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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

>>

Emission reductions through partial substitution of fossil fuel with alternative fuels in three cement plants of Holcim Philippines Inc.

Version ~~02~~**03**, ~~09~~**20**/~~04~~**09**/2008

A.2. Description of the project activity:

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The project activity consists of a partial replacement of fossil fuel (predominantly coal) in the kiln system by alternative fuels (AF) like agricultural by-products (rice husk, coconut waste, tobacco leaves, bagasse, etc.) and sorted municipal solid waste (shredded plastics, shredded rubbers, etc). The purpose of the project activity is to reduce CO_2 emissions generated from fuel burning requirements in clinker production and therefore cement manufacturing.

The project is for implementation in the 3 cement plants of Holcim Philippines, Inc. (HPHI) located in Bulacan, Lugait and Davao. The project activity aims to replace 15% of the heat requirement with agricultural waste and 3.8% with sorted municipal solid waste. The thermal substitution rate has been fixed taking into consideration the technical barriers to be overcome to ensure that production losses are minimized and quality of the clinker is not compromised.

Clinker manufacturing, and therefore cement manufacturing, is a highly, energy-intensive process. The pyro-processing stage, i.e., where the raw material is heated to a temperature that leads to the key chemical change in producing clinker, requires the largest amount of heat in the total cement manufacturing activity. The use of agricultural by-products and sorted municipal solid waste as alternative sources of thermal energy to manufacture the clinker will therefore result in a significant saving on non-renewable fossil fuels.

The project activity will strengthen sustainable development, specifically, in the 3 regions where HPHI cement facilities are located. The volume of non-renewable fuels required in the cement manufacturing process will be significantly reduced, consequently, economised. The project activity will also contribute regionally to the waste disposal infrastructure and will help address local environmental problems. It will bring about wide-ranging benefits to the health and well-being of the community by raising the socio-economic level and improving the quality of ambient air of the locality.

As a contribution to sustainable development in the Philippines, the project will carry out several environmental improvements and socio-economic benefits such as:

- **The use of cleaner, more efficient and sustainable solution to waste disposal**

One of the various environmental challenges faced by the Philippine government is the proper disposal of wastes. The Japan International Cooperation Agency (JICA) estimates that approximately 2.4 million tonnes of hazardous wastes are generated annually (2002). In addition, several thousand tonnes of municipal solid wastes are generated daily. The same study showed that the infrastructure for waste collection, treatment and disposal in the Philippines is underdeveloped. With this problem on waste disposal, sources of drinking water become polluted and the flora and fauna are destroyed.

In many developed countries, cement kilns are the preferred option in the management of suitable wastes since the energy and material value of these waste materials can be reclaimed or recovered. Provided that these are properly equipped with sufficient safety and environmental management systems, cement kilns via co-processing have an enormous potential to help address the disposal of wastes in the Philippines.

- **Livelihood and other economic opportunities in the community**

Although farmers and rice millers currently earn income from their existing trade, this project is expected to provide an opportunity for additional income. Through this project, agricultural by-products that were once considered wastes will now become a source of revenue, not just to the farmers and rice-millers but, to other members of the community as well.

Wastes that will be utilized as alternative fuels will be yielded by rice husk mills and Material Recovery Facilities (MRF). These wastes will be transported to the nearest HPHI cement plant by trucks. Employment will be generated from the process of collecting, pre-processing and transporting of these wastes. In a survey conducted by HPHI, the biomass supply requires at least 4 people for every delivery of truck load to the plant. For HPHI Bulacan plant alone, it is estimated that 20 truckloads per day is needed to replace 15% of the fossil fuel requirement.

A Material Recovery Facility (MRF) already exists in Bulacan. This will soon be followed by the communities in Davao and Lugait. MRF's in these areas will be installed in compliance with the Ecological Solid Waste Management Act of 2000.

- **Provision of new financial resources**

The project activity will also support regional economic development. The use of agricultural by-products, previously burned in open air or landfilled in an uncontrolled manner without any value, will create new income sources. The biomass business will provide opportunity for additional revenue for local community. As a result, economic status and social well-being of the local people will be improved

A.3. Project participants:

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Name of Party involved	Private and/or public entity (ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant
Philippines (host)	Private entity: Holcim Philippines, Inc.	No
Switzerland	Private entