Plausible**
P5	The installation of a new biomass residue fired power plant, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	**Plausible**
P6	The installation of a new biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity. Therefore, the power output is the same as in the project case.	**Plausible**
P7	The retrofitting of an existing biomass residue fired power, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.	**N/A** *(as there is no existing biomass power plant at the project site)*
P8	The retrofitting of an existing biomass residue fired power that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity.	**N/A** *(as there is no existing biomass power plant at the project site)*
P9	The installation of a new fossil fuel fired captive power plant at the project site.	**N/A** *(as the existing fossil fuel fired plant is relatively*

		new and can meet the demand)

As the proposed project activity is the cogeneration of power and heat the following plausible baseline scenarios are considered:

H1	The proposed project activity not undertaken as a CDM project activity.	**Plausible**
H2	The proposed project activity fired with the same type of biomass, but with a different efficiency of heat generation.	**Plausible**
H3	The generation of heat in the existing captive cogeneration plant, using only fossil fuel.	**Plausible**
H4	The generation of heat in boilers using the same type of biomass residues.	**Plausible**
H5	The continuation of heat generation in an existing biomass residue fired cogeneration plant at the project site, in the same configuration, without retrofitting and fired with the same type of biomass residues as in the project activity.	**N/A** *(as there is no existing biomass cogeneration plant)*
H6	The generation of heat in boilers using fossil fuel.	**Plausible**
H7	The use of heat from external sources, such as district heat.	**N/A** *(as there is no external sources available in the area).*
H8	Other heat generation technologies (e.g. heat pumps or solar energy). ***N/A as the process steam demand is so high that no other alternatives to steam boiler technology are realistic.***	**N/A** *(as the process steam demand is so high that no other alternatives to steam boiler technology are realistic)*

For the use of biomass residues, the realistic and credible alternatives are:

B1	The biomass residues are dumped or left to decay under mainly aerobic conditions. This applies, for example, to dumping and decay of biomass residues on fields.	**Plausible**
B2	The biomass residues are dumped or left to decay under clearly anaerobic conditions. This applies, for example, to deep landfills with more than 5 meters. This does not apply to biomass residues that are stock-piled2 or left to decay on fields.	**Plausible**
B3	The biomass residues are burnt in an uncontrolled manner without utilizing it for energy purposes.	**Plausible**
B4	The biomass residues are used for heat and/or electricity generation at the project site	**Plausible** *(This is the project activity)*
B5	The biomass residues are used for power generation, including cogeneration, in other existing or new grid-connected power plants	**Plausible**
B6	The biomass residues are used for heat generation in other existing or new boilers at other sites	**Plausible**
B7	The biomass residues are used for other energy purposes, such as the generation of biofuels	**Plausible**
B8	The biomass residues are used for non-energy purposes, e.g. as fertilizer or as feedstock in processes (e.g. in the pulp and paper industry)	**Plausible**

Discussion of baseline alternatives:

For the power generation part of the project activity the following scenarios are plausible:

P1, P3, P4, P5 and P6.

For the cogeneration and heat part of the project activity the following scenarios are plausible:
H1, H2, H3, H4 and H6.

These alternatives can be combined as they have similarities in the following way:

Alternative	Scenario	Scenario	Description
1	P1	H1	The proposed project activity not undertaken as a CDM project activity.
2	P3	H3	The generation of heat and power in the existing captive cogeneration plant
3	P4	H6	The generation of power in the grid and generation of heat using fossil fuel
4	P4	H4	The generation of power in the grid and the generation of heat using the same type of biomass
5	P5	(H2)	The installation of a new biomass residue fired power plant, fired with the same type and with the same annual amount of biomass residues as the project activity, but with a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project plant and therefore with a lower power output than in the project case.
6	P6	H2	The installation of a new biomass residue fired power plant that is fired with the same type but with a higher annual amount of biomass residues as the project activity and that has a lower efficiency of electricity generation (e.g. an efficiency that is common practice in the relevant industry sector) than the project activity. Therefore, the power output is the same as in the project case.

The following 6 alternatives are evaluated below:

<u>Alternative 1: The project activity not undertaken as a CDM project activity:</u>

The installation of a biomass energy plant involves investment in equipment and operational costs and purchase of fuel and transportation, which makes the project financially unattractive compared to a continuation of supply from the existing cogeneration plant and grid electricity. The income from CDM will provide additional revenue, which will enhance the project viability and make it viable.

<u>Alternative 2: Continuation of heat and power generation in the existing captive cogeneration plant</u>

The existing cogeneration plant is less than 10 years old and is well maintained. As the paper mill has been connected to the electricity grid after the installation of the cogeneration plant there is now a high degree of surplus capacity, so the plant would be able to supply the mill with both the required process steam and power in the future. As the plant is able to supply the process steam from only one of the 3 cogeneration lines after the grid connection, this has extended the overall lifetime of the plant beyond the initial technical lifetime as the operation hours on each line will be reduced in the future.

Another alternative under this scenario could be conversion to other fossil fuels i.e. natural gas. As natural gas is not available in the region this is not a credible alternative and is not considered further.

Alternative 3: Electricity supply from the grid and heat generation from existing fossil fuel fired boilers

This alternative is a technical possibility, but unlikely as the cogeneration installations are already in place and ensure a low generation cost of electricity, when running cogeneration mode, the cost of electricity is therefore considered to be the marginal cost of additional fuel consumption. Increased electricity supply from the grid compared the historic supply is a possibility, but it is unlikely that it will be lower than about 10 MW, which is the lowest power generation in cogeneration mode. This alternative is also already a part of alternative 2, as the current praxis is to generate heat and power in the cogeneration plant and import additional power from the grid.
This alternative is therefore excluded and not evaluated further.

Alternative 4: Electricity supply from the grid and heat generation from new biomass boiler

Installation of a biomass boiler plant only and import electricity from the electricity grid is also a plausible alternative. However, the project activity is to retrofit and connect one of the existing steam turbines to the biomass boiler plant the additional cost for power generation is limited and only require the investment in the super heater for high pressure steam generation and modification of the turbine and interconnections. The additional investment for the power generation is limited and the power generation will mainly be based on marginal cost of electricity generation, which is mainly cost of additional biomass consumption. *This alternative is therefore not considered to be a likely alternative and excluded for further evaluation.*

Alternative 5: Installation of a new biomass cogeneration plant with lower electrical efficiency

Installation of the same biomass boiler as in the project activity, but a lower efficiency steam turbine is not a likely alternative, as the plan is to retrofit one of the existing steam turbines. This means the investment in the steam turbine is lower than buying a new steam turbine of a lower efficiency. *This alternative is therefore not considered to be a likely alternative and excluded for further evaluation.*

Alternative 6: Installation of new biomass cogeneration with a lower overall efficiency

This scenario is evaluated by a sensitivity analysis of the project scenario, where it is assumed that the investment cost is reduced and the biomass cost i.e. biomass consumption is increased. The sensitivity is made for a decrease in investment by 10% and an increase in fuel cost by 10%. This will mean that a plant with 10% lower overall efficiency will cost 10% less than the plant in the project activity. *This alternative is therefore included in alternative 1 as a sensitivity analysis.*

Baseline scenario for the use of biomass residues:

All scenarios B1-B8 are plausible scenarios and will combined into one baseline scenario. As the biomass source for the project activity is purchased from mainly palm oil mills where biomass residues are abundantly available and is being disposed in large quantities. Palm oil mills are consuming a part of the residues for their own heat and power production, but the excess biomass is disposed off by mulching in plantations, dumping in disposal sites or incinerated. A portion of the biomass residues are used by other users, such as biomass plants, fibreboard manufacturers, biofuel etc., but the vast amount of excess biomass in Malaysia does not incur constrains to these other uses. A biomass availability study is attached in Annex 7.

The baseline scenario for the biomass use in the baseline will be a combination of scenario B1, B2 and B3 and that biomass would be dumped, left to decay or burned.

Final list of alternative scenarios:

The alternatives to be further evaluated are:
Alternative 1: Project activity not undertaken as a CDM project (including alternative 6 as sensitivity)
Alternative 2: Continuation of current practice (Baseline scenario)

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

Both alternatives 1 and 2 above and the project activity are in compliance with applicable law, regulations and standards set by the Malaysian authorities.

