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

CONTENTS

* as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB 54 meeting report, annex 34).

MONITORING REPORT
Version 01; 19/05/2011
Project Title: Replacement of Fossil Fuel by Palm Kernel Shell Biomass in the production of Portland Cement
Reference number: 247
Monitoring period number 03 (01/01/2010 - 30/04/2010)

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

The project activity was developed by Lafarge Malayan Cement Bhd (LMCB). The purpose of the project activity is to substitute the coal used for clinker production in the cement kilns at Kanthan and Rawang plants in Malaysia with Palm Kernel Shell (PKS) Biomass from the Oil Palm Industry and some other type of biomass. Project activity reduces GHG emissions which would have otherwise been emitted from fossil fuel burning in the cement kilns.

The technology implemented in the project activity incorporates technologies for fuel reception, sorting and size reduction together with the necessary conveyors and hoppers to feed the fuels into the kilns. More details are provided in section A.4.

The project was commissioned on 01/05/2000 by Lafarge Malayan Cement Bhd (LMCB) at Kanthan and Rawang plants in Malaysia. The project activity did not face any major shutdown during the current monitoring period.

The project activity has achieved emission reductions equivalent to **41,150 tCO_2**.

A.2. Project Participants

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 Party)	Private entity: Lafarge Malayan Cement Bhd, LMCB	No
France	Private entity: Lafarge S.A	No

A.3. Location of the project activity:

The project activity includes two plants located at Rawang (latitude 3^0 and longitude $101^0$34.5'E) next to the road leading to Kuang from the junction off the trunk road Rawang – Batu Arang. It is approximately 4km from North –South Expressway Interchange and 2 km from Rawang town, Selangor and at Kanthan (Latitude $4^0$46'N and Longitude 101^o 07'E) next to the trunk road Ipoh-Kuala Kangsar , Perak .

The addresses of these of the two plants are as follows.
Kanthan Works
Batu 13½, Jalan Kuala Kangsar, 31200 Chemor, Perak Darul Ridzuan,
Malaysia

Rawang Works
48000 Rawang, Selangor Darul Ehsan,
Malaysia

A.4. Technical description of the project

The technology implemented in the project activity incorporates technologies for fuel reception, sorting and size reduction together with the necessary conveyors and hoppers to feed the biomass. The technology development consisted of the in-house design for a new and additional fuel feed system to sit alongside the existing coal system. This new PKS system incorporates technologies for reception, sorting and material size reduction together with the necessary conveyors and hoppers to feed the PKS into the process at a point where optimum combustion conditions and residence time are available. The plant's central control computer automatically manages the associated reduction in pulverised coal required to maintain process stability and product quality. The main technological input to this process is from Europe, and latterly from the Lafarge Asia Technical Centre in Kuala Lumpur. Their contribution has been in the following areas: research and management of trials on chemistry and process burning conditions to ensure complete combustion, sizing of the material handling equipment required, calculation and guidance on feed rates and mix ratios of PKS and coal critical to the efficiency of the operation and product quality. Initial issues related to material handling, high moisture content, high abrasivity and long burnout time have generally been accommodated through process adaptation, invention and modification. This knowledge and skills based technology transfer is very exclusive to Lafarge Malayan Cement.

The physical equipment developed to allow the project activity to proceed is restricted to the fuel processing and feeding system and has no additional environmental impact. It allows reduced running hours of existing coal processing equipment and therefore efficiency can be maintained.

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

Title: ACM0003, Version 1 "Emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture"

Reference:
http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_ACM_YOZT4HEMDMXQROFYK0LVBGFYJL2E2Q.pdf

A.6. Registration date of the project activity:

The project activity was registered on 07/04/2006 and can be accessed at:

http://cdm.unfccc.int/Projects/DB/DNV-CUK1137498953.91/view

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

Start date of crediting period: 01/05/2000
Choice of crediting period: 10 years fixed

There has been no change in the start date of the crediting period post registration of the project activity.

