MONITORING REPORT FORM (CDM-MR)
Version 01 - in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT
Version 04, 26/03/2012

Bentong Biomass Energy Plant in Malaysia
UNFCCC Ref. No.:0501
Monitoring Period Number 1 for the Dates (01/01/2008 - 30/06/2009)

SECTION A. General description of the project activity

A.1. Brief description of the project activity: >>

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This project uses Empty Fruit Bunches (EFB), Mesocarp Fibres, Palm Kernel Shells and Wood Waste, which are a waste product of the palm oil milling and wood plantations, as the fuel for a modern, highly efficient 64 tonnes per hour capacity, 25 Barg biomass -fired cogeneration system to supply steam to Pascorp Paper Industries Berhad, Bentong, Pahang, Malaysia.

The project activity will be able to reduce emissions in two ways. First is by displacing fossil fuel, which is used to generate 64 t/h of steam. Second is by reducing methane emissions from the rotting EFB waste piles at the mills.

The energy plant is sourcing the biomass waste from neighbouring palm oil mills and wood plantations via fuel purchase agreements and spot purchases from local mills that cannot dispose of the EFB, Mesocarp Fibres, Palm Kernel Shells and Wood Waste, except by dumping onto piles. This biomass is abundantly available in the region and was earlier open air burned, but since the ban on open air burning in Malaysia entered into force, the EFB biomass must be disposed of in the plantations. However, many mills and wood plantations face a problem in disposing the waste as they do not possess any plantation, but only operate a mill. Plantation owners supplying the fresh palm oil fruit bunches (FFB) are typically not interested in collecting the waste at the mill and disposing it in their plantation. Thus some of the mills are left with only the option to dispose the EFB in piles to naturally decompose at their mill site, or into natural valleys where it decays, emitting biogas containing methane, a potent greenhouse gas and potential fire hazard. The biogas also emits a putrid odor from the decaying piles that poses an increasing problem for employees and nearby residents of the mills.

The Paper Plant was operating Fuel-Oil Fired Boilers to supply steam for the plant process, and purchases power from the electricity grid. The project is to replace the amount of steam produced from fuel oil in the paper mill and thus reduce greenhouse gas emissions from the plant.

The project will contribute to the use of sustainable renewable energy sources in a highly efficient manner and is in line with Malaysia's development policy of renewable energy as the fifth fuel. This will lead to greater self-sufficiency of fuel for the energy sector. Currently fuel oil is subsidized and the project will directly lead to reduction of subsidized fuel oil for the plant as it will produce steam from renewable biomass.

The biomass energy system is developed and manufactured by ENCO Systems, a Malaysian company, which manufactures high efficiency boilers and biomass utilization systems, based on a design developed

by ENCO's partner - B&W Volund in Denmark. The project leads to technology and knowledge transfer from Denmark to Malaysia to facilitate local manufacturing of highly efficient biomass boilers. Being able to provide such technology locally will ensure local employment and reduce the foreign expenditures and currency risk for developing these renewable energy sources in Malaysia.

The project will be implemented in two stages. At the first stage, 32 t/h of steam will be generated for the Paper Plant process steam consumption. The second stage of the project will be to supply all the requirements that the Paper Plant has for steam, which will be up to 32 t/h more.

Below is the technical specification and status of each component in the project activity;

Biomass Boiler
The testing and commissioning for the 32t/h, 25 bar, biomass boiler was completed in 2007 and the boiler is in operation since 01/01/2008. The old oil and gas-fired boilers were on standby service since 01/20/2008.

The second stage of the project will be implemented for start-up late in 2011 due to financial constraints.

The emission reduction achieved during this monitoring period (01/01/2008 - 30/06/2009) is 132,017 tCO_2e.

A.2. 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)
Malaysia (host)	Enco Danstoker (Malaysia) Sdn. Bhd.
Canada	LFGC Corporation
Germany	Vattenfall Europe Generation AG & Co. KG

A.3. Location of the project activity:

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The project site has the following physical postal address;
Lot 1A, Kawasan Perindustrian Bentong,
28700 Bentong,
Pahang Darul Makmur,
Malaysia

GPS coordinates:
Latitude 3° 29' 24.144" North
Longitude 101° 56' 48.264" East

A.4. Technical description of the project

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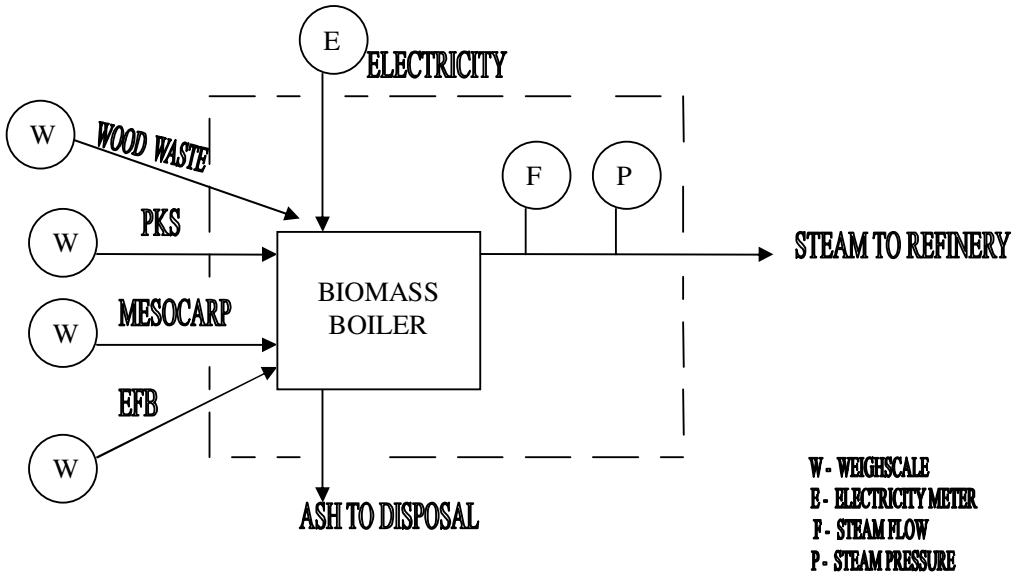
The Project uses biomass boiler technology that will allow the plant to be operated solely on EFB fuel. The technology to be used is supplied and the equipment commissioned by ENCO, a local systems manufacturer in Kuala Lumpur. ENCO has a Technology Transfer Agreement with Babcock & Wilcox Volund (BWV) of Denmark, who has supplied biomass boiler systems to more than 50 different countries, including a number of sites in South East Asia. The system used will have a fuel to steam efficiency of 75%, compared to 60% for most existing biomass systems. ENCO has supplied a boiler to another site in Malaysia that started up in 2005, and another two that started up in mid 2006. The steam turbine generator is very robust technology that has been in use for almost a century.

The characteristics of EFB – a high moisture, low calorie biomass – make it difficult to use as fuel for steam and power generation. Advanced technologies and additional measures to pre-treat the EFB to reduce the moisture content to below 40% are required. The history of biomass use in the Palm Oil Industry is that milling factories prefer to use fiber and shells for boiler fuel due to their higher heating value, and little or no use has been made of EFB. The Project will therefore contribute to important technology transfer, and will show the lead for other millers to follow in using an otherwise waste product and environmental contaminant for producing renewable energy to use in their processes.

The Project boundary is shown below (dashed line) with the monitoring points shown for data collection:



BIOMASS PLANT – FITTING LIST

Parameters	Description of Instruments
1. Steam Drum Pressure Transmitter	Yokogawa, Model: EJA530A-DCS7N-02NE/D3, Inlet: ½", 0-50 Bar, 4-20mA
2. Water Flow Meter	Yokogawa, Model: DY050-DBLAD4-2D, 0-40 m3/hr at 32 barg, Inlet: 50mm, Outlet: 50mm, 4-20mA, BRAIN, wafer type
3. Steam Flow Meter	Yokogawa, Model: DY150-DBLBD4-2D/MV, Inlet: 150mm, Outlet: 150mm, 4-20mA, 0-35T/h at 25Barg
4. Electricity Meter	Standard Electricity Meters provided by government linked Utilities company, Tenaga National Berhad (TNB)
5. Steam Differential Pressure Transmitter	Yokogawa, Model: EJA110A-DMS4A-92NA/D4, Inlet: ½", cal. 0-373mmH20, 4-20mA
6. Furnace Differential Pressure Transmitter	Yokogawa, Model: EJA110A-DMS4A-92NA/D4, Inlet: ½", -100 to 100mmH20, 4-20mA
7. Smoke Density Meter	Betronics, Model: SDMS-BT-9, cw projector & receiver, 4-20mA

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

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The project is a small scale project activity and falls under the category AMS-I.C Version 8 and category AMS-III.E Version 8 according to Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities.

AMS- I.C Version 8 includes the baseline methodology for the thermal energy for the user; i.e., the biomass based steam supply to the refinery to displace oil-fired based steam and electricity. The baseline has been determined according to paragraph 6 (For renewable energy technologies that displace technologies using fossil fuels).

AMS-III.E Version 8 includes the baseline methodology for methane avoidance. There is only one method available in Appendix B. The baseline is the amount of methane from the decay of biomass treated in the Project activity, calculated using the IPCC default emission factors.

A.6. Registration date of the project activity:

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The project has been registered with UNFCCC on 02/09/2006 as a CDM project activity under article 12 of the Kyoto protocol. UNFCCC Ref. Number: 0501.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

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The project has a 7 years renewable crediting period from 01/01/2008 to 31/12/2014.

A.8. Name of responsible person(s)/entity(ies):

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Mr.Gerald Hamaliuk
LFGC Corporation
200 N. Service Road W.,
Unit 1, Ste. 410,
Oakville, ON, Canada
L6M 2Y1
Tel: 001-647-333-2115
Fax: 001-905-469-4281
E-mail: projectnet@cogeco.ca

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

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1. Starting date of operation of the project activity
01/01/2008

The project will be implemented in two stages. At the first stage, 32 t/h of steam will be generated for the Paper Plant process steam consumption. The second stage of the project will be to supply all the requirements that the Paper Plant has for steam, which will be up to 32 t/h more.

Below is the technical specification and status of each component in the project activity;

Biomass Boiler

The testing and commissioning for the 32t/h, 25 bar, biomass boiler was completed in 2007 and the boiler is in operation since 01/01/2008. The old oil and gas-fired boilers were on standby service since 01/20/2008.

The second stage of the project will be implemented for start-up late in 2011 due to financial constraints.

2. Maintenance Shutdown Period (Jan 2008 - June 2009)

Year 2008

Month	No	Date / Time			Job Complete	Comment
		From	To	Downtime		
JAN ' 08	1.	01/01/2008 1600hrs	03/01/2008 1700hrs	2 days	Firetube and Air Heater Cleaning	Maintenance to clean up chokes
	2.	08/01/2008 2100hrs	16/01/2008 1400hrs	8 days	Seal by DOE	To rectify and fulfil Dept of Environment regulation on black smoke
FEB '08	3.	01/02/2008 1540hrs	02/02/2008 2310hrs	1 day 7 hours	Firetube Cleaning	Maintenance to clean up chokes
	4.	15/02/2008 0600hrs	15/02/2008 2045hrs	15 hours	Firetube Cleaning	Maintenance to clean up chokes
MAR '08	5.	17/03/2008 0930hrs	17/03/2008 2100hrs	11.5 hours	Firetube Cleaning	Maintenance to clean up chokes
	6.	26/03/2008 0730hrs	26/03/2008 0950hrs	2 hours	Firetube Cleaning	Maintenance to clean up chokes
APR '08	7.	10/04/2008 2153hrs	11/04/2008 1410hrs	1 day	Firetube Cleaning	Maintenance to clean up chokes
	8.	24/04/2008	24/04/2008	12 hours	Firetube Cleaning	Inspection by DOSH

		0845hrs	2045hrs			
MAY ' 08	9.	05/05/2008 0900hrs	05/05/2008 1845hrs	10 hours	Firetube Cleaning	Maintenance to clean up chokes
	10.	22/05/2008 1736hrs	23/05/2008 0917hrs	16 hours	Firetube Cleaning	Maintenance to clean up chokes
	11.	29/05/2008 1350hrs	30/05/2008 0140hrs	12 hours	Firetube Cleaning	Maintenance to clean up chokes
JUN '08	12.	11/06/2008 1122hrs	11/06/2008 2300hrs	11.5 hours	Firetube Cleaning	Maintenance to clean up chokes
	13.	26/06/2008 1130hrs	27/06/2008 1900hrs	1 days	Firetube Cleaning	Maintenance to clean up chokes
JULY '08	14.	22/07/2008 2330hrs	23/07/2008 0600hrs	6.5 hours	Firetube Cleaning	Maintenance to clean up chokes
AUG '08	15.	09/08/2008 1300hrs	09/08/2008 1500hrs	2 hours	Firetube Cleaning	Maintenance to clean up chokes
	16.	11/08/2008 0815hrs	11/08/2008 2310hrs	15 hours	Firetube Cleaning	Maintenance to clean up chokes
	17.	19/08/2008	19/08/2008	8 hours	Firetube Cleaning	Maintenance to clean up chokes

		0800hrs	1600hrs			
	18.	22/08/2008 0445hrs	23/08/2008 2130hrs	1 day 17 hours	Firetube Cleaning	Maintenance to clean up chokes
SEPT ' 08	19.	04/09/2008 0115hrs	05/09/2008 1000hrs	1 day	Firetube Cleaning	Maintenance to clean up chokes
	20.	13/09/2008 1930hrs	14/09/2008 0700hrs	11.5 hours	Firetube Cleaning	Maintenance to clean up chokes
	21.	29/09/2008 2345hrs	06/10/2008 1250hrs	6.5 days	Firetube Cleaning	Maintenance to clean up chokes
OCT '08	22.	16/10/2008 2230hrs	17/10/2008 0625hrs	8 hours	Clear Bufferbin	Fuel Jammed
NOV '08	23.	17/11/2008 1920hrs	21/11/2008 0830hrs	3 days 13 hours	Boiler Overhauling (According to OHSAS 18000 Standards)	Inspection by Department of Health and Safety (DOSH)
DEC '08	24.	07/12/2008 0025hrs	10/12/2008 1500hrs	3 days 15 hours	Hari Raya Aidilfitri / Maintenance Work	Pascorp Shut Down/Maintenance work conducted to ensure tip-top condition of plant and equipment
	25.	29/12/2008 0908hrs	29/12/2008 1545hrs	6.5 hours	Firetube Cleaning	Maintenance to clean up chokes

Year 2009 (Jan 2009 – June 2009)

Month	No	Date / Time			Job Completed	Comment
		From	To	Downtime		
JAN ' 09	1.	04/01/2009 2050hrs	06/01/2009 1300hrs	1 days 16 hours	Firetube Cleaning and Maintenance Work	Maintenance to clean up chokes
	2.	24/01/2009 2300hrs	28/01/2009 1850hrs	4 days	Chinese New Year Shutdown	Routine Maintenance
FEB '09	3.	09/02/2009 0015hrs	10/02/2009 1110hrs	1 day 11 hours	Boiler Trip due Hydraulic power Pac Wiring shortage	Repairing work
	4.	17/02/2009 1925hrs	19/02/2009 1030hrs	1 day 15 hours	Boiler Breakdown due to Vibrating Grate Tube Leaking	Repairing work
	5.	21/02/2009 1010hrs	21/02/2009 2030hrs	10 hours	Remove clinkers and add T-bar at the Vibrating Grate	Repairing work
MAR '09	6.	03/03/2009 1140hrs	04/03/2009 0100hrs	13 hours	Firetube Cleaning and Maintenance Work	Maintenance to clean up chokes
	7.	18/03/2009 1900hrs	24/03/2009 1205hrs	5 days 17 hours	Boiler Overhauling (According to OHSAS 18000 Standard)	Insp. By Department of Health and Safety (DOSH)

APR '09	8.	13/04/2009 2320hrs	15/04/2009 0415hrs	1 days 5 hours	Firetube Cleaning and Maintenance Work	Maintenance to clean up chokes
MAY ' 09	9.	31/05/2009 0330hrs	31/05/2009 0510hrs	1.5 hours	Cleaning ID Fan Impeller due to Fan Vibrating	Cleaning work
JUN '09	10.	01/06/2009 2000hrs	03/06/2009 1220hrs	1 day 16.5hours	Firetube Cleaning and Maintenance Work	Maintenance to clean up chokes
	11.	29/06/2009 2050hrs	01/07/2009 0545hrs	1 day 9 hours	Firetube Cleaning and Maintenance Work	Maintenance to clean up chokes

3. No events or situations that occurred during the monitoring period, which may impact the applicability of the methodology

B.2. Revision of the monitoring plan

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The monitoring plan has been revised and approved on 05/29/ 2010.

B.3. Request for deviation applied to this monitoring period

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B.4. Notification or request of approval of changes

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SECTION C. Description of the monitoring system

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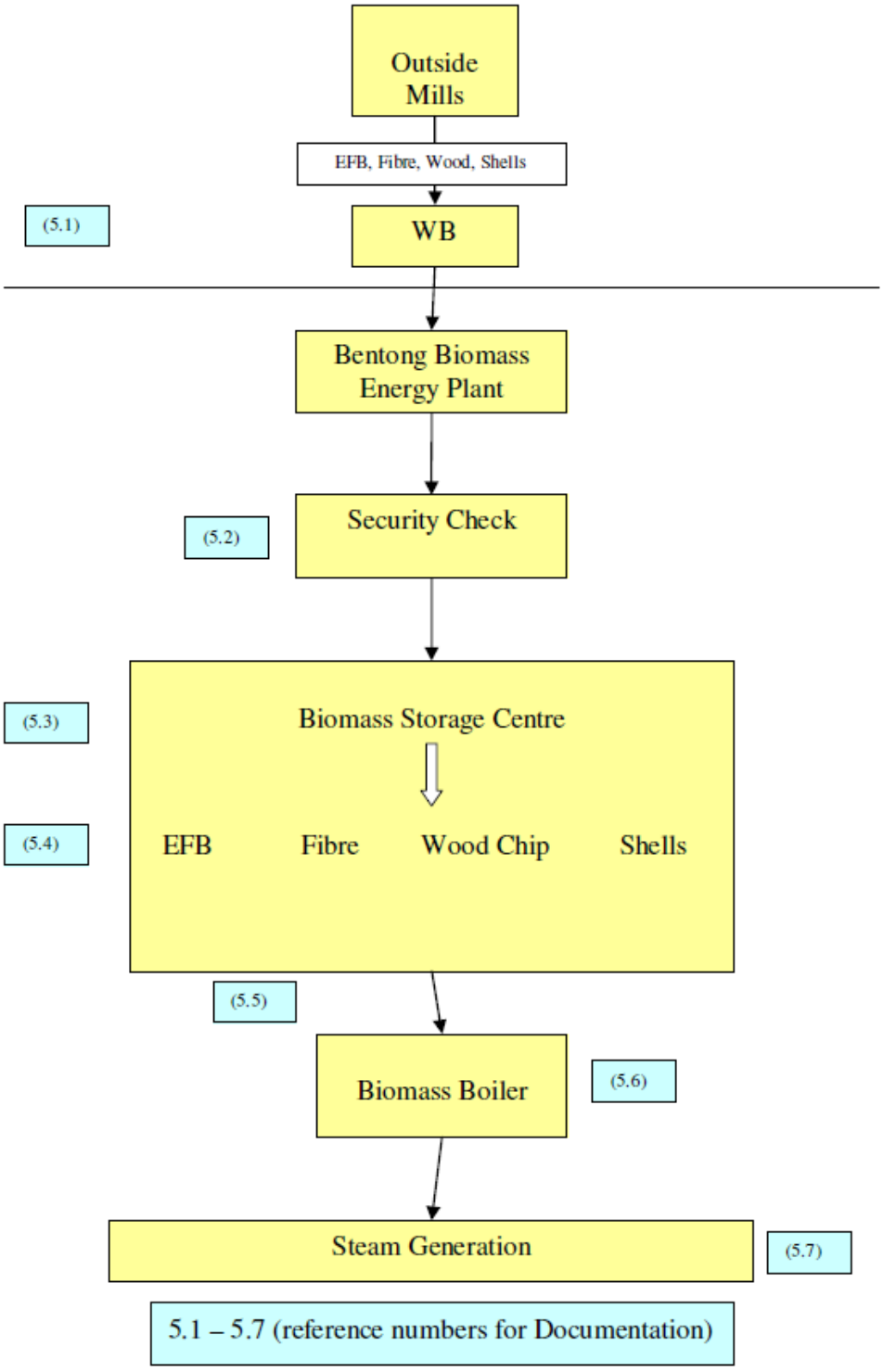
Process Flow Diagram:



5.1 Supplying Mills

Who	Where	When	Action	Ref	Records
Fuel Procurement Officer	Biomass Storage Centre	Daily	To check and verify all EFB, fibre, wood chip and occasionally palm shells weighing before sending the figures to the data entry clerk for compilation		WB tickets
Data Entry Clerk	Office	Weekly	To collect all WB tickets for EFB, Fibre, Wood Chips and shells deliveries from Fuel Procurement Officer for compilation		WB transaction summary / WB Tickets
CDM Executive Coordinator	Office	Weekly	To ensure WB tickets are in order and well kept		WB transaction summary / WB Tickets

5.2 Security Check

Who	Where	When	Action	Ref	Records
Security Guard	Plant Entrance	Daily	Keep track of all EFB, fibre, wood chip and occasionally palm shells transporters entering the plant		Security Book
Fuel Procurement Officer	Office	Weekly	To check all records of suppliers' transporters against the security book		Security Book

5.3 Biomass Storage Centre (Incoming Raw Materials)

Who	Where	When	Action	Ref	Records
Fuel Procurement Officer	Biomass Storage Centre	Daily	To record all receipts for EFB, Fibre, Wood Chips and Palm Shells. Receipts are passed to Data Entry Clerk on a weekly basis		Transaction Receipts
CDM Executive Coordinator	Office	Weekly	To collect all receipts of EFB, Fibre, Wood Chips and shells for compilation		Transaction Receipts

5.4 Biomass Storage Centre (Control over Supply)

Who	Where	When	Action	Ref	Records
CDM Chief Coordinator	Biomass Storage Centre	Monthly	- To measure EFB, fibre, wood chips and shells monthly supply - To verify and reconcile fuel stock and consumption on a monthly basis		

5.5 Biomass Storage Centre (Storage of Supply)

Who	Where	When	Action	Ref	Records
Fuel Procurement Officer / Wheel loader driver	Biomass Storage Centre	Daily	To monitor the usage of EFB, Fibre, Wood Chip and shells usage		
Shift Leaders	Office	Daily	To verify usage of EFB, Fibre, Wood Chip and shells according to daily supply to the plant		

5.6 Biomass Boiler

Who	Where	When	Action	Ref	Records
Electrical Engineer	Boiler Control Room	Daily	To ensure that the boiler control panel is working fine and backup data for at least 6 months		
CDM Executive Coordinator	Boiler Control Room	Monthly	To ensure that the SCADA system is backup data for at least 6 months		Daily Boiler Operating Logsheet
Assistant General Manager	Office	Yearly	To check and recalibrate all steam flow meters, electricity meters, smoke density meter and water flow meter		Instruments Annual Recalibration Certificates

5.7 Steam Production

Who	Where	When	Action	Ref	Records
Boilerman	Boiler Control Room	Daily	To ensure all records of steam flow, water usage and electricity consumption are keyed in correctly		Daily Boiler Operation Logsheet, Daily Electricity Consumption Sheet
Shift Leaders/ Electrical Engineer	Boiler Control Room	Daily	To verify all records of steam flow, water usage and electricity		Daily Boiler Operating Logsheet, Daily Electricity

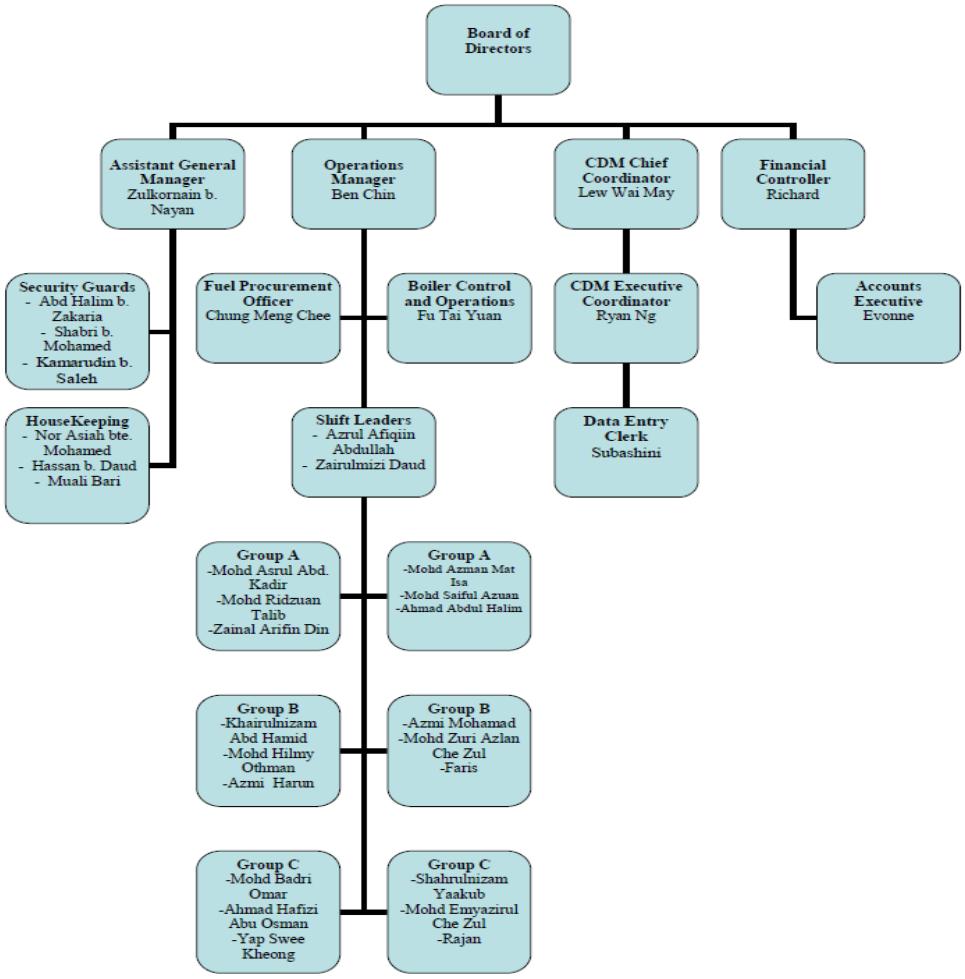
			consumption are recorded accurately		Consumption Sheet
Assistant General Manager	Office	Yearly	To check and recalibrate all steam flow meters, electricity meters, smoke density meter and water flow meter		Instruments Annual Recalibration Certificates

Monitoring Process:

Monitoring Process	Who	Where	When	Action	Records
Step 1	Fuel Procurement Officer	Biomass Storage Centre	Daily	To check and verify all EFB, fibre, wood chip and occasionally palm shells weighing before sending the figures to the data entry clerk for compilation	WB tickets
Step 2	CDM Chief Coordinator	Office	Monthly	To check and verify EFB, fibre, wood chip and occasionally palm shells monthly consumption	
Step 3	Shift Leaders	Office	Daily	To check and verify all records of:- i) Boiler Operation Logsheet ii) To send all verified records to Operations Manager for Checking	Daily Boiler Operation Log Sheet
Step 4	Operations Manager	Office	Monthly	To verify all data are accurate before compiling and sending to CDM Coordinator	Daily Boiler Operation Log Sheet

Step 5	Data Entry Clerk	Office	Monthly	To crosscheck and compile all WB tickets before sending to CDM Coordinator	WB transaction summary / WB tickets
Step 6	CDM Executive Coordinator	Office	Monthly	To ensure all data collected is correct and consistent before keying all CER data into Microsoft Excel Spreadsheet	CER Spreadsheet, Daily Boiler Operation Log Sheet, Daily Electricity Consumption, WB transaction summary / WB tickets
Step 7	CDM Chief Coordinator	Office	Monthly	To verify that all CER data is correct before signing off	CER spreadsheet

Organization Chart



Responsibilities and Skills
The responsibilities and skills of individual monitoring team members are listed as below:

Employee's Name and Position	**Responsibilities and skill sets**
1. Ben Chin *Plant Operation Manager*	- Overall responsible for the implementation of the monitoring system. Reports to the directors of EDMSB. - Responsible for the overall operations of the plant on day-to-day basis - Responsible for checking and verifying all data collected that has been pre-checked by shift leaders
2. Zulkornain b. Nayan *Assistant General Manager*	- Responsible for the welfare of the plant on day-to-day basis - Responsible for the calibrations of all steam meters, electricity meters, water meters and all other equipments of the boiler plant.
3. Azrul and Mizi *Shift Leaders*	- Responsible for checking and verifying all data collected prior final entry into the Daily Boiler Operating Log sheet - Responsible for the overall operations of the plant on day-to-day basis
4. Chung Meng Chee *Fuel Procurement Officer*	- Responsible for cross-checking of the stock supplies against the security book - Responsible for collecting all WB tickets of EFB, Fibre, Wood Chip and shells before handing it over to data entry clerk on a weekly basis - Responsible for arrangement of stock pile around the biomass storage centre.
5. Fu Tai Yuan *Electrical Engineer*	- Responsible for daily gathering of all data associated with boiler log sheets, utilities usage and etc. - Responsible for monitoring the control panel of the boiler system as well as data entry of steam production into the daily boiler operating log sheet
7. Lew Wai May *CDM Chief Coordinator*	- Management representative for the monitoring system of Bentong Biomass Energy Plant. Reports to the directors of EDMSB - Responsible for cross checking all data entries made into the CER spread sheets - Responsible for estimating monthly stock of EFB, Fibre, Wood

	Chips and shells at the biomass storage centre - To reconcile stock and consumption accordingly
8. Ryan Ng *CDM Executive Coordinator*	- Responsible for data entries made into the CER spreadsheets - Responsible for the compilation of all reports regarding the CDM Project - Responsible for keeping all records of the monitoring plan
6. Subashini *Data Entry Clerk*	- Responsible for compilation and data entry of WB figures of EFB, Fibre, Wood Chip and shells deliveries.
9. Richard Yeo *Financial Controller*	- Responsible for overlooking of the company's financial position
10. Evonne *Accounts Executive*	- Responsible for all payments made to fuel suppliers which consist of EFB, Fibre, Wood Chip and shells - Responsible for all payments made for lab testing which consist of Calorific Value and Total Organic Carbon

In-House Training Programs consists of

- In-House Seminar Program
- Boiler Equipment Operation and Control
- SCADA System Operation and Control
- CDM Training Seminars

Emergency procedures for the monitoring system:

The weighbridge and the steam meter are the main equipments during the operation.

For weighbridges, there is one in the palm oil mill where the biomass is sourced, and another one in Bentong biomass plant. It is sufficient for back up for this emergency procedure.

For the steam meters, as the project operator, Bentong plant has a steam meter. Pascorp paper mill also has its own steam flow meter to counter check on the consistency. It is also sufficient for back up for this emergency procedure.

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors	
Data / Parameter:	Fuel Oil Fired Boiler Efficiency
Data unit:	%
Description:	Amount of energy from fuel oil converted into steam
Source of data used:	Boiler manufacturer's specifications
Value(s) :	85%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Additional comment:	

Data / Parameter:	Emission Coefficient of Fuel Displaced (Medium Fuel Oil)
Data unit:	tCO_2e/TJ
Description:	
Source of data used:	IPCC Default
Value(s) :	74.07
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Additional comment:	

Data / Parameter:	Emission Coefficient of Fuel Used(Diesel)
Data unit:	tCO_2e/TJ
Description:	
Source of data used:	IPCC Default
Value(s) :	73.76
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations
Additional comment:	

Data / Parameter:	Heat Value of Diesel
Data unit:	TJ/t
Description:	

Source of data used:	IPCC Default
Value(s) :	0.043
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations
Additional comment:	

Data / Parameter:	Emission coefficient for Grid
Data unit:	tCO_2e/MWh
Description:	
Source of data used:	IPCC Default
Value(s) :	0.8
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations
Additional comment:	

Data / Parameter:	Diesel Mass Density
Data unit:	tonnes/litre
Description:	
Source of data used:	Ratio provided by supplier
Value(s) :	0.000819
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculations
Additional comment:	

Data / Parameter:	Net Enthalpy Difference
Data unit:	kJ/kg
Description:	
Source of data used:	Standard Steam Table
Value(s) :	2549.9
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Additional comment:	

D.2. Data and parameters monitored	
Data / Parameter:	Thermal Energy, HGy
Data unit:	TJ

Description:	Steam Supplied to the plant
Measured /Calculated /Default:	Measured and Calculated
Source of data:	Steam meter with temperature and pressure compensation internally.
Value(s) of monitored parameter:	766.22
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Yokogawa Vortex Flowmeter, Accuracy Class +/- 0.24% readings, +/- 0.1% full scale; Serial Number is S5G501354720, Calibrated once a year, Last calibrated on 3/11/2008.
Measuring/ Reading/ Recording frequency:	Recording Monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	calibrated annually

Data / Parameter:	Electrical Energy
Data unit:	kWh
Description:	Electricity Consumed by the biomass Boiler
Measured /Calculated /Default:	Measured
Source of data:	The meters are provided by the grid company. This parameter is measured by using electricity consumption invoices. (monthly bills from the electricity company)
Value(s) of monitored parameter:	Year 2008 (Jan – Dec) 2,157,079 kWh Year 2009 (Jan – June) 1,256,822 kWh Total : 3,413,901 kWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emission Calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Meters from the grid company, Enco does not have access to the meters
Measuring/ Reading/ Recording frequency:	Recording Monthly
Calculation method (if applicable):	Not applicable – the electricity is directly metered.
QA/QC procedures applied:	According to national standards, meters are calibrated periodically. The

	calibration is conducted by the electricity company, as the project owner does not have access to the meters.