All the non-plausible alternatives discussed in step 1 are also in compliance with existing laws and regulations.

Choice of baseline

From the above analysis the baseline can be concluded to be continuation of the present practice, where steam and power is generated by the existing cogeneration plant and additional power is imported from the electricity grid. This baseline scenario is in accordance with baseline scenario 7 in Table to in ACM0006, ver06.

Step 2: Investment Analysis

An investment analysis has been carried out for the two alternative scenarios identified in step 2 above. The two alternatives are compared with regard to the financial indicator IRR of the investment and future cost of operation. The alternative with the highest IRR is the financially most attractive alternative scenario.

Sub-step 2a: Determine appropriate analysis method

The CDM project activity generates financial benefits by saving MFO consumptions. Thus simple cost analysis (Option 1) is not applicable and benchmark analysis (Option III) is selected for this project activity.

Sub-step 2b: Option I. Apply simple cost analysis
This option is not applicable for this project activity as the CDM project activity generates financial benefits by saving MFO consumptions.

Sub-step 2b: Option II. Apply investment comparison analysis

This option is not selected as there is only one identified alternative and no investment is required for continuing the current practice of baseline scenario.

Sub-step 2b: Option III. Apply benchmark analysis
The benchmark analysis (Option III) is selected. The benchmark for this project activity is derived from the internal benchmark based on standard operating procedures, (SOP) of MNI which is 15%. (Section 3.G of Malaysian Newsprint Industries Sdn.Bhd Standard Operating Procedure, 16th April 2001)

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):

A report from Energy Information Administration which is an official energy statistics from the US government was obtained to get a professional view on the expected trend on the world oil prices. The report was released in February 2007 and has projection of crude oil prices until 2030. An index was derived from the crude oil prices using 2006 as the base year. The derived index values was later multiplied with annual average of MFO price from MNI to estimate the local MFO prices for the financial analysis.

The results from the financial analysis reveal that the project has a negative IRR without CDM and an IRR more than the benchmark of 15% with CDM revenue.

Details of the investment analysis can be found in Annex 5

Sub-step 2d: Sensitivity analysis (only applicable to Options II and III):
The sensitivity analysis is made by varying three major components individually or in a combined sensitivity scenarios. The sensitivity analysis was made based on the document titled, "*Guidance on the Assessment of Investment Analysis, Annex 35"* from EB 39. Three major sensitive variables selected according to the guidelines mentioned above are:

a) Capital Expenditure
b) Cost of Biomass
c) Savings from MFO

The results from sensitivity analysis by varying the major components of the financial analysis listed above are described in the sub sections below.

<u>Capital Expenditure</u>

IRR Without CDM, %	IRR after Variation,%	
	- 10%	+10%
negative	negative	negative

The 10% decrease in the capital expenditure may occur if the project proponent opt for a cheaper technology with less efficiency. The 10% increase in capital expenditure might be due to unexpected increase in building materials such a steel prices or a much efficient cogeneration system. For both the above scenarios the IRR is negative which makes the project to be not sensitive to capital expenditure.

Cost of Biomass

IRR Without CDM, %	IRR after Variation,%	
	- 10%	+10%
negative	12.3	negative

Decrease in biomass price is an unlikely scenario as the demand for biomass fuel is increasing as the fossil fuel prices are escalating and the awareness and demand for renewable energy is positively growing. The project IRR for 10% decrease in biomass price is still below the project proponent IRR benchmark. While, 10% increase in biomass price results in a negative IRR. The above sensitivity analysis on the biomass cost indicates that the project is not sensitive to fluctuation in biomass cost.

Savings from MFO

IRR Without CDM, %	IRR after MFO Price Variation,%	
	- 10%	+10%
negative	negative	13.7%

The variation in the savings from MFO is due to the MFO price fluctuation. 10 % decrease in the MFO results in a negative IRR and 10% increase in biomass still results in an IRR which is lower than the benchmark. Thus the project is not sensitive enough to meet the IRR benchmark with MFO price fluctuation.

Lesser Capital Expenditure and higher biomass cost

Investing in a cheaper technology will result in a cogeneration system with lower efficiency which will use more biomass fuel. This sensitivity analysis is made by reducing the capital expenditure by 10% and increasing the biomass cost by 10%. The result from this analysis is shown in the table below.

IRR Without CDM, %	IRR after Variation,%
	10% Cheaper Technology and 10% Additional Biomass Quantity
negative	negative

The project is not sensitive for the above scenario as the IRR is still negative with 10% decrease in capital expenditure and 10% increase in biomass consumption.

Step 3. Barrier Analysis

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

Investment barriers: The project activity will require a large investment, which will have to justified by lower operational costs compared to the present situation. The investment is analysed in step 2 above. The project owner can cover the investment for the project activity, but it will require that the investment is more viable than the alternative.

The continuation of the steam and power generation by the existing cogeneration plant will not require additional investment and does not face any investment barriers.

Technological barriers: The project activity involves the installation of biomass energy technology, which will incur a lower reliability of steam and power supply due to the supply of biomass and handling of the fuel. As the biomass energy plant require more manual and mechanical operation of fuel preparation, transportation and handling, this can increase the risk of plant failure and down time. Biomass boiler and energy technology is well-proven and the risks are known to a high extent and can be mitigated to a certain extent.

As the existing plant is being maintained as back up, this risk is manageable and the project activity does not introduce any major risk to the paper mill operation and the technological barriers for the project activity is therefore low and does not prevent the project from being implemented.

The continuation of the steam and power generation by the existing cogeneration plant will be business as usual and does not face any technological barriers.

Lack of prevailing practice: The use of biomass energy in industries outside the palm oil sector is limited, especially in the scale that the project activity suggests. Prevailing practice is to use fossil fuel, which is considered to be more reliable and provide security of energy supply. However the installation of biomass energy plant has been successfully commissioned in industries in Malaysia, mostly in other CDM projects. Therefore there are reference plants in operation, which increases the confidence of the reliability of biomass energy plants. Thus the lack of prevailing practice does not contribute to any major barriers to the implementation of the project activity.

The continuation of the steam and power generation by the existing cogeneration plant is the prevailing practice and does not face any barriers due to lack of prevailing practice.

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

None of the two alternatives are prevented by the identified barriers.

Step 4. Common practice analysis

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

The common practice for paper mills in Malaysia is to generate steam is either using MFO or natural gas. Below is the information gathered from a number of paper mills in Malaysia.

No	Name of Paper Mill	Mill Capacity	Steam generation method and type of energy used	CDM Project (Yes/No)
1	Sabah Forest Industry	165,000 paper p.a	Steam and electricity generated from boiler using wood chips residues from the integrated timber complex with saw mills, plywood mill, timber kiln dryers, and paper mill.	No
2	Genting Sayen Paper	270,000 paper p.a	Steam and electricity generated from CHPP fired with natural gas.	No
3	UPB Paper Mill	75,000 paper p.a	Steam generated from Natural Gas and electricity from the grid	No
4	Muda paper	280,000 paper p.a	Steam generated from natural gas and electricity from the grid	No
5	PASCORP	75,000 paper p.a	Currently steam is generated using MFO boilers and electricity is purchased from the grid. Steam will be purchased from independent 3rd party company operating biomass boiler using EFB and fibres.	Yes

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

Production of steam in Sabah Forest Industry using steam is unique as the paper mill is located in an integrated timber complex processing raw timber until the downstream products in the same complex. It is a common practise in the wood industry to use the wood residues to generate heat for the kiln and other processes. This scenario is unlikely for paper mills using recycle paper such as MNI.

Based on the step-by-step additionality analysis carried out above, the project is proven to be **additional**.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The baseline is defined as scenario 7 in Table 2 in ACM.0006, Ver.06.

The project activity is to install a biomass residue cogeneration project with a 66t/h biomass boiler and retrofitting of an existing steam turbine to displace steam from existing MFO boilers and electricity from grid. The project activity will lead to project emissions from the electricity used for the project activity, transportation and handling of biomass fuel.