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

The person responsible for completing the monitoring report is Ms. Hooi Ping Seet. Her contact details are mentioned below:

Organization:	**Lafarge Malayan Cement Bhd**
Building:	L12, Bangunan TH Uptown 3
Street/P.O.Box:	Jalan SS21/39

City:	Petaling Jaya
State/Region:	Selangor Darul Ehsan
Postcode/ZIP:	47400
Country:	Malaysia
Telephone:	+60 3 77238332
E-Mail:	-
Represented by:	
Title:	Vice President, Legal and Business Affairs
First Name:	Hooi Ping
Last Name:	Seet
Personal E-Mail:	Hooi-Ping.Seet@my.lafarge.com

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

The commissioning date of the project activity is 01/05/2000. Both Rawang and Kanthan plants were commissioned on this date

Both the plants in the project activity operated as per expectations during the current monitoring period with no major stoppages.

B.2. Revision of the monitoring plan

There is no revision applied in the monitoring plan.

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

No deviation has been applied to this monitoring period.

B.4. Notification or request of approval of changes

No notification or request of approval of changes from the project activity as described in the registered CDM-PDD has been made.

SECTION C. Description of the monitoring system

All the key monitoring parameters required for this project can be obtained from Senior Works Manager Report compiled on monthly basis. This report is prepared by the Plant Controller and approved by the Senior Works Manager. LMCB head quarters receive all the individual works reports and compile them as per standard ISO requirements. Monitoring data for validation and registration for the project and CERs can be obtained from LCMB HQ.

Data recording approach is as per standard business accountancy procedures (Opening Stock plus deliveries minus closing stock = utilization) and thus minimizes the possibilities of mistakes and misconceptions. Simplistic in that it requires only inputs that are generated as part of the standard business accountancy system and/or ISO registered and audited quality procedures. These are part of the normal KPIs (Key Performance Indicators) measured by the respective plant.

Internal Key Performance Indicators in the Senior Works Manager Report will track the following on a monthly basis;

1. Cement clinker produced per plant per annum in units of tonnes. This is a published business accountancy figure and audited internally and externally. (Data monitored : C, tonnes of clinker per year)

2. Net Total specific Heat Consumption of each plant to produce above clinker tonnes per annum in units of kJ/kg clinker. This is a calculated figure based on the management accounts using weighbridge tickets of fuel supplies to generate payments to fuel suppliers and 'weigher-totalisers' to record consumption of heat bearing raw materials. The laboratory quality procedures determine the frequency of fuel/raw material calorific value testing and this value is applied to the amounts of each fuel/raw material used. Procedures, frequency and test methods are all defined within each plants quality management systems.

An assumption is made based on historical lab test data that heat values of PKS fuel "as-received" is approximately the same as heat values of "as-fired". High moisture content during delivery will not be evaporated significantly even after the stock piling for a few weeks. PKS fuel on the surface of the stockpile will dry after a few days but the inner layer is still wet. High air humidity in Malaysia contributes partly to the moisture in the PKS fuel to remain the same.

QA/QC Procedures:
Quality assurance/quality control plan was prepared as per ISO-9001 guidelines. Environmental management consists of specialists who have been given the task of monitoring various parameters involved in the project activity.

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:	**EF_{AF}**
Data unit:	tCO2/t
Description:	Emission factor for NEG sludge used as alternative fuel in the project activity
Source of data used:	NCV values as provided by the Malaysia Nuclear Agency
Value(s) :	1.051
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project Emission calculations
Additional comment:	

Data / Parameter:	**mp**
Data unit:	MJ/kg /10% of biomass
Description:	Moisture penalty
Source of data used:	As per registered PDD
Value(s) :	0.1 MJ/kg /10% of biomass
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline Emission calculations
Additional comment:	

Data / Parameter:	**EF_{FF}**
Data unit:	**tCO2/t**
Description:	Emission factor for fossil fuel