Data / Parameter:	Electrical Energy
Data unit:	kWh
Description:	Electricity Consumed by the processing plant
Measured /Calculated /Default:	Measured
Source of data:	Electrical Meter
Value(s) of monitored parameter:	Year 2008 (Jan –Dec) : 266,370 kwh, Year 2009 (Jan – June) : 298,350kwh Total 564,720 kwh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emission Calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	The meter was installed on 28/11/2007 and will be replaced every 2 years.
Measuring/ Reading/ Recording frequency:	Recording Monthly
Calculation method (if applicable):	Not applicable – the electricity is directly metered.
QA/QC procedures applied:	

Data / Parameter:	Tonnes of biomass
Data unit:	Tonnes
Description:	Biomass consumed by the steam boiler –EFB ,mesocarp fibre, palm kernel shell and wood waste recorded separately from the weighbridge tickets. Only EFB is used for the methane avoidance calculations.
Measured /Calculated /Default:	Measured
Source of data:	Weighbridge tickets for each type of biomass
Value(s) of monitored parameter:	For EFB: 43,663.71 For mesocarp fibre: 63,866.68 For palm kernel shell: 317.37 For wood: 7,723.27
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration	For EFB at the processing site: SPMT Weighing Instrument, Accuracy Class not stated, Serial Number is 00230766 CS, Calibrated once a year, Last calibrated on 31/10/08.

frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Recording Monthly (aggregate)
Calculation method (if applicable):	N/A
QA/QC procedures applied:	

Data / Parameter:	Biomass Heat Value
Data unit:	Kcal/kg
Description:	Heat value for Mesocarp Fibres, Palm Kernel Shells and Wood Residues
Measured /Calculated /Default:	Measured
Source of data:	Lab test results
Value(s) of monitored parameter:	Please refer to Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	only for reference
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	by the third party laboratory
Measuring/ Reading/ Recording frequency:	Recording Yearly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	

Data / Parameter:	Biomass Heat Value
Data unit:	Kcal/kg
Description:	Heat value for EFB
Measured /Calculated /Default:	Measured
Source of data:	Lab test results
Value(s) of monitored parameter:	Please refer to Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission	Reference value

calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	by the third party laboratory
Measuring/ Reading/ Recording frequency:	Recording Monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	

Data / Parameter:	Total Organic Carbon
Data unit:	%
Description:	Distinguish between aged and fresh EFB
Measured /Calculated /Default:	Measured
Source of data:	
Value(s) of monitored parameter:	Please refer to Annex 1
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Reference value
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	by the third party laboratory
Measuring/ Reading/ Recording frequency:	Recording Monthly for aged EFB and yearly for fresh EFB
Calculation method (if applicable):	N/A
QA/QC procedures applied:	

Data / Parameter:	Distance
Data unit:	km
Description:	Between EFB, Mesocarp Fibres, Palm Kernel Shells and Wood Residues source and Project
Measured /Calculated /Default:	Measured
Source of data:	Weighbridge ticket
Value(s) of monitored parameter:	Average distance to project site is 97 Km

Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Leakage
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Recording Yearly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	

Data / Parameter:	Distance
Data unit:	km
Description:	Between EFB source and Sanitary Landfill
Measured /Calculated /Default:	Measured
Source of data:	Weighbridge ticket
Value(s) of monitored parameter:	Average distance from the source to the landfill is 104 Km
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Leakage
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Recording Yearly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	

Data / Parameter:	Landfill gas collection occurs on the landfill near the Project
Data unit:	N/A
Description:	Observation as to occurrence of activity
Measured /Calculated /Default:	Observed
Source of data:	Visit to the landfill
Value(s) of monitored	Yes or no – the result for this period is No

parameter:	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Leakage
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	Recording Yearly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Refer to the photos provided with this monitoring report

Data / Parameter:	Diesel
Data unit:	liter
Description:	Diesel consumed by the bio-energy plant
Measured /Calculated /Default:	Measured
Source of data:	Purchase Record (Supplier's Invoice)
Value(s) of monitored parameter:	78,039
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emission Calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Level guage in storage tank
Measuring/ Reading/ Recording frequency:	Recording Monthly
Calculation method (if applicable):	from guaging tables
QA/QC procedures applied:	

Data / Parameter:	Survey
Data unit:	tonnes
Description:	Surplus biomass in the region
Measured /Calculated /Default:	Survey
Source of data:	Official statistics

Value(s) of monitored parameter:	Please refer to Annex 2
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Leakage evaluation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Survey
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Official data sources

Calibration Plan

Item No.	Description	Make	Model No.		Serial No.	Certificate No.	Date of Calibration	Calibration Frequency	Acceptable Tolerance	Remarks
1	Steam flow meter	Yokogawa	DY 150-DBLBD4-2D/MV*S1	New	S5G501354720	New supply	01/01/2008	Annually	±0.24%	Calibrated accordingly
						BB1-08277	03/11/2008	Annually	±0.24%	Calibrated accordingly
2	Boiler Plant power consumption KWH meter	ACTARIS	SL 7000		AC 06003265	T07 131323	See remark	Periodically by TNB		Meters from the grid company installed by TNB & TNB will do the calibration & Enco does not have access to the meters
3	Processing Plant electricity consumption KWH meter	MPI	CA 4-U672T(500/5)	New	20062041403	New supply	28/11/2007	2 years	±2%	Installed on 28/11/2007 & will replace a new electricity meter every 2 years
4	Weighbridge	SPMT	18m Concrete Deck Pitless	New	00230766 CJ / 00799896 HJ	B231051 B324769	29/10/2007 31/10/2008	Annually	±10kg	Calibrated accordingly

* Remarks:-

TNB is our national electricity utility company & any meter installed by them at customers premises will be calibrated by themselves.

Proof of calibration done by them is by affixing their own security label on to the meter.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

>>

Year 2008-2009 (January 1st2008 –June 30th2009)

Baseline Emission

Data for Year 2008

Month	Process Steam Consumption		EFB Fed to Boiler	Mesocarp Fibre Fed to Boiler	Wood
	t/month	TJ/month	Tonnes/month	Tonnes/month	Tonnes/month
January, 2008	9,356	23.86	1,455.38	2,184.23	69.65
February, 2008	13,673	34.86	3,570.17	2,278.83	102.55
March, 2008	18,291	46.64	3,251.73	3,963.05	137.18
April, 2008	19,000	48.45	3,377.78	4,116.67	142.50
May, 2008	19,839	50.59	1,873.68	5,290.40	148.79
June, 2008	15,408	39.29	1,455.20	4,108.80	115.56
July, 2008	21,021	53.60	3,153.15	4,904.90	157.66
August, 2008	19,847	50.61	3,087.31	4,630.97	99.24
Sept, 2008	18,424	46.98	2,558.89	4,298.93	230.30
October, 2008	16,322	41.62	2,266.94	3,808.47	204.03
November, 2008	14,968	38.17	2,078.89	3,492.53	187.10
December, 2008	17,586	44.84	2,442.50	4,103.40	219.83
Total	**203,735**	**519.50**	**30,571.63**	**47,181.18**	**1,814.37**
Calibration Adjustments on 29/10/08 &30/10/08			**(0.07)**	**(0.15)**	**(0.03)**
			30,571.56	**47,181.03**	**1,814.34**

Data for Year 2009

Month	Process Steam Consumption		EFB Fed to Boiler	Mesocarp Fibre Fed to Boiler	Wood	Palm Shell
	t/month	TJ/month	Tonnes/month	Tonnes/month	Tonnes/month	Tonne
January , 2009	16,384	41.78	2,093.51	4,096.00	93.62	0.00
February, 2009	17,509	44.65	3,404.53	3,501.80	250.13	0.00
March, 2009	9,089	23.18	1,767.31	1,817.80	129.84	0.00
April, 2009	11,957	30.49	2,170.11	2,391.40	170.81	69.69
May, 2009	21,854	55.73	3,102.17	2,549.63	2112.47	247.68
June, 2009	19,963	50.90	554.53	2,329.02	3152.05	0.00
Total	**96,756**	**246.72**	**13,092.15**	**16,685.65**	**5908.93**	**317.37**

Summary

Year	Process Steam Consumption		EFB Fed to Boiler	Mesocarp Fibre Fed to Boiler	Wood	Palm Shell
	t/year	TJ/year	Tonnes/year	Tonnes/year	Tonnes/year	Tonnes/year
2008	203,735	519.50	30,571.56	47,181.03	1,814.34	0
2009	96,756	246.72	13,092.15	16,685.65	5908.93	317.37
Total	300,491	766.22	43,663.71	63,866.68	7,723.27	317.37

***Baseline Emission from EFB**

Calculations on Baseline Emission from FOD Model for 2008:
Year 2008 Baseline Emission from FOD Model showing from the 2008 removal excel file: 36,997 tCO_2e

Calculations on Baseline Emission from FOD Model for 2009:
Year 2009 Baseline Emission from FOD Model showing from 2008 full year removal data: 29,395 tCO_2e

From the 2008 removal excel file, the actual portion used for 2009 Baseline Emission from FOD Model: (29,395) * 1/2= 14,698 tCO_2e (Only 6 months in 2009 are counted in the crediting period of this monitoring report)

Year 2009 Baseline Emission from FOD Model showing from the 2009 removal excel file: 16,938 tCO_2e

The actual data used for the 2009 Baseline Emission from FOD Model for this monitoring report: 14,698 +16,938 = 31,636 tCO_2e

The emissions from avoiding methane from decaying EFB are calculated as 36,997 tCO_2e for 2008 as this is the first year that EFB is removed from wastes accumulating since 2003. For 2009, the amounts of methane avoided venting to the atmosphere are composed of amounts avoided from the EFB removed in 2008 and the amounts removed in 2009. An adjustment is made to the amount avoided from 2008 removal for the half year in 2009. This amount will be added to 2009 avoided methane release for the second half of 2009 in a future monitoring report.

Summary
Total Baseline Emission from EFB (According to FOD Model)
36,997 **(2008) +** 31,636 **(2009) = 68,633 tCO_2e**

Baseline Emission Calculation Table:

STEP 1	**Steam**				
	A	**B**	**C***	**D****	**E = C x D**
Period **January 1,2008 – June 30,2009**	**Total Steam Demand** **t/period**	**Steam Production** **TJ/period**	**Baseline Fuel Consumption** **TJ/period**	**Emission Coefficient of Fuel Displaced** **tCO_2e/TJ**	**Baseline Emissions** **tCO_2e /period**
	300,491	766.22	901.44	74.07	66,769.49

STEP 2			
	F		**G**
Period **January 1,2008 – June 30,2009**	**EFB Fed to Boiler** **t/period**		**Baseline Emissions** **tCO_2e/ period**
	43,663.71		68,633

Total Baseline Emission = 66,769.49 (from Step1) + 68,633 (from Step2)= 135,402.49tCO_2e

E.2. Project emissions calculation

>>

This section shall include all formulae used and description to calculate the project emissions applying actual values. A table may be used and included in this monitoring report or include references to spreadsheet

Project Emission

Electricity Consumptions

The electricity consumptions for project emission data are recorded according to the monthly utility bills

Data for 2008

Month	Electricity Consumed		
	Biomass Boiler kWh	Processing Site kWh	Net Electricity Consumed kWh
January, 2008	115,057	12,350	127,407
February, 2008	196,722	30,420	227,142
March, 2008	213,999	27,690	241,689
April, 2008	247,675	28,730	276,405
May, 2008	236,103	15,990	252,093
June,2008	25,128	12,350	37,478
July, 2008	115,496	26,910	142,406
August, 2008	215,207	26,390	241,597
Sept, 2008	220,714	25,740	246,454
October, 2008	160,971	23,920	184,891
November, 2008	196,909	23,010	219,919
December, 2008	213,098	12,870	225,968
Total	2,157,079	266,370	2,423,449

Data for Year 2009

Month	Electricity Consumed

	Biomass Boiler kWh	Processing Site kWh	Net Electricity Consumed kWh
January , 2009	216,488	37,310	253,798
February, 2009	160,667	52,390	213,057
March, 2009	187,071	46,410	233,481
April, 2009	206,154	51,220	257,374
May, 2009	252,813	58,760	311,573
June, 2009	233,629	52,260	285,889
Total	1,256,822	298,350	1,555,172

Summary

Year	Electricity Consumed		
	Biomass Boiler kWh	Processing Site kWh	Net Electricity Consumed kWh
2008	2,157,079	266,370	2,423,449
2009	1,256,822	298,350	1,555,172
Total	3,413,901	564,720	3,978,621

Diesel Consumption

Data for Year 2008

Month	**Diesel Consumed**				
	Operation				
	Boiler Plant	**Processing Plant**	**Total**	Density	Tonne
	Litre	Litre	Litre		
January, 2008	1,000	1,350	2,350	0.000819	1.92
February, 2008	1,600	1,497	3,097	0.000819	2.54
March, 2008	2,600	2,440	5,040	0.000819	4.13
April, 2008	2,600	1,881	4,481	0.000819	3.67
May, 2008	3,200	1,836	5,036	0.000819	4.12

June,2008	1,000	1,303	2,303	0.000819	1.89
July,2008	2,800	821	3,621	0.000819	2.97
August,2008	2,200	1,343	3,543	0.000819	2.90
Sept,2008	2,400	2,312	4,712	0.000819	3.86
October,2008	2,000	1,973	3,973	0.000819	3.25
November,2008	2,200	2,307	4,507	0.000819	3.69
December,2008	3,000	1,797	4,797	0.000819	3.93
Total	26,600	20,860	47,460	0.000819	**38.87**

Data for Year 2009

Month	**Diesel Consumed**				
	Operation				
	Boiler Plant	**Processing Plant**	**Total**	Density	Tonne
	Litre	Litre	Litre		
January, 2009	2,800	2,214	5,014	0.000819	4.11
February, 2009	3,330	2,132	5,462	0.000819	4.47
March, 2009	2,930	2,856	5,786	0.000819	4.74
April, 2009	2,730	1,983	4,713	0.000819	3.86
May, 2009	2,730	2,252	4,982	0.000819	4.08
June,2009	2,730	1,892	4,622	0.000819	3.79
Total	17,250	13,329	30,579	0.000819	**25.04**

Summary

Year	**Diesel Consumed**		
	Operation		
	Litre	Density	Tonne
2008	47,460	0.000819	38.87
2009	30,579	0.000819	25.04
Total	78,039	0.000819	63.91

Project Emission Calculation Table:

STEP 3			
	H	**I**	**J= H*I**

Period January 1,2008 – June 30,2009	Electricity Drawn from Grid MWh/period	Emission Coefficient for Grid tCO2e/mwh	Project Emissions tCO2e/period
	3,978.621	0.8	3,182.90

STEP 4				
	K	L	M	N= K*L*M
Period January 1,2008 – June 30,2009	Diesel Consumed For Operation t/period	Heat Value of Diesel TJ/t	Emission Coefficient for Diesel tCO2e/TJ	Project Emissions tCO2e/period
	63.91	0.043	73.76	202.702

Total Project Emission = 3,182.90 (from Step3) +202.702 (from Step4)= 3,385.602tCO_{2e}

E.3. Leakage calculation

>>

There is no significant leakage in this project activity, since the equipment used is not transferred from another activity and survey shows large amount of surplus biomass in the region. Please check 2008 Biomass Availability in Annex 2.

E.4. Emission reductions calculation / table

>>

Total Project Emission Reduction= Total baseline emissions- Total project emissions
Total baseline emissions: 135,402.49 (According to the baseline emission calculation table in Section E.1, "Data E + Data G")

Total project emissions: 3,385.602 (According to the project emission calculation table in Section E.2, "Data J+ Data N")

Total leakage: 0

Total emission reductions: 132,016.89 **tCO_{2e}** (135,402.49- 3,385.602= 132,016.89)

Emission Reduction Calculation Table:

STEP 5	
	S=E +G-J-N
Period January 1,2008 – June 30,2009	Total Project Emission Reduction tCO2e/period
	132,016.89

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

>>

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	281,649	132,016.89

* (1)Values applied in ex-ante calculation of the registered CDM-PDD for 2008: 367,003
(2) Values applied in ex-ante calculation of the registered CDM-PDD for 2009: 392,589*1/2= 196,295
Totalling (1) and (2) = 563,298
(3) Since only one boiler is installed in the current operation, the comparison with the PDD value should be 563,298*1/2 = 281,649

E.6. Remarks on difference from estimated value in the PDD

>>

The actual emission reductions achieved during the current monitoring period is lower than the value on the PDD.

Annex 1 Biomass Monthly Calorific Values and Doc Values

For Year 2008

Month	Calorific Value (kcal/kg)			Calorific Value (MJ/kg)			TOC Content (%)
	EFB	Mesocarp	Wood	EFB	Mesocarp	Wood	Decayed EFB
Jan-08	2252.00	3717.00	4020.00	9.43	15.56	16.83	30.48
Feb-08	2060.00	3818.00	4048.00	8.62	15.99	16.95	31.56
Mar-08	2025.00	3852.00	4397.00	8.48	16.13	18.41	27.38
Apr-08	2046.00	3851.00	4335.00	8.57	16.12	18.15	29.07
May-08	2169.00	3930.00	4403.00	9.08	16.45	18.43	32.19
June-08	2192.00	3721.00	4378.00	9.18	15.58	18.33	29.78
July-08	2246.00	3499.00	4400.00	9.40	14.65	18.42	31.4
Aug-08	2915.00	4180.00	4477.00	12.20	17.50	18.74	41.73
Sept-08	2740.00	3728.00	4441.00	11.47	15.61	18.59	30.78
Oct-08	2218.00	3600.00	4329.00	9.29	15.07	18.12	40
Nov-08	2371.00	3927.00	4522.00	9.93	16.44	18.93	38.13
Dec-08	2211.00	2974.00	4423.00	9.26	12.45	18.52	46.7

Fresh EFB samples were also sent to the independent laboratory for TOC content analysis in November 2008 the result is 33.6%

For Year 2009

Month	Calorific Value (kcal/kg)				Calorific Value (MJ/kg)				TOC Content (%)
	EFB	Mesocarp	Wood	PKS	EFB	Mesocarp	Wood	PKS	Decayed EFB
Jan-09	2944.00	2391.00	4278.00	0.00	12.33	10.01	17.91	0.00	49.86
Feb-09	2344.00	3031.00	4255.00	0.00	9.81	12.69	17.81	0.00	35.52
Mar-09	2890.00	3275.00	4391.00	0.00	12.10	13.71	18.38	0.00	43.08

Apr-09	3167.00	3426.00	3610.00	3518.00	13.26	14.34	15.11	14.73	52.08
May-09	3079.00	3502.00	4323.00	3593.00	12.89	14.66	18.10	15.04	57.9
Jun-09	2398.00	3622.00	4480.00	0.00	10.04	15.16	18.76	0.00	44.63

Fresh EFB samples were also sent to the independent laboratory for TOC content analysis in June 2009 the result is 38%

Annex 2 2008 Biomass Availability

Table 1: Price Comparison of EFB, Mesocarp Fibre and Wood Residues (inclusive of Transportation Cost)

Biomass Type	EFB	Mesocarp Fibre	Wood Residue
Price (RM/tonne)	35 - 40	45 - 50	85 - 125

Table 2: Milling Capacity in Pahang District[1]

Milling Capacity by District in Pahang		
2008 Total FFB milling capacity in Pahang	14,799,605	ton
2008 Total FFB processed in Pahang	13,868,710	ton
Utilization rate	93.71%	

Table 3: Biomass Availability in Pahang[2]

Residency	District	No. of Mills	Capacity
			ton/year
PAHANG	Temerloh	11	2,430,000
	Maran	11	2,340,000
	Bentong	2	270,000
	Jerantut	4	900,000
	Kuala Lipis	2	540,000

[1] Milling Capacitiy in Pahang District : http://econ.mpob.gov.my/economy/ei_monstatus.htm

[2] Numbers of Mills in Pahang : http://www.ptm.org.my/biomass/listformpalm_pub.asp?dsn=&pg=8

	Raub	3	630,000
	Rompin	20	4,209,305
	Kuantan	5	940,100
	Pekan	11	2,540,200
TOTAL		**69**	**14,799,605**

Table 4: Details of Palm Oil Mills and Their Installed Capacity within 100km radius of Bentong Plant

District	Name of Mills	Installed Capacity	Total	Total FFB Milling Capacity
Temerloh	Felda Palm Industries – KKS Bukit Mendi	15		
	Felda Palm Industries – KKS Triang	60		
	Felda Palm Industries – KKS Kemasul	15		
	Felda Palm Industries – KKS Tementi	15		
	Kerdau Palm Oil	30		
	Kilang Kelapa Sawit D.M.	45		
	Kilang Kelapa Sawit Semantan	45		
	MHC Kemayan Plantation	45		
	Syarikat Penanaman Bukit Senorang	45		
	Pujaan Makmur	45		
	Jeng Huat (Bahau) Realty	45	405	2,430,000
Maran	Felda Palm Industries – KKS Bukit Kepayang	30		
	Felda Palm Industries – KKS Seroja	30		
	Felda Palm Industries – KKS Jengka 3	30		
	Felda Palm Industries – KKS Jengka 4	30		
	Felda Palm Industries – KKS Jengka 8	15		

	Kilang Kelapa Sawit Chenor	60		
	Kema Development Sdn Bhd	30		
	Kilang Kelapa Sawit Felcra Maran	45		
	Sri Senggora Kilang Kelapa Sawit	45		
	Tian Siang Oil Mill Sdn Bhd	45		
	Timur Oil Plantation	45	390	2,340,000
Bentong	Felda Palm Industries – KKS Krau	15		
	Felda Palm Industries – KKS Mempaga	30	45	270,000
Jerantut	Felda Palm Industries – KKS Kota Gelanggi	30		
	Felda Palm Industries – KKS Padang Piol	30		
	Kilang Kelapa Sawit Felcra Jaya Putra	45		
	Kilang Kelapa Sawit Jerantut	45	150	900,000
Kuala Lipis	Felda Palm Industries – KKS Jengka 9	60		
	Felda Palm Industries – KKS Kechau B	30	90	540,000
Raub	Felda Palm Industries – KKS Sungai Koyan	30		
	Felda Palm Industries – KKS Tersang	30		
	Raub Oil Mill	45	105	630,000
			1,185	**7,110,000**

Number of operating hours of the mills = 6000 hours/ year

Table 5: Pahang Biomass Steam Consumption by Energy Plants within 100km radius around Bentong[3]

Company	Location	Steam Capacity	Power Capacity	Status	Estimated steam production	Estimated Biomass Consumption
		ton/hr	mw		ton/year	ton/year
Bentong Biomass Energy Plant	Bentong	32	1.2	Operating	261,120	93,591
MNI Paper Factory	Mentakab	64	0	Operating	522,240	187,183
TNB + Japan Jpower[4]	Jengka		10	under construction	510,000	0
Korean Biomass Power Plant	Karak	32		under construction	261,120	0
				sub-total (within 100km radius)	**1,293,360**	**280,774**
					TOTAL	**280,774**

Assumptions:			
1 mwh	=	6.25[5]	ton/hr of biomass steam
1 ton of biomass	=	2.79[6]	ton of steam
Operating days	=	340	days

[3] Calculated based upon the assumptions table

[4] Upcoming Power Plant in Pahang - http://www.bernama.com/bernama/v5/newsindex.php?id=321341

[5] Reference: Case study of Palm Oil Fuelled Power Plant, China EnerSave Ltd.

[6] Reference: SEO Energy average steam/palm biomass ratio from Jan - Dec'08

Operating hours	=	24	hours/day

Table 6: Biomass Available for Bentong District within 100km radius[7]

			2008	Biomass Yield			Biomass Available			
District	**Capacity**	**Utilization rate**	**FFB processed (est.)**	**EFB**	**PKS**	**Fibre**	**EFB**	**PKS**	**Fibre**	**TOTAL**
	ton/year	%	ton/year	ton/year	ton/year	ton/year	ton/year	ton/year	ton/year	ton/year
	A	B	A x B							
Temerloh	2,430,000	93.71%	2,277,153	500,974	125,243	307,416	500,974	12,524	30,742	544,240
Maran	2,340,000	93.71%	2,192,814	482,419	120,605	296,030	482,419	29,603	29,603	541,625
Bentong	270,000	93.71%	253,017	55,664	13,916	34,157	55,664	1,392	3,416	60,471
Jerantut	900,000	93.71%	843,390	185,546	46,386	113,858	185,546	4,639	11,386	201,570
Kuala Lipis	540,000	93.71%	506,034	111,327	27,832	68,315	111,327	2,783	6,831	120,942
Raub	630,000	93.71%	590,373	129,882	32,471	79,700	129,882	3,247	7,970	141,099
							1,465,812	**54,188**	**89,948**	**1,609,947**

As a result, there is about 574% excess of palm biomass available for Bentong District; since 1,609,947 tons of palm waste is available and only 280,774 tons of biomass is expected to be consumed by the biomass boilers in the region.

Table 7: Assumptions for biomass wastes from the Oil Palm Milling Process[8]

[7] Calculated based on Table 3,4 and 5

[8] Biomass wastes produced of 100% of FFB: refer to Feasibility Study on Grid Connected Power Generation Using Biomass Cogeneration Technology, Jan 2000, by Pusat Tenaga Malaysia, PTM

Biomass Availability: refer to Noel Wambeck, Oil Palm Process Synopsis ed.2, 2001.

Biomass	Biomass Produced of 100% FFB	Biomass Availability
EFB	21%	100%
Mesocarp Fibre	14%	10%
Palm Kernel Shell	6%	10%

It is assumed that biomass is available according to the percentage shown in Table 7 out of total weight of FFB yield. Out of this only 10% of fibres are available for other industries outside palm oil mills to utilize. Whereas, EFB is assumed to be fully available as it is currently brought back to plantations for disposal, or dumped in piles or landfills near the mills.

Table 8: Production of logs in Peninsula Malaysia (in m³)[9]

States	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Pahang	2,862,507	2,114,889	2,326,912	1,706,176	1,462,046	1,629,796	1,604,859	1,826,066	1,953,273	1,782,523
Negeri Sembilan	114,814	64,497	149,234	119,443	68,241	103,823	102,661	102.656	80,956	73,860
Johor	296,179	211,295	179,217	193,700	181,927	198,342	142,846	159,152	96,419	213,816
Kedah	221,257	113,276	228,138	164,183	157,005	141,622	138,246	147,042	109,480	179,453
Kelantan	1,757,492	1,146,382	1,081,,987	1,339,501	944,700	873,026	919,466	694,256	815,585	1,066,479
Melaka	72,565	16,223	10,767	4,310	1,610	2,830	-	4,407	111	1,508
Perak	939,243	721,469	653,384	878,000	606,264	723,599	757,884	887,454	787,548	833,802
Perlis	-	26	-	-	-	-	-	-	-	-
Pulau Pinang	768	60	100	-	-	-	-	-	-	-

[9] Production of logs in Peninsula Malaysia
Forestry Statistics Peninsula Malaysia, 2006

Selangor	109,807	42,694	56,625	69,994	65,015	44,388	71,288	40,492	38,981	48,142
Terengganu	1,005,791	669,004	669,694	596,843	668,322	640,864	682,146	711,403	522,738	493,864
TOTAL	**7,380,423**	**5,099,815**	**5,356,058**	**5,072,150**	**4,155,130**	**4,358,290**	**4,419,936**	**4,572,918**	**4,405,091**	**4,693,447**

For research/study purposes, the total amount of logs produced in Peninsula Malaysia is tabulated in the table above. As we can see that if we were to compare the production of logs in Peninsula Malaysia, Pahang state would have the highest production of logs in the continent. This point will come to use in the next few tables we're about to present. Source of the data is obtained from a hard copy of wood statistics from the Forestry Statistics Peninsula Malaysia, 2006.

Table 9: Production of logs in Pahang (in m^3)[10]

Wood Types	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Sawntimber	1,229,490	721,762	943,976	928,675	761,323	771,903	738,670	920,199	914,603	842,766
Mouldings	126,354	160,571	173,182	198,276	1,341,307	32,194	26,796	39,275	39,281	34,422
Veneer	502	4,695	5,728	24,681	15,571	11,179	19,632	26,541	56,758	60,043
Plywood	179,038	125,424	141,360	122,611	95,593	94,458	113,604	144,412	163,870	159,886
TOTAL	**1,535,384**	**1,012,452**	**1,264,246**	**1,274,243**	**2,213,794**	**909,734**	**898,702**	**1,130,427**	**1,174,512**	**1,097,117**

For wood residues estimation purposes, we have selected the four highest productions of wood types in the Pahang state which visibly will produce the highest amount of wood residues.

Table 10: Estimation of wood residues in Pahang (in m^3)[11]

[10] Production of logs in Pahang
Forestry Statistics Peninsula Malaysia, 2006

[11] Calculated based on Table 8 & 9

Wood Types	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Sawntimber	245,898	144,352	188,795	185,735	152,265	154,381	147,734	184,040	182,921	168,553
Mouldings	25,271	32,114	34,636	39,655	268,261	6,439	5,359	7,855	7,856	6,884
Veneer	236	2,207	2,692	11,600	7,318	5,254	9,227	124,746	26,676	28,220
Plywood	84,148	58,949	66,439	57,627	44,929	44,395	53,394	67,874	77,019	75,146
TOTAL	**355,553**	**237,623**	**292,563**	**294,617**	**472,773**	**210,469**	**215,714**	**384,515**	**294,472**	**278,804**

Based on the case study "Wood Waste Utilization in Malaysia" and "Assessment of Wood Residues in Indonesia", we managed to obtain an estimate of wood residues composited in the Pahang area from year 1997 to 2006. Under "Wood Waste Utilization in Malaysia", it was mentioned that from 10.62 million m^3 of log production, about 5.32 million m^3 of industrial wood residues were produced. From the 5.32 million m^3 of wood residues produced, 20% of it goes to the sawmill off-cuts. Apart from that, the research paper also mentioned that the recovery rate on plywood is subjected to 47% annually. Due to the lack of information from local institutions, an estimation based on the amount of resources we had in hand was conducted. From the analysis conducted, we can see that the amount of wood residues supply is more than sufficient for operations of the plant as we only use at maximum an amount of 1.2% out of the total amount of wood residues generated for our fuel mix.

Table 11: Excess wood residues in Pahang (in m^3)[12]

Wood Residue Produced	2005	2006
Total Wood Residues Produced	292,472	278,804
Bentong Plant Consumption	3,237.8	3,237.8
TOTAL EXCESS	**289,234.2**	**275,566.2**

Other Articles: Wood Waste Utilization in Malaysia: refer to Dr.Hooi W.K, FRIM, 1997
Asia Pacific Forestry Commision – Trash or Treasure (Appendix 2)

http://www.fao.org/DOCREP/003/X6966E/X6966E00.HTM

[12] Calculated based on Table 10

The total consumption of wood residues for the Bentong Biomass Plant amounts to 1,942.3 tons for the year of 2008. The fuel mix that the plant is currently running only utilizes 1.2% of wood residues as fuel for the boilers, which makes up 1,942.3 tons of wood residues per annum. With the conversion rate of 0.6 tonnes to a cubic meter, the figure obtained here would be 3,237.8 m^3. Furthermore, the plant is not causing any competition for the production of wood waste as currently it is the only plant that is purchasing wood waste for renewable energy purposes (this excludes sawmills that burn wood residues to generate energy for their plant) in a 100km radius around the plant. Therefore, from the study exercised here, it can be seen that there is no leakage at the current time. To further justify our case, we also have a letter of clarification from our wood residue suppliers to show that the amount of wood waste we purchased is not significant to cause any competition among wood residue users in the radius of 100km around the plant. The total excess of wood residues in 2006 shows that there is sufficient wood residues available as the plant only consumes 1.2% of the total wood residues in the Pahang state.