Emission Reductions

Emission reductions are calculated using formula 1 in ACM0006, Ver.06 as presented below.

$$ER_y = ER_{heat,y} + ER_{electricity,y} + BE_{biomass,y} - PE_y - L_y$$

Where:

ER_y = Emissions reductions of the project activity during the year *y* (tCO2/yr)

$ER_{electricity,y}$ = Emission reductions due to displacement of electricity during the year *y* (tCO2/yr)

$ER_{heat,y}$ = Emission reductions due to displacement of heat during the year *y* (tCO2/yr)

$BE_{biomass,y}$ = Baseline emissions due to natural decay or burning of anthropogenic sources of biomass residues during the year *y* (tCO2e/yr)

PE_y = Project emissions during the year *y* (tCO2/yr)

L_y = Leakage emissions during the year *y* (tCO2/yr)

Baseline emission from decay of biomass is excluded in this project activity as all decay of biomass is considered to under aerobic conditions. This is a conservative approach as anaerobic decay might occur for parts of the biomass and this would lead to higher emission reductions. Thus the above formulae can be simplified as shown below:

$$ER_y = ER_{heat,y} + ER_{electricity,y} - PE_y - L_y$$

Project Emissions

The formulae to calculate project emissions calculated using formula 2 of ACM 0006, Ver.06 is shown below.

$$PE_y = PET_y + PEFF_y + PE_{EC,y} + GWP_{CH4} \bullet (PE_{Biomass,CH4,y} + PE_{ww,CH4,y})$$

Where:

PET_y = *CO_2 emissions during the year y due to transport of the biomass residues to the project plant (tCO_2/yr)*

$PEFF_y$ = *CO_2 emissions during the year y due to fossil fuels co-fired by the generation facility or other fossil fuel consumption at the project site that is attributable to the project activity (tCO_2/yr)*

$PE_{EC,y}$ = *CO_2 emissions during the year y due to electricity consumption at the project site that is attributable to the project activity (tCO_2/yr)*

GWP_{CH4}	=	*Global Warming Potential for methane valid for the relevant commitment period*
$PE_{Biomass,CH4,y}$	=	*CH_4 emissions from the combustion of biomass residues during the year y, (tCH_4/yr)*
$PE_{WW,CH4,y}$	=	*CH_4 emissions from waste water generated from the treatment of biomass residues in year y (tCH_4/yr)*

The project emissions included in this project activity comes from the sources identified in the project boundary as indicated below:
• CO_2 emissions from transportation of biomass residues to the project site (PET_y),
• CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$),
• CO_2 emissions from consumption of electricity ($PEEC_{,y}$),

$PE_{Biomass,CH4,y}$ and $PE_{WW,CH4,y}$ are excluded as per table 3 in ACM 0006, Ver.06 and section B.3 in this PDD as CH_4 emissions in the baseline is not included in the baseline emission calculations.

Thus the above formula can be simplified to the following expression:

$$PE_y = PET_y + PEFF_y + PE_{EC,y}$$

CO_2 emissions from transportation of biomass residues to the project site (PET_y)

Project emission from transportation of biomass residues comes from diesel consumption of trucks carrying biomass residues from the source to the project site. Option 1 and formula 3 in ACM 0006 is selected to calculate project emission from transportation based on distance and vehicle type. The relevant formula is shown below.

$$PET_y = N_y \times AVD_y \times EF_{km,CO2,y}$$

Where:

PET_y	=	CO_2 emissions during the year *y* due to transport of the biomass residues to the project plant (tCO_2/yr)
N_y	=	Number of truck trips during the year *y*
AVD_y	=	Average round trip distance (from and to) between the biomass residue fuel supply sites and the site of the project plant during the year *y* (km)
$EF_{km,CO2,y}$	=	Average CO_2 emission factor for the trucks measured during the year *y* (tCO_2/km)

Formula 4 from ACM 0006, Ver.06 is not applied in this project activity as the number of trips and biomass origin will be monitored.

CO_2 emissions from on-site consumption of fossil fuels due to the project activity ($PEFF_y$)

Project emission from on-site is from mechanical handling of biomass residues at the project site using, front loaders, shovels, trucks and other mechanical equipment. Since these trucks are more stationary rather than traveling in long distance compare to off-site transportation, this source of project emission is not categorized as off-site transportation.

CO_2 emissions from on-site combustion of fossil fuels (*PEFFy*) are calculated using the latest approved version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion, Ver 01" as shown below.

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Note : $PEFF_y = PE_{FC}$

Where:

$PE_{FC,j,y}$ = CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2 / yr);
$FC_{i,j,y}$ = Quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit / yr);
$COEF_{i,y}$ = CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2 / mass or volume unit);
I = Fuel types combusted in process *j* during the year *y*.

This project activity only includes diesel consumption from the on-site mechanical handling of biomass residues. The combustion process is from heavy duty diesel engines. To be conservative all trucks used at the project site are considered as to have heavy duty engine's emission factor.

The CO_2 emission coefficient $COEF_{i,y}$ can be calculated using option B from the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion, Ver 01"as shown below.

Option B: The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of the fuel type *i*, as follows;

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

$COEF_{i,y}$ = CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2 / mass or volume unit);
$NCV_{i,y}$ = Weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit);
$EF_{CO2,i,y}$ = Weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ);
i = Fuel types combusted in process *j* during the year *y*.

For this project activity j is defined as combustion process in heavy duty (HD) diesel engines using fuel type i which is diesel. Thus, the above two equations can be rewritten as:

$$PE_{FC,HD,y} = FC_{HD,y} \times COEF_{diesel,y}$$

and

$$COEF_{diesel,y} = NCV_{diesel,y} \times EF_{CO2,diesel,y}$$

By simplifying the above two equations, the formula for on-site project emission from diesel consumption will be as shown below.

$$PEFF_y = PE_{FC,HD,y} = FC_{HD,y} \times NCV_{diesel,y} \times EF_{CO2,diesel,y}$$

CO_2 emissions from consumption of electricity ($PE_{EC,y}$)

The project emission from electricity is due to electricity drawn from the grid for the use of the biomass cogeneration plant, biomass fuel handling and storage systems. The electrical load will include motors, pumps, conveyors, walking floors and etc.

The project will not be using the electricity generated from MFO boilers during the crediting period. This will be ensured by having dedicated electrical network for the biomass residue cogeneration plant, fuel handling and storage system connected to the national grid.

CO_2 emissions from on-site electricity consumption (PE_{EC},y) will be calculated using the latest approved version of the "Tool to calculate project emissions from electricity consumption, Version 01". According to this tool and the description given above, this project falls under case A where the electricity will be purchased from the grid, as the biomass energy plant will be the only plant operating and the existing fossil fuel fired cogeneration will only be used for back up.

> ***Case A:*** *Electricity consumption from the grid. The electricity consumed by the project activity is purchased from the grid. Either no captive power plant is installed at the project site or if any on-site captive power plant exits, it is not operating or it cannot provide electricity to the project activity.*

Project emissions from consumption of electricity from the grid are calculated based on the power consumed by the project activity and the emission factor of the grid, adjusted for transmission losses, using the following formula:

$$PE_{EC,y} = EC_{PJ,y} \times EF_{grid,y} \times (1 + TDL_y)$$

Where:

$PE_{EC,y}$	=	Project emissions from electricity consumption by the project activity during the year y (tCO_2 / yr);
$EC_{PJ,y}$	=	Quantity of electricity consumed by the project activity during the year y (MWh);
$EF_{grid,y}$	=	Emission factor for the grid in year y (tCO_2/MWh)
TDL_y	=	Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site

Emission reductions due to displacement of electricity

The electricity generated by the biomass energy plant in the project activity will displace electricity generated by the existing cogeneration plant in the baseline scenario. The emission reductions can be calculated according to Formula 8 in ACM 0006, Ver.06 as stated below:

$$ER_{electricity,y} = EG_y \times EF_{electricity,y}$$

Where:

$ER_{electricity,y}$	=	Emission reductions due to displacement of electricity during the year y (tCO_2/yr)

EG_y = Net quantity of increased electricity generation as a result of the project activity (incremental to baseline generation) during the year *y* (MWh)
$EF_{electricity,y}$ = CO_2 emission factor for the electricity displaced due to the project activity during the year *y* (tCO_2/MWh)

$$EF_{electricity,y} = \begin{cases} \alpha \cdot EF_{CP} + (1-\alpha) \cdot EF_{grid,y} & \text{where } 0 < \alpha < 1 \\ EF_{CP} & \text{where } \alpha \geq 1 \\ EF_{grid,y} & \text{where } \alpha \leq 1 \end{cases}$$

with

$$\alpha = \frac{\frac{EG_{CP,historic,3y}}{3} - EG_{CP,y}}{EG_{project-plant,y}},$$

where:

$EF_{electricity,y}$ = CO_2 emission factor for the electricity displaced due to the project activity during the year *y* (tCO_2/MWh)
$EF_{grid,y}$ = CO_2 emission factor for grid electricity during the year *y* (tCO_2/MWh)
EF_{CP} = CO_2 emission factor for electricity displaced in the fossil fuel fired captive power plant identified as baseline plant (P3) (tCO_2/MWh)
$EG_{CP,y}$ = Net quantity of electricity generated in the fossil fuel fired captive power plant identified as baseline plant (P3) during the year *y* (MWh/yr)
$EG_{CP,historic,3y}$ = Net quantity of electricity generated during the three most recent years in the fossil fuel fired captive power plant identified as baseline plant (P3) (MWh)
$EG_{project\ plant,y}$ = Net quantity of electricity generated in the project plant during the year *y* (MWh)

Note : $EG_{project\ plant,y} = EG_y$ for this project activity.

Emission reductions due to displacement of heat

For scenario 7 in ACM 0006, Ver.06, the quantity of heat generated by the project plant displaces heat generation in the existing fossil fuel fired cogeneration plant. However, the associated emission reductions are already accounted in the calculation of emission reductions from electricity generation. Thus the emission reduction from heat displacement will be zero.

$ER_{heat,y} = 0$

Leakage

Leakage due to increased use of fossil fuel elsewhere as a result of the project activity's consumption of biomass is assessed in the biomass availability study in Annex 6. The option L_2 in ACM 0006, Ver.06 has been used in the biomass availability study and will be updating during the crediting period to monitor that the quantity of available biomass residue of the type used by the project activity will continue to be at least 25% larger than the quantity of biomass utilized, including the project activity. In case leakage the leakage emissions shall be calculated according to formula 36 in ACM 0006, ver.06.

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

Data / Parameter:	**$EG_{CP,historic,3y}$**
Data unit:	MWh
Description:	Net quantity of electricity generated during the three most recent years in the MFO fired cogeneration plant identified as baseline plant.
Source of data used:	On-Site Measurement
Value applied:	607,486
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**$FF_{CP,historic,3y,MFO}$**
Data unit:	Liters
Description:	Quantity of MFO combusted during the three most recent years in the MFO fired cogeneration plant identified as baseline plant.
Source of data used:	On-Site Measurement
Value applied:	213,611,307
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using volume meters. The quantity is cross checked with the quantity of electricity generated and fuel purchase receipts.
Any comment:	

Data / Parameter:	EF $CO_{2,diesel}$
Data unit:	tCO_2 / GJ
Description:	CO_2 emission factor per unit of energy from medium fuel oil
Source of data used:	IPCC Guidelines on National GHG Inventories, Chapter 1 of Vol.2 (Energy), Table 1.4.
Value applied:	0.0748
Justification of the choice of data or description of measurement methods	IPCC default values at the upper limit of the uncertainty at a 95% confidence level interval as provided in the reference given above.

and procedures actually applied :	
Any comment:	

Data / Parameter:	$EF_{km,CO2}$
Data unit:	kg $C0_2$/km
Description:	CO_2 emission factor for heavy duty diesel engines
Source of data used:	Universiti of Malaya(2005)"Energy Used in the Transportation Sector of Malaysia", page 230.
Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on IPCC 2006, 1 liter of diesel emits 2.73 kg CO_2. A heavy duty truck can travel approximately 3 km using 1 liter of diesel according to the source of data mentioned above. Thus, the emission factor for heavy duty diesel engine is obtained by dividing 2.73 kg CO_2/liter with 3 km/liter. To be conservative it is estimated that the mechanical turners used in the co-composting site will be heavy duty diesel engines.
Any comment:	-

Data / Parameter:	$EFCO_{2,y}$
Data unit:	tCO_2/MWh
Description:	Malaysian electrical grid emission factor
Source of data used:	Pusat Tenaga Malaysia
Value applied:	0.63
Justification of the choice of data or description of measurement methods and procedures actually applied :	The grid emission factor is calculated as per the procedures detailed in ACM0002.
Any comment:	

Data / Parameter:	D_{diesel}
Data unit:	kg/liter
Description:	Diesel Density
Source of data used:	Caltex Malaysia
Value applied:	0.85
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	-

Data / Parameter:	NCV_{diesel}
Data unit:	GJ/ tonne
Description:	Net calorific values of diesel
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2, Energy Table 2.3, p.g 2.16
Value applied:	43.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	To be conservative, the upper limit of NCV of diesel oil is selected according to the reference given above.
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

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Calculation of emission factor for electricity displaced in the MFO fired cogeneration power plant identified as baseline plant is shown in the table below applying the formula 11 from ACM 0006, Ver.06.

Description	Value	Unit
$FF_{CP,historic,3y,MFO}$	213,611,307	liters
$Density_{MFO}$	0.99	kg/liter
NCV_{MFO}	41.7	MJ/kg
EF_{CPCO2}	0.0788	tCO2/GJ
$EG_{CP,historic,3y}$	607,486	MWh
EF_{CP}	1.14	tCO2/MWh

Calculation of α from formula 10 of ACM 0006, Ver.06 is shown below assuming there will be no electricity generation from the MFO cogeneration plant during the crediting period and the biomass residue cogeneration plant is capable of generating approximately 6.7 MW of electricity displacing MFO.

Description	Value	Unit
$EG_{CP,historic,3y}$	607,486	MWh
$EG_{CP,y}$	0	MWh
$EG_{project\ plant,y}$	56,000	MWh
α	3.62	

The annual emission factor for the electricity displaced due to the project activity during the crediting period can be determined using the grid emission factor, EF_{CP} and α.

Since α≥1, $EF_{electricity} = EF_{CP} = 1.14\ tCO_2/MWh$ by applying equation 9 from ACM 0006, Ver.06.

Please refer to Annex 3 for details of the estimation of emission reduction calculations.

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

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Since there is no significant leakage in this project activity, to total emission reduction is summarised in the table below.

Year	Estimation of project activity emissions ($tCO_{2\,e}$)	Estimation of baseline emissions ($tCO_{2\,e}$)	Estimation of leakage ($tCO_{2\,e}$)	Estimation of overall emission reductions ($tCO_{2\,e}$)
1*	9,697	63,840	0	54,143
2	9,697	63,840	0	54,143
3	9,697	63,840	0	54,143
4	9,697	63,840	0	54,143
5	9,697	63,840	0	54,143
6	9,697	63,840	0	54,143
7	9,697	63,840	0	54,143
8	9,697	63,840	0	54,143
9	9,697	63,840	0	54,143
10	9,697	63,840	0	54,143
Total (tones of CO2 e)	969,70	638,400	0	541,430

**Please refer to section C.2.2.1 for the starting date of the crediting period.*

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EG_y
Data unit:	MWh
Description:	Quantity of electricity generation as result of the project activity in a given year "y"
Source of data to be used:	kWh meter readings
Value of data	56,000
Description of	The biomass residue cogeneration plant is expected to operate for 8000 hours in a

measurement methods and procedures to be applied:	year generating electricity up to 7MW using the steam from biomass residue boiler. Actual data will be monitored using steam flow meters at the respective biomass boiler units. The reading from kWh meter will be recorded manually in a daily record sheet by the energy plant operator and verified monthly by the plant engineer. The data will be later transferred into softcopy version for emission reduction calculations.
QA/QC procedures to be applied:	All the data will be kept for at least 2 years after the crediting period in both hard and softcopy. The respective steam flow meters will be calibrated according to the manufacturers' recommendation.
Any comment:	

Data / Parameter:	$PE_{EC,y}$
Data unit:	MWh
Description:	Amount of electricity consumed by the project activity from the grid in the year "y"
Source of data to be used:	kWh meter readings
Value of data	7,600 MWh/yr
Description of measurement methods and procedures to be applied:	The reading from kWh meter will be recorded manually in a daily record sheet by the energy plant operator and verified monthly by the plant engineer. The data will be later transferred into softcopy version for emission reduction calculations.
QA/QC procedures to be applied:	All the data will be kept for at least 2 years after the crediting period in both hard and softcopy. The respective kWh meters will be calibrated according to the manufacturer's recommendations.
Any comment:	

Data / Parameter:	$N_{,k,y}$
Data unit:	-
Description:	Number of trips made to source biomass type "k"in a year "y".
Source of data to be used:	Weigh Bridge record book at MNI guard house.
Value of data	Based on actual trips made each year
Description of measurement methods and procedures to be applied:	Actual counting will be taken upon receiving a truck load at the MNI weigh bridge station. Each trips made for each type of fuel will be recorded separately. The plant uses mainly four types of biomass waste which can be categorised under type "k" namely, empty fruit bunches (EFB), fibres, palm kernel shells (PKS) and wood chips. The number of trips for each biomass type will be summed up to calculate the total number of trips in a particular year.
QA/QC procedures to be applied:	The quantity of biomass can be divided by an average truck size to verify the number of trips recorded at the weigh bridge station.
Any comment:	

Data / Parameter:	$AVD_{,,k,y}$
Data unit:	km
Description:	Average round trip distance(from and to) between the source of biomass residue type "k" and project site in a year "y"
Source of data to be used:	Weigh Bridge record book at MNI Guard House.
Value of data	Based on estimated distance recoded for each type of fuel
Description of measurement methods and procedures to be applied:	The distance between each biomass source and MNI is predetermined using a route map or by conducting a test drive from MNI to the new biomass source location. The distance will be tabulated in a look up table. Once, a truck load is arrived from a known destination, the respective mileage is recorded using the look up table. The plant uses mainly four types of biomass waste which can be categorised under type "k" namely, empty fruit bunches (EFB), fibres, palm kernel shells (PKS) and wood chips. The mileage for each type of biomass fuel will be recorded separately and summed up as the total mileage for a particular year.
QA/QC procedures to be applied:	A map with a scale can be used to determine the radius of the biomass source location from MNI. The estimated distance recorded in the look up table is considered valid if the value is higher than the measured radius. Else the distance from the biomass source will be recalculated.
Any comment:	

Data / Parameter:	$FC_{HD,y}$
Data unit:	m^3
Description:	Volume of diesel used for on-site transportation in a given year "y"
Source of data to be used:	Volume meters installed at the diesel pump stations at biomass residue cogeneration plant site.
Value of data	53 m^3/yr
Description of measurement methods and procedures to be applied:	Diesel purchase invoices will be used to cross check the energy balance with daily truck usage log book which will have records of diesel consumption. The data will be later transferred into softcopy version for emission reduction calculations.
QA/QC procedures to be applied:	All the data will be kept for at least 2 years after the crediting period in both hard and softcopy.
Any comment:	

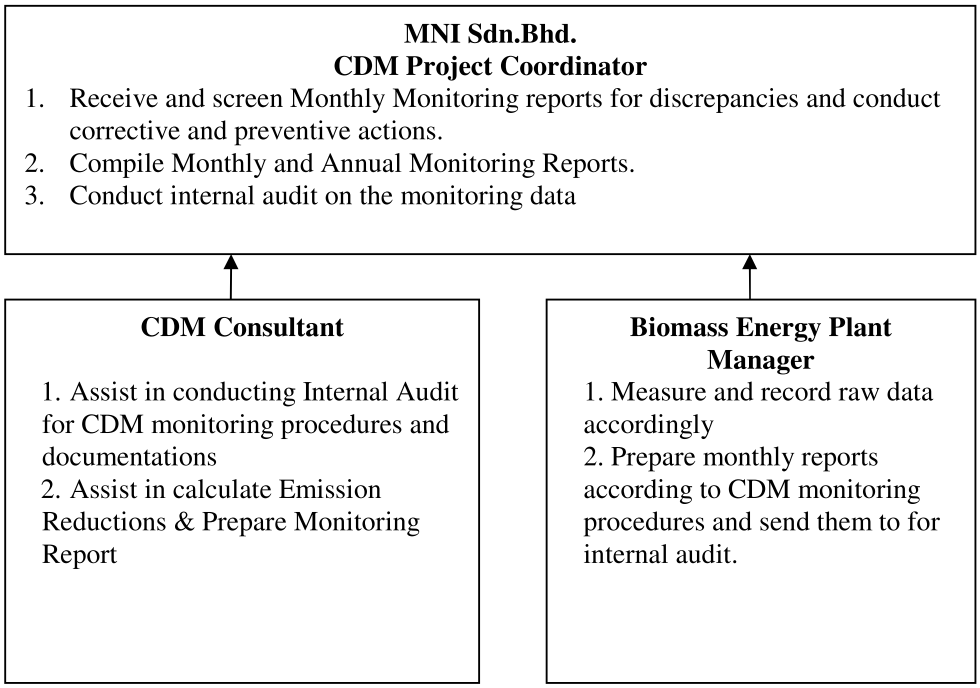
Data / Parameter:	$EG_{CP,y}$
Data unit:	MWh
Description:	Quantity of electricity generation from existing MFO fired cogeneration unit in a given year "y"
Source of data to be used:	kWh meter readings
Value of data	0-10
Description of measurement methods and procedures to be applied:	The MFO cogeneration plant is expected to operate less when the biomass residue cogeneration plant is fully commissioned. Actual data will be monitored using steam flow meters at the respective biomass boiler units. The reading from kWh meter will be recorded manually in a daily record sheet by the energy plant operator and verified monthly by the plant engineer. The data will be later transferred into softcopy version for emission reduction calculations.
QA/QC procedures to be applied:	All the data will be kept for at least 2 years after the crediting period in both hard and softcopy. The respective steam flow meters will be calibrated according to the manufacturers' recommendation.
Any comment:	

B.7.2. Description of the monitoring plan:

>>
MNI Sdn.Bhd has an operational and management structure in place to monitor emission reductions from the project activity.

The biomass energy plant manager will be responsible to assign his subordinates to collect and record the monitoring parameters and verify them monthly. All the data will be kept for at least two years after the crediting period in both hard copy and soft copy at MNI Sdn Bhd, Mentakab.

The CDM project coordinator in MNI Sdn.Bhd will receive and screen the monthly monitoring reports and may assign a third party consultant or in-house expertise to calculate the emission reduction and prepare annual monitoring reports. The CDM project coordinator will also be responsible to conduct internal audits on the monitoring procedures and parameters.



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

>>

The baseline and monitoring study was completed on 24th April 2008 by:

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

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

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

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
25th Sept 2007

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

>>
12 years

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

C.2.1. Renewable crediting period:

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

>>
Not applicable.

C.2.1.2. Length of the first crediting period:

>>
Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/01/09

C.2.2.2. Length:

>>
10 years and 0 months

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

According to the Malaysian environmental law, Environmental Quality Act 1974 (ACT127) & Subsidiary Legislation; this project activity doesn't fall under any one of the prescribed activities to conduct an Environmental Impact Assessment. Thus, no Environmental Impact Assessment prepared for this project activity.

Nevertheless, the project will comply with the environmental regulations of the country and obtain the necessary approvals before commissioning and during operation of the project.

The project will apply modern, efficient technologies and the environmental impact will be managed better than in the existing situation, as the biomass waste will be used for energy production to the highest possible extent, which includes efficient combustion of the biomass.

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:

>>

No environmental impacts are considered significant by the project participants or the host party for this project activity.

SECTION E. Stakeholders' comments

>>

This project activity is within the existing boundary of newsprint manufacturing facility located in an industrial area. As mentioned in the previous section the environmental impact of the project is insignificant in the surrounding environment. Thus the project has minimal involvement to the local stakeholders.

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

>>

The management of MNI Sdn Bhd invited local stakeholders for a presentation on the CDM Renewable Energy project and to receive comments. Formal invitations were personally sent to the local stake holders at least 1 week before the meeting to confirm their attendance and to provide sufficient time for the related parties to attend the meeting.

The meeting was held in MNI Sdn Bhd, Temerloh on 26th Feb 2008 from 10.00a.m to 12.00noon. The meeting started at 10.00a.m with a welcoming speech by the plant General Manager, followed by presentations on the project activity by the MNI Utilities Manager and CDM consultant. Below is the list of parties attended the meeting and the site visit.

No:	Department/Organization	No of Representatives
1	Village Head of Mentakab	2
2	Local Town Council of Temerloh	3
3	Department of Environment, Temerloh	3
4	Taman Tualang Indah (Housing estate)	1
5	Wehayu Regelung Sdn Bhd (Industrial supplier)	2
6	Kampung Mambang Berulang	1
7	Tenaga Tiub Sdn.Bhd	3
8	Mackenzie Industries Sdn.Bhd	1
9	Danish Energy Management	3
10	MNI	5
	Total	24

E.2. Summary of the comments received:

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

ID	Comment	Name & Organization
1	What is the use of the steam generated from the biomass boiler?	En. Abd Malik - AJKK Kg. Mambang Berulang, Mentakab.
2	Is this a new paper machine plant and do you use old newspaper/old magazines for recycling?	
3	Between fossil fuel and Empty fruit bunch which one produce higher CO2?	Mr. Lee - MPT
4	Ultimately any plan to use solar energy?	
5	Which one is cheaper to use? Fossil fuel or biomass?	
6	Is EFB bought or free and where is it from?	En. Norani - KRT Taman Tualang Indah, Mentakab
7	Will there be any issues with the smell from biomass ?	
8	Is there any relation between MNI and any palm oil mill in terms of ownership?	En. Abd Malik - AJKK Kg. Mambang Berulang, Mentakab.
9	How is the control on the smoke emission ?	En. Zamri - KRT Taman Tualang Indah, Mentakab
10	A house owner who is staying close to a palm oil mill noticed that the zinc roof of his house is getting rusted due to the smoke from the palm oil mill. Any problem here?	
11	Any plan to build incinerator to burn all the rubbish collected from surrounding area?	
12	What is the difference between MNI biomass boiler and palm oil mill boiler?	Mr. Lee - MPT
13	Currently the lorries carrying ash to MNI are entering residential are in Taman Tualang causing a lot if dirt and dust to avoid police road blocks? How will the EFB transported in the future ?	En. Zamri - KRT Taman Tualang Indah, Mentakab
14	Is there a possibility for acid rain due to this project activity ?	Mr. Lee - MPT
15	Any release of lead (Pb) from this project activity?	

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

>>

ID	Answers
1	The steam is used for the paper mill processes displacing existing MFO boilers.
2	The project is not to build a new paper machine plant or add the capacity of the existing paper mill. The current paper mill does use recycled newspapers/old magazines to produce newsprints .

ID	Answers
3	The emission from EFB would not be considered as project emission because it is carbon-neutral in this case. Mr.Thirupathi Rao further explained on the differences between fossil fuel burning and biomass burning.
4	There are no plans to produce energy using solar power at the moment.
5	Comparatively, the biomass fuel is cheaper than fossil fuel without taking into account the transportation charges and huge investment cost for biomass boiler. However, there is a potential future scenario which biomass fuel price might increase faster than the fossil fuel price increase. The revenue from carbon credits is expected to make this project feasible over a long run.
6	EFB is bought from palm oil mills located in approximately 120 km radius from MNI.
7	The smell is generated when wet EFB is left to undergo anaerobic degradation. The EFB transported to MNI will be shredded and dewatered at the palm oil mills. The shredded EFB will have better air permeability which will prevent anaerobic digestion. Furthermore the EFB will be used within 1 week in the biomass boiler which reduces the chances of any prolonged degradation to take place. Thus there will be no smell generated from EFB decomposition.
8	No.MNI doesn't own any palm oil mills.
9	An air monitoring program is already in place ever since the plant was structured, as part of Department of Environment's requirement. However the new biomass plant will comply to any rules or regulation set by the local Department of Environment.
10	The isolated case described is happening in palm oil mill surroundings may be due to the significant amount of steam (vapour) released from the chimney when they burn the wet EFB in an inefficient biomass boiler. The biomass transported to MNI is better to be dry to increase the heat value and produce more energy for the boiler. It is also the intension of MNI to optimise the boiler efficiency to maximise their steam output. Thus, zinc rusting will be an unlikely scenario in MNI and MNI will be the first to suffer from rusting as the whole plant is made out of steel. Furthermore, the biomass source contain less acidic gasses which will improve environmental requirement of the stack gas.
11	An incinerator plant is much more expensive and more hazardous to surroundings compare to a biomass boiler. The management of MNI has no ideas to embark on an incinerator plant project for the moment.
12	The main difference is in the use of EFB as main biomass fuel. The biomass boilers in palm oil mills are not equipped with fuel preparation system to process the EFB as the have excess energy using fibres and shells. The biomass boiler in MNI will use a better fuel preparation system to use mainly EFB as the biomass fuel. This MNI biomass boiler is also capable of burning other biomass fuels such as wood chips, palm trunks, fibres and shells.
13	The management of MNI was unaware of the situation and will immediately highlight this issue to the current ash transporter not to use the residential route. The management of MNI will also ensure that contracted future biomass transport companies will not use the residential route to bring biomass fuel to MNI.
14	This project will have less acidic components in the stack gas emissions compare to the fossil fuel use at present. Even the stack gases in the MFO boilers are monitored accordingly and comply to the local department of environment rules and regulations. Thus there will be less chances of acid rain due to this project activity.
15	No. The biomass source is from food industry and it is lead free.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Owner:

Organization:	Malaysian Newsprint Industries Sdn.Bhd
Street/P.O.Box:	P.O.Box 29 Mentakab
Building:	Lot 3771
City:	Jalan Lencongan Mentakab-Temerloh, Temerloh Industrial Park
State/Region:	Mentakab, Pahang Darul Makmur
Postfix/ZIP:	28400
Country:	Malaysia
Telephone:	+6 09 277 9898
FAX:	+6 09 277 9800
E-Mail:	mni_mill@tm.net.my
URL:	http://www.newsprint.com.my
Represented by:	
Title:	Mr.
Salutation:	.
Last Name:	Khairul Anuar Bin Abdullah
Middle Name:	.
First Name:	.
Department:	Utility
Mobile:	019 9301 676
Direct FAX:	09 277 6395
Direct tel:	09 2715 361
Personal E-Mail:	akhairul@mni.hongleong.com.my

CER Buyer :

Organization:	Nordjysk Elhandel A/S
Street/P.O.Box:	Osterbro 42
Building:	
City:	Aalborg
State/Region:	
Postfix/ZIP:	DK 9000
Country:	Denmark
Telephone:	+45 96 31 69 00
FAX:	+45 96 31 69 99
E-Mail:	handel@nordjysk-elhandel.dk
URL:	www.nordjysk-elhandel.dk
Represented by:	
Title:	Trader
Salutation:	Ms.

Last Name:	Decker
Middle Name:	
First Name:	Dagmar
Department:	Customer Service
Mobile:	+45 20 85 09 15
Direct FAX:	
Direct tel:	+45 96 31 69 15
Personal E-Mail:	dd@nordjysk-elhandel.dk

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for this project activity.

Annex 3

BASELINE INFORMATION

Emission Reduction from Electricity Displacement

Step 1 : Estimation of Baseline Emission from Electricity Displacement

Year	E EG MWh	F $EF_{electricity}$ tCO_{2eq}/MWh	G = E x F $ER_{electricity}$ tCO_{2eq}
1	56000	1.14	63,840
2	56000	1.14	63,840
3	56000	1.14	63,840
4	56000	1.14	63,840
5	56000	1.14	63,840
6	56000	1.14	63,840
7	56000	1.14	63,840
8	56000	1.14	63,840
9	56000	1.14	63,840
10	56000	1.14	63,840

Project Emission

Step 1 : Estimation of Project Emissions From Off-Site Transportation

Year	A	B	C	D=A x B x C /1000
	N	AVD km	$EF_{km,CO2}$ $kg\ CO_{2eq}/km$	PET tCO_{2eq}
1	14,000	300	0.9	3,780
2	14,000	300	0.9	3,780
3	14,000	300	0.9	3,780
4	14,000	300	0.9	3,780
5	14,000	300	0.9	3,780
6	14,000	300	0.9	3,780
7	14,000	300	0.9	3,780
8	14,000	300	0.9	3,780
9	14,000	300	0.9	3,780
10	14,000	300	0.9	3,780

Step 2 : Estimation of Project Emissions From On-Site Diesel Consumption

Year	A	B	C	D	E =A x B x C x D
	FC_{HD} m^3	D_{diesel} t/m^3	NCV_{diesel} GJ/tonne	$EF_{CO2,diesel}$ tCO_{2eq}/GJ	$PEFF = PE_{FC,HD}$ tCO_{2eq}
1	53	0.85	43.3	0.0748	172
2	53	0.85	43.3	0.0748	172
3	53	0.85	43.3	0.0748	172
4	53	0.85	43.3	0.0748	172
5	53	0.85	43.3	0.0748	172
6	53	0.85	43.3	0.0748	172
7	53	0.85	43.3	0.0748	172
8	53	0.85	43.3	0.0748	172
9	53	0.85	43.3	0.0748	172
10	53	0.85	43.3	0.0748	172

Step 3 : Estimation of Project Emissions From Grid Electricity

Year	A	B	C	D = A x B x (1+C)
	EC_{PJ} MWh	EF_{grid} tCO_{2eq}/MWh	TDL %	PE_{EC} t CO_{2eq}
1	7,600	0.63	20%	5,746
2	7,600	0.63	20%	5,746
3	7,600	0.63	20%	5,746
4	7,600	0.63	20%	5,746
5	7,600	0.63	20%	5,746
6	7,600	0.63	20%	5,746
7	7,600	0.63	20%	5,746
8	7,600	0.63	20%	5,746
9	7,600	0.63	20%	5,746
10	7,600	0.63	20%	5,746

Step 4 : Total Project Emissions

Year	A	B	C	D = A + B + C
	PET tCO_{2eq}	PEFF t CO_{2eq}	PE_{EC} t CO_{2eq}	PE t CO_{2eq}
1	3,780	172	5,746	9,697
2	3,780	172	5,746	9,697
3	3,780	172	5,746	9,697
4	3,780	172	5,746	9,697
5	3,780	172	5,746	9,697
6	3,780	172	5,746	9,697
7	3,780	172	5,746	9,697
8	3,780	172	5,746	9,697
9	3,780	172	5,746	9,697
10	3,780	172	5,746	9,697

Emission Reductions

Year	$ER_{electricity}$ tCO_{2eq}	PE tCO_{2eq}	$ER=ER_{electricity}$-PE tCO_{2eq}
1	63,840	9,697	54,143
2	63,840	9,697	54,143
3	63,840	9,697	54,143
4	63,840	9,697	54,143
5	63,840	9,697	54,143
6	63,840	9,697	54,143
7	63,840	9,697	54,143
8	63,840	9,697	54,143
9	63,840	9,697	54,143
10	63,840	9,697	54,143
Total	638,400	96,970	541,430

Annex 4

MONITORING INFORMATION

Monitoring & Quality Assurance Information Table

No	Parameter	Symbol	Unit	Recording Frequency	Data; measured [m], calculated [c], Estimated [e]	Location	Method	Person Recording/ Calculating / Compiling Data	Person Verifiying Data
1	Electricity Generation	EG	MWh	daily	m	kWh meter at the biomass residue cogeneration plant	kWh meter reading will be recorded daily on a record sheet	Boiler man	Biomass Energy Plant Manager
2	Grid Electricity Consumption	EC_{PJ}	MWh	daily	m	kWh meter supplying electricity to biomass energy plant	kWh meter reading will be recorded daily on a record sheet	Boiler man	Biomass Energy Plant Manager
3	Number of trips made to source EFB	N_{EFB}	-	Every Truck	c	Weigh bridge station at MNI	Recording number of trucks carrying EFB to MNI	Weigh Bridge Operator	Biomass Energy Plant Manager
4	Number of trips made to source Fibres	N_{Fibres}	-	Every Truck	c	Weigh bridge station at MNI	Recording number of trucks carrying Fibres to MNI	Weigh Bridge Operator	Biomass Energy Plant Manager
5	Number of trips made to source PKS	N_{PKS}	-	Every Truck	c	Weigh bridge station at MNI	Recording number of trucks carrying PKS to MNI	Weigh Bridge Operator	Biomass Energy Plant Manager

No	Parameter	Symbol	Unit	Recording Frequency	Data; measured [m], calculated [c], Estimated [e]	Location	Method	Person Recording/ Calculating / Compiling Data	Person Verifiying Data
6	Number of trips made to source Wood Chips	N_{Wood}	-	Every Truck	c	Weigh bridge station at MNI	Recording number of trucks carrying wood chips to MNI	Weigh Bridge Operator	Biomass Energy Plant Manager
7	Distance to source EFB	AVD_{EFB}	-	Every Truck	e	Weigh bridge station at MNI	Recording the origin of the EFB load and have a predetermined location and distance table to estimate the distance to source biomass fuel.	Weigh Bridge Operator	Biomass Energy Plant Manager
8	Distance to source Fibre	AVD_{Fibre}	-	Every Truck	e	Weigh bridge station at MNI	Recording the origin of the Fibre load and have a predetermined location and distance table to estimate the distance to source biomass fuel.	Weigh Bridge Operator	Biomass Energy Plant Manager
9	Distance to source PKS	AVD_{PKS}	-	Every Truck	e	Weigh bridge station at MNI	Recording the origin of the PKS load and have a predetermined location and distance table to estimate the distance to source biomass fuel.	Weigh Bridge Operator	Biomass Energy Plant Manager

No	Parameter	Symbol	Unit	Recording Frequency	Data; measured [m], calculated [c], Estimated [e]	Location	Method	Person Recording/ Calculating / Compiling Data	Person Verifiying Data
10	Distance to source Wood Chips	AVD_{Wood}	-	Every Truck	e	Weigh bridge station at MNI	Recording the origin of the wood chips load and have a predetermined location and distance table to estimate the distance to source biomass fuel.	Weigh Bridge Operator	Biomass Energy Plant Manager
11	On-Site Diesel Consumption for Heavy Duty Trucks	FC_{HD}	m^3	daily	m & c	Biomass residue Cogeneration Plant Office	Invoices from purchase of fuel will be used to cross check with the estimated daily consumption summarised in a log book	Boiler Man	Biomass Energy Plant Manager
12	Net Quantity of electricity generated in MFO fired captive power plant	$EG_{CP,y}$	MWh	daily	m & c	kWh meters at the MFO cogeneration plant	kWh meter readings will be recorded daily on a record sheet	Boiler man	Biomass Energy Plant Manager