Source of data used:	Registered PDD
Value(s) :	94.2 (fixed ex-ante)
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:	**C**
Data unit:	tons
Description:	Clinker production
Measured /Calculated /Default:	Measured and calculated
Source of data:	Plant records
Value(s) of monitored parameter:	1,341,747
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	LMCB monitors the clinker production as a part of their production management activities and data is included in monthly production reports. Raw material to produce clinker is measured using weighing feeders and clinker production is calculated. The weighing feeders are calibrated regularly. The calibration details are as follows: Accuracy class: 0.5 Calibration frequency: Annual Rawang works:

Equipment	Model number	Calibration dates
Shale A weigher	Model 76420	17/04/2009; 08/04/2010
Shale B weigher	Model 76419	17/04/2009; 08/04/2010
Limestone weigher	Model 75418	17/04/2009; 08/04/2010

Kanthan works:

Equipment	Model number	Calibration dates
KK4 –kiln feed A stream	Model 76420	19/01/2009; 21/01/2010
KK4 - kiln feed B stream	Model 76419	19/01/2009; 01/02/2010
KK 3 – Kiln feed weigher	Model 75418	16/07/2009

The equipments were found to be working within the permissible limits.

Measuring/ Reading/ Recording frequency:	Recording frequency: Monthly Measuring frequency: batch-wise
Calculation method (if applicable):	NA
QA/QC procedures applied:	The weighing equipment is regularly calibrated

<table>
<tr><td>Data / Parameter:</td><td>Q_{AF}</td></tr>
<tr><td>Data unit:</td><td>Tons</td></tr>
<tr><td>Description:</td><td>Quantity of alternative fuels used in the project activity</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured</td></tr>
<tr><td>Source of data:</td><td>Plant records</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>
<table>
<tr><th>Fuel</th><th>Quantity</th></tr>
<tr><td>$Q_{AF- PKS}$</td><td>8,474</td></tr>
<tr><td>$Q_{AF- murner}$</td><td>593</td></tr>
<tr><td>$Q_{AF- NEG}$</td><td>486</td></tr>
<tr><td>$Q_{AF- paddy husk}$</td><td>13,592</td></tr>
<tr><td>$Q_{AF- Wood chips}$</td><td>8,033</td></tr>
<tr><td>$Q_{AF- Coco chips}$</td><td>5,406</td></tr>
<tr><td>$Q_{AF- SBE}$</td><td>8,787</td></tr>
</table>
</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Project and baseline emission calculations</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>Monitoring equipment: Weighing Feeders
Accuracy class: 0.5

The calibration details of the various weighing feeders used in the project activity are as follows:

Rawang Works :

<table>
<tr><th>Equipment</th><th>Model number</th><th>Calibration frequency</th><th>Calibration dates</th></tr>
<tr><td>Preheater FF PKS weigher</td><td>FT 3290</td><td rowspan="2">4 months</td><td>07/12/2009; 05/04/2010</td></tr>
<tr><td>Shale mill PKS weigher</td><td>FT2611</td><td>29/10/2009; 25/02/2010</td></tr>
</table>

Kanthan Works:

<table>
<tr><th>Equipment</th><th>Model number</th><th>Calibration frequency</th><th>Calibration dates</th></tr>
<tr><td>KK4 PKS belt weigher</td><td>FI 334.01</td><td rowspan="2">6 months</td><td>25/12/2009; 26/02/2010</td></tr>
<tr><td>KK3 PKS belt weigher</td><td>FI 8.42</td><td>10/12/2009; 11/03/2010</td></tr>
</table>

The equipment were found to be working within the permissible limits.</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Recording frequency: Monthly
Measuring frequency: batch-wise</td></tr>
<tr><td>Calculation method (if applicable):</td><td>NA</td></tr>
<tr><td>QA/QC procedures applied:</td><td>The weighing feeders are calibrated regularly.</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>HV_{AF}</td></tr>
<tr><td>Data unit:</td><td>Kcal/kg</td></tr>
<tr><td>Description:</td><td>Heat value of alternative fuels used in the project activity</td></tr>
</table>

Measured /Calculated /Default:	Measured and calculated
Source of data:	Plant records
Value(s) of monitored parameter:	<table><tr><th>Fuel</th><th>Calorific value</th></tr><tr><td>$HV_{AF- PKS}$</td><td>3,354</td></tr><tr><td>$HV_{AF- murner}$</td><td>1,568</td></tr><tr><td>$HV_{AF- NEG}$</td><td>2,526</td></tr><tr><td>$HV_{AF- paddy husk}$</td><td>3,356</td></tr><tr><td>$HV_{AF- Wood chips}$</td><td>2,258</td></tr><tr><td>$HV_{AF- Coco chips}$</td><td>3,539</td></tr><tr><td>$HV_{AF- SBE}$</td><td>2,335</td></tr></table> The values mentioned above are average values. Monthly values have been presented in section E of this monitoring report.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project and baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Monitoring equipment: Bomb calorimeter Calibration frequency: 4 months <table><tr><td>Location</td><td>Calibration dates</td></tr><tr><td>Rawang plant</td><td>03/11/2009; 03/03/2010</td></tr><tr><td>Kanthan plant</td><td>19/10/2009; 21/01/2010</td></tr></table>
Measuring/ Reading/ Recording frequency:	Recording frequency: Monthly Measuring frequency: batch-wise
Calculation method (if applicable):	NA
QA/QC procedures applied:	Regular calibration of the bomb calorimeter is carried out

Data / Parameter:	**HI_{AF}**
Data unit:	TJ
Description:	Heat content of alternative fuels
Measured /Calculated /Default:	Calculated
Source of data:	-
Value(s) of monitored parameter:	591
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline and project emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Recording frequency: Monthly
Calculation method (if applicable):	Calculation based on the monitored data by the following formula: $HI_{AF} = Q_{AF} * HV_{AF}$
QA/QC procedures applied:	The equipment used to calculate Q_{AF} and HV_{AF} are calibrated regularly.

Data / Parameter:	**S_{AF}**
Data unit:	%
Description:	Share of heat input from alternative fuels
Measured /Calculated /Default:	Calculated
Source of data:	Calculated based on monitored data
Value(s) of monitored parameter:	12% (this is the average value for 4 months for both RW and KW. The monthly values have been provided in Section E of this report)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	NA
Measuring/ Reading/ Recording frequency:	Recording frequency: Monthly
Calculation method (if applicable):	$S_{AF}=HI_{AF}/(\sum Q_{FF}*HV_{FF})+HI_{AF}$
QA/QC procedures applied:	The equipment used to measure the monitored data are regularly calibrated

Data / Parameter:	**Q_{FF}**
Data unit:	Tons
Description:	Quantity of fossil fuel used
Measured /Calculated /Default:	Measured
Source of data:	Plant records
Value(s) of monitored parameter:	<table><tr><th>Fuel</th><th>Total</th></tr><tr><td>$Q_{FF\text{-}Coal\ HCV}$</td><td>3,426</td></tr><tr><td>$Q_{FF\text{-}Coal\ LCV}$</td><td>155,862</td></tr><tr><td>$Q_{FF\text{-}Petcoke}$</td><td>37,649</td></tr><tr><td>$Q_{FF\text{-}Diesel\ Oils}$</td><td>1,152</td></tr></table> The monthly details have been provided in Section E of this report
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Monitoring equipment: weighing feeders Calibration frequency: Annual Accuracy class: 0.5 The calibration details of the weighing feeders are as follows: Rawang Works: <table><tr><th>Equipment</th><th>Model number</th><th>Calibration dates</th></tr><tr><td>Kiln coal weigher</td><td>Model 76057</td><td>14/04/2009; 09/04/2010</td></tr><tr><td>Kiln coal weigher FFA</td><td>Model 75850</td><td>15/04/2009; 04/04/2010</td></tr></table>

	Kiln coal weigher FFB | Model 73815 | 15/04/2009; 06/04/2010 Kanthan Works: Equipment | Model number | Calibration dates KK4 coal weigher | FI.8.063 | 19/01/2009, 21/01/2010 KK4 coal weigher | FI.8.067 | 19/01/2009, 21/01/2010 KK3 coal weigher | F.718.03 | 10/12/2009 The equipments were found to be working under the permissible limits.
Measuring/ Reading/ Recording frequency:	Recording frequency: Monthly Measuring frequency: batch-wise
Calculation method (if applicable):	NA
QA/QC procedures applied:	LMCB monitors the amount of fossil fuel purchase as a part of the procurement and payment for the deliveries and data is included in monthly production reports. Quantity of fossil fuel is measured using weighing feeders before fired into the kiln.

Data / Parameter:	**HV_{FF}**
Data unit:	Kcal/kg
Description:	Heat value of the fossil fuels
Measured /Calculated /Default:	Measured
Source of data:	Plant records
Value(s) of monitored parameter:	**Fuel** | **Value** **$HV_{FF\text{-}Coal\ HCV}$** | 5,063 **$HV_{FF\text{-}Coal\ LCV}$** | 5,017 **$HV_{FF\text{-}Petcoke}$** | 3,203 **$HV_{FF\text{-}Diesel\ Oils}$** | 9,942 These are average value for the monitoring period
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)	Monitoring equipment: Bomb calorimeter Calibration frequency: 4 months Location | Calibration dates Rawang plant | 03/11/2009; 03/03/2010 Kanthan plant | 19/10/2009; 21/01/2010 The equipment were found to be working within the permissible limits
Measuring/ Reading/ Recording frequency:	Recording frequency: Monthly Measuring frequency: batch-wise
Calculation method (if applicable):	NA
QA/QC procedures applied:	LMCB monitors the heat value of fossil fuel as a part of the procurement and payment for all deliveries and data is included in monthly production reports. The value is measured using calorimeter.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

The monthly values of the monitored parameters are as follows:

- **Clinker production (C):**

2010	January	February	March	April
Rawang Works	145,832	85,989	146,484	48,675
Kanthan Works	150,262	177,876	296,632	289,997

- **Alternative fuel quantity (Q_{AF}):**

Rawang Works:

Fuel	January	February	March	April
$Q_{AF\text{- PKS}}$	2,172	213	1,052	413
$Q_{AF\text{- NEG}}$	10	206	140	130
$Q_{AF\text{- paddy husk}}$	354	547	644	330
$Q_{AF\text{- Wood chips}}$	2,025	937	2,095	488
$Q_{AF\text{- SBE}}$	1,694	1,022	664	70

Kanthan works:

Fuel	January	February	March	April
$Q_{AF\text{- PKS}}$	1,961	984	1,006	673
$Q_{AF\text{- murner}}$	186	126	281	0
$Q_{AF\text{- paddy husk}}$	1,563	2,231	3,106	4,817
$Q_{AF\text{- Wood chips}}$	0	0	923	1,565
$Q_{AF\text{- Coco chips}}$	525	1,423	1,854	1,603
$Q_{AF\text{- SBE}}$	805	1,278	1,770	1,484

- **Alternative fuel heat value (HV_{AF}):**

Rawang Works:

Fuel	January	February	March	April
$HV_{AF\text{- PKS}}$	2,964	2,973	2,963	2,964
$HV_{AF\text{- NEG}}$	2,526	2,526	2,526	2,526
$HV_{AF\text{- paddy husk}}$	3,444	3,444	3,064	3,064
$HV_{AF\text{- Wood chips}}$	3,010	3,010	2,987	2,515
$HV_{AF\text{- SBE}}$	2,200	2,200	2,272	2,272

Kanthan works:

Fuel	January	February	March	April
$HV_{AF\text{- PKS}}$	3,864	3,864	3,635	3,605
$HV_{AF\text{- murner}}$	1,568	1,568	1,568	1,568
$HV_{AF\text{- paddy husk}}$	3,649	3,649	3,269	3,269
$HV_{AF\text{- Wood chips}}$	0	0	3,629	2,913
$HV_{AF\text{- Coco chips}}$	3,460	3,460	3,629	3,607
$HV_{AF\text{- SBE}}$	2,434	2,434	2,434	2,434

- **Quantity of fossil fuels (Q_{AF}):**

Rawang Works:

Fuel	January	February	March	April
$Q_{FF\text{-Coal HCV}}$	0	0	0	0
$Q_{FF\text{-Coal LCV}}$	13,400	7,457	12,784	4,212
$Q_{FF\text{-Petcoke}}$	12,111	7,824	13,107	4,477
$Q_{FF\text{-Diesel Oils}}$	182	144	32	403

Kanthan works:

Fuel	January	February	March	April
$Q_{FF\text{-Coal HCV}}$	1,760	1,666	0	0
$Q_{FF\text{-Coal LCV}}$	17,812	21,299	38,959	39,939
$Q_{FF\text{-Petcoke}}$	0	0	0	130
$Q_{FF\text{-Diesel Oils}}$	233	90	67	2

- **Heat value of fossil fuels (HV_{FF}):**

Rawang Works:

Fuel	January	February	March	April
$HV_{FF\text{-Coal HCV}}$	0	0	0	0
$HV_{FF\text{-Coal LCV}}$	4,618	4,845	4,476	4,577
$HV_{FF\text{-Petcoke}}$	3,958	3,958	3,958	3,786
$HV_{FF\text{-Diesel Oils}}$	9,528	9,528	9,528	9,528

Kanthan works:

Fuel	January	February	March	April
$HV_{FF\text{-Coal HCV}}$	7,595	7,595	-	-
$HV_{FF\text{-Coal LCV}}$	5,331	5,328	5,596	5,363
$HV_{FF\text{-Petcoke}}$	0	0	0	2,492
$HV_{FF\text{-Diesel Oils}}$	10,356	10,356	10,356	10,356

The baseline emissions are calculated following the approved methodology ACM 0003. The following stepwise approach is used as outlined in methodology.

Step 1. Calculate project heat input from alternative fuels

$HI_{AF} = \sum Q_{AF} * HV_{AF}$ Eq -1

Where

Parameter	Details	Unit
HI_{AF}	Heat input from alternative fuels	(TJ/yr)
Q_{AF}	Quantity of each alternative fuel	(tonnes/yr)
HV_{AF}	Lower heating value of the alternative fuel(s) used	(TJ/tonnes fuel)

The values of HI_{AF} thus calculated are as follows:

Rawang Works:

Fuel Type	Jan	Feb	Mar	April
HI_{AF-PKS}	27	3	13	5
HI_{AF-NEG}	0.11	2	1	1
$HI_{AF-paddy\ husk}$	5	8	8	4
$HI_{AF-Wood\ chips}$	26	12	26	5
HI_{AF-SBE}	16	9	6	1
Total	**73**	**34**	**55**	**17**

Kanthan works:

Fuel Type	Jan	Feb	Mar	April
HI_{AF-PKS}	32	16	15	10
$HI_{AF-murner}$	1.2	0.8	1.8	-
$HI_{AF-paddy\ husk}$	24	34	43	66
$HI_{AF-Wood\ chips}$	0	0	14	19
$HI_{AF-Coco\ chips}$	8	21	28	24
HI_{AF-SBE}	8	13	18	15
Total	**71**	**84**	**118**	**134**

Step 2. Calculate alternative heat input as a share of total baseline fossil fuel heat input