Annex 5
INVESTMENT ANALYSIS

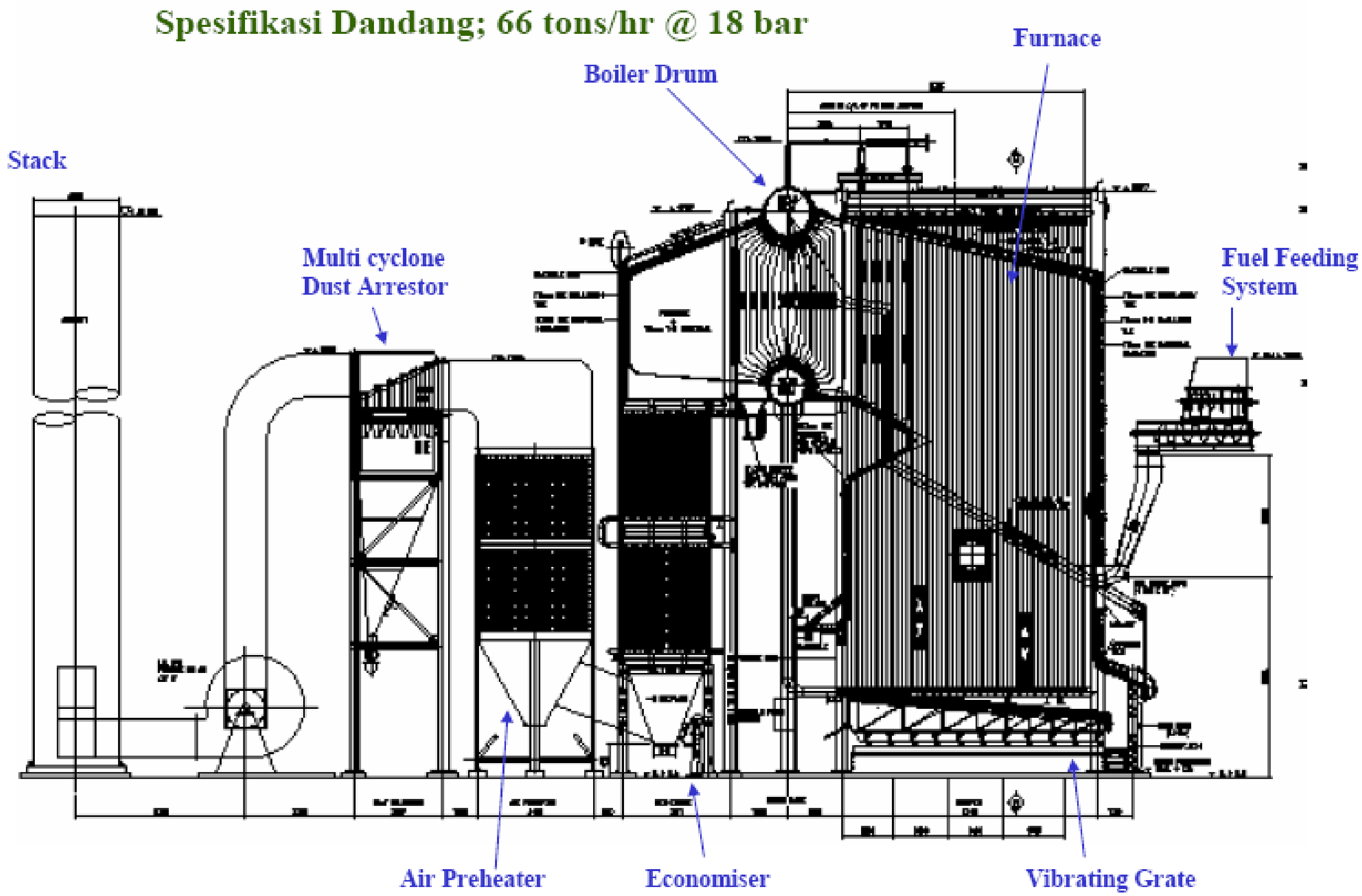
IRR Analysis for MNI Renewable Energy Project

No	Description	Unit		1	2	3	4	5	6	7	8	9	10	11	12
	A. Capex	RM	33,000,000												
	B. Income														
1	Saving from MFO Consumption	litres		40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000	40,000,000
2	MFO Price			0.99	0.94	0.89	0.85	0.82	0.81	0.82	0.82	0.83	0.84	0.84	0.85
	Total Inflow			39,680,790	37,473,251	35,486,468	33,830,814	32,947,801	32,506,294	32,653,382	32,801,450	33,099,985	33,407,849	33,706,384	34,014,243
	C. Expenses														
1	Production supply	RM		120,000	122,640	125,338	128,096	130,914	133,794	136,737	139,745	142,820	145,962	149,173	152,455
2	Operating & Materials	RM		496,800	507,730	518,900	530,315	541,982	553,906	566,092	578,546	591,274	604,282	617,576	631,163
3	Spares & Maintenance	RM		1,243,000	1,270,346	1,298,294	1,326,856	1,356,047	1,385,880	1,416,369	1,447,529	1,479,375	1,511,921	1,545,184	1,579,178
4	Boiler & Fuel Handling Plant Major Maintenance	RM		0	1,022,000	0	1,067,463	0	1,114,948	0	1,164,545	0	1,216,349	0	1,270,457
5	Diesel for shovel/ forklift	RM		93,890	95,956	98,067	100,224	102,429	104,682	106,985	109,339	111,745	114,203	116,715	119,283
6	Contract Workers	RM		230,400	235,469	240,649	245,943	251,354	256,884	262,535	268,311	274,214	280,247	286,412	292,713
7	Shovel/ Forklift Rental	RM		1,516,000	1,549,352	1,583,438	1,618,273	1,653,875	1,690,261	1,727,446	1,765,450	1,804,290	1,843,984	1,884,552	1,926,012
8	Boiler Ash Disposal Cost	RM		258,000	263,676	269,477	275,405	281,464	287,656	293,985	300,453	307,063	313,818	320,722	327,778
9	Administration	RM		24,000	24,528	25,068	25,619	26,183	26,759	27,347	27,949	28,564	29,192	29,835	30,491
10	Incremental Loss of Production due to biomass boiler breakdown	RM		775,320	528,251	269,936	0	0	0	0	0	0	0	0	0
11	MFO Consumption due to biomass boiler breakdown	RM		109,658	69,039	32,689	0	0	0	0	0	0	0	0	0
12	Electricity Consumption due to biomass boiler breakdown	RM		38,640	26,327	13,453	0	0	0	0	0	0	0	0	0
13	Utility Electricity consumption for Biomass Cogeneration Plant	RM		1,748,000	1,786,456	1,825,758	1,865,925	1,906,975	1,948,929	1,991,805	2,035,625	2,080,408	2,126,177	2,172,953	2,220,758
14	Biomass Fuel Cost	RM		16,340,000	16,699,480	17,066,869	17,442,340	17,826,071	18,218,245	18,619,046	19,028,665	19,447,296	19,875,136	20,312,389	20,759,262
15	Additional electrical load from TNB	RM		5,776,821	5,903,911	6,033,797	6,166,541	6,302,205	6,440,853	6,582,552	6,727,368	6,875,370	7,026,628	7,181,214	7,339,201
	Total Outflow		-	28,770,530	30,105,160	29,401,732	30,793,000	30,379,499	32,162,796	31,730,901	33,593,526	33,142,418	35,087,900	34,616,726	36,648,750
	D.Inflation Rate	2.2%		1.00	1.02	1.04	1.07	1.09	1.11	1.14	1.16	1.19	1.22	1.24	1.27
	Net Cash Flow		**- 33,000,000**	**10,910,260.11**	**7,368,091.47**	**6,084,736.53**	**3,037,813.56**	**2,568,301.84**	**343,497.52**	**922,480.76**	**-792,075.73**	**-42,433.18**	**-1,680,051.07**	**-910,341.45**	**-2,634,507.73**
	Project IRR Without CDM	**#NUM!**													
	Discount Rate	10%													
	NPV (RM)	-9,343,259													
	Total CER's up to 2012 (tCO2)	216,000													
	Required CER Price (RM/tCO2)	-43.26													
	Exchange Rate (RM/EUR)	4.80													
	Required CER Price (EURO/tCO2)	-9.01													

No	Description	EUR/tCO2		1	2	3	4	5	6	7	8	9	10	11	12
1	Net Cash Flow Without CDM		-33,000,000	10,910,260	7,368,091	6,084,737	3,037,814	2,568,302	343,498	922,481	-792,076	-42,433	-1,680,051	-910,341	-2,634,508
2	Revenue from CER's	10.00		**2,592,000**	**2,592,000**	**2,592,000**	**2,592,000**	**2,592,000**	**2,592,000**	**2,592,000**	**2,592,000**	**2,592,000**	**2,592,000**		
3	**Net Cash Flow With CDM**		**-33,000,000**	**13,502,260**	**9,960,091**	**8,676,737**	**5,629,814**	**5,160,302**	**2,935,498**	**3,514,481**	**1,799,924**	**2,549,567**	**911,949**	**-910,341**	**-2,634,508**
	Estimated CER's (tCO2/yr)	54,000													
	Project IRR With CDM	**16.55%**													
	Discount Rate	10%													
	NPV (RM)	5,135,576													

Annex 6

BIOMASS BOILER LAYOUT



Annex 7

BIOMASS AVAILABILITY STUDY

Parameter	EFB
LHV* (GJ/tonne)	4.85
% of Usage	100%
Energy Required (TJ/yr)	1,396
Biomass Required (tonnes/yr)	287,808
Excess Biomass Available in East Coast and Perak**, (tonnes/yr)	4,868,282
Excess	16.9

**Feasibility Study On Grid Connected Power Generation Using Biomass Cogeneration Technology*

**Malaysian Palm Oil Board, MPOB

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