$S_{AF} = HI_{AF} / (\sum Q_{FF} * HV_{FF}) + HI_{AF})$ Eq - 2

Where

Parameter	Details	Unit
S_{AF}	Alternative heat input share of total baseline fossil fuel heat input	%
HI_{AF}	Heat input from alternative fuels	(TJ/yr)
Q_{FF}	Quantity of each fossil fuel used in baseline	(tonnes/yr)
HV_{FF}	Lower heating value of the fossil fuel(s) used in baseline	(TJ/tonne fuel)

The calculated values of S_{AF} are as follows:

	January	February	March	April
Rawang Works	14%	11%	11%	9%
Kanthan Works	14%	14%	12%	13%

Step 3. Application of project specific moisture "penalty"

$$mp = (HC_{AF(i)} - HC_{FF})/Si * 10 \quad \text{Eq - 3}$$

Where

Parameter	Details	Unit
mp	Moisture penalty	MJ/tonne/10% alternative fuel share of total heat input
$HC_{AF(i)}$	Specific heat consumption using i % alternative fuel	MJ/ton- clinker
HC_{FF}	Specific heat consumption using fossil fuels only	MJ/ton- clinker
Si	Alternative fuel heat input share of total baseline heat input in the moisture penalty test	%

Moisture penalty (mp) is fixed ex-ante (Section D.1).

The total moisture penalty is calculated as:

$$MP_{Total} = S_{AF}/10\% * C * mp \quad \text{Eq - 4}$$

Where

Parameter	Details	Unit
MP_{Total}	Total moisture penalty	TJ/yr
S_{AF}	Alternative heat input share of total baseline fossil fuel heat input	%
C	Total clinker production	tonnes/yr
mp	Moisture penalty	MJ/tonne/10% alternative fuel share of total heat input

The values of total moisture penalty are as follows:

	January	February	March	April
Rawang Works	16.81	7.74	13.41	3.71
Kanthan Works	17.30	20.72	29.19	32.10

Step 5. Calculate the baseline GHG emissions from the fossil fuel(s) displaced by the alternative fuel(s)

$$FF_{GHG} = [(Q_{AF} * HV_{AF}) - MP_{total}] * EF_{FF} \quad \text{Eq - 6}$$

Where

Parameter	Details	Unit
FF_{GHG}	GHG emissions from fossil fuels displaced by the alternatives	tCO_2/yr
$Q_{AF}*HV_{AF}$	Total actual heat provided by all alternative fuels	TJ/yr
MP_{total}	Total moisture penalty	TJ/yr
EF_{FF}	Emission factor(s) for fossil fuel (s) used	tCO_2/TJ

The values of baseline emissions thus calculated are as follows:

	January	February	March	April	TOTAL
Rawang Works	5,319	2,468	3,946	1,208	**12,941**
Kanthan Works	5,213	6,006	8,545	9,645	**29,409**

Step 7. Calculate emission savings from reduction of on-site transport of fossil fuels

$$OT_{GHGFF} = OF_{FF} * EF_{t\,CO2e} \quad \text{Eq. 8}$$

where

Parameter	Details	Unit
$OT\text{-}_{GHGFF}$	Emissions from reduction of on-site transport of fossil fuels	tCO_{2e}
OF_{FF}	Fuel saving from on-site transportation of fossil fuels	t/yr
$EF_{T\,CO2e}$	Emission factor of fuel used for transportation	tCO_{2e}/t fuel

Emission savings from reduction of on-site transport of fossil fuel is negligible. Therefore, emission savings are not considered for emission reduction calculation.

E.2. Project emissions calculation

Step 4 Calculate GHG emissions from the use of alternative fuels in kilns (AF_{GHG})

$$AF_{GHG} = \Sigma(Q_{AF} * HV_{AF} * EF_{AF}) \quad \text{Eq - 5}$$

Where

Parameter	Details	Unit
AF_{GHG}	GHG emissions from alternative fuels	tCO_{2e}/yr
Q_{AF}	Monitored alternative fuels input in clinker production	tonnes/yr
HV_{AF}	Lower heating value of the alternative fuel(s) used	TJ/tonne fuel
EF_{AF}	Emission factor(s) of alternative fuel(s) used	tCO_{2e}/TJ

Q_{AF} and HV_{AF} are monitored parameters.

Alternately, AF_{GHG} can also be calculated as:

$$AF_{GHG} = \Sigma(Q_{AF} * EF_{AF})$$

Where,
EF_{AF} = Emission factor(s) of alternative fuel(s) used (tCO_2/t fuel)

NEG was only used in Rawang plant. Thus,

	January	February	March	April	TOTAL
Rawang Works	11	216	147	137	**511**

Murner was only used in Kanthan plant. Thus,

	January	February	March	April	TOTAL
Kanthan Works	125	85	190	0	**400**

Step 6. Calculate GHG emissions due to on-site transportation and drying of alternative fuels

$$OT_{GHG} = OF_{AF} * (V_{EF\ CO2} + VEF_{\ CH4} * GWP_{\ CH4}/1000 + V_{EF\ N2O} * GWP_{\ N2O}/1000) + (FD * FD_{\ HV} * VE_{FD})$$

Where

Parameter	Details	Unit
OT_{GHG}	GHG emissions from on-site transport and drying of alternative fuels	tCO_{2e}/yr
OF_{AF}	Transportation fuel used for alternative fuels on-site during the year	t/yr

$V_{EF\ CO2}$	CO2 emission factor for the transportation fuel	tCO_2/tone
$V_{EF\ CH4}$	CH4 emission factor for the transportation fuel	kg CH_4/tone
$V_{EF\ N2O}$	N2O emission factor for the transportation fuel	Kg N2O/tonne
GWP_{CH4}	Global warming potential for methane	-
GWP_{N2O}	Global warming potential for N2O	-
FD	Fuel used for drying alternative fuels	t/yr
FD_{HV}	Heating value of the fuel used for drying	TJ/t fuel
VE_{FD}	Emission factor of the fuel used for drying	tCO_2/TJ

Project emissions from transportation of fuel are insignificant in the project activity. The energy consumption for fuel handling and crushing of coal and PKS is estimated to be about the same amount. The emissions difference from the power consumption for the fuel handling system is therefore assumed to be negligible. Please refer annex 9 of the registered PDD.

Thus,

	January	**February**	**March**	**April**
Rawang Works	0	0	0	0
Kanthan Works	0	0	0	0

E.3. Leakage calculation

The biomass used in the project activity is abundantly available for the project activity. Hence, leakage calculations for the same are not required.

E.4. Emission reductions calculation / table

$$AF_{ER} = FF_{GHG} - AF_{GHG}$$

where

Parameter	**Details**	**Unit**
FF_{GHG}	GHG emissions from fossil fuels displaced by the alternatives	(tCO2/yr)
AF_{GHG}	GHG emissions from alternative fuels	(tCO2/yr)

Emission reductions will be equivalent to the emissions from fossil fuels displaced by the alternatives fuels as project emissions and leakages are considered negligible. Therefore,

Rawang Works:

Period	Project activity emissions (tCO_2e)	Baseline emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
01/01/2010 - 30/04/2010	511	12,941	0	12,431

Kanthan Works:

Period	Project activity emissions (tCO_2e)	Baseline emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
01/01/2010 - 30/04/2010	400	29,409	0	29,409

Thus, the total emission reductions achieved by the project activity in the monitoring period can be summarised as:

Period	Project activity emissions (tCO_2e)	Baseline emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
01/01/2010 - 30/04/2010	**911**	**42,350**	**0**	**41,439**

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)	**20,670**	**41,439**

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

The increase in the number of CERs is mainly due to increased use of alternative fuels in both plants, which resulted in an increased amount of coal being displaced.

However, the total actual emission reductions for the entire crediting period are less than those estimated in the registered PDD.

Values applied in ex-ante calculation of the registered CDM-PDD for the entire crediting period	Actual values reached during the entire crediting period
620,110	614,107

- - - - -

History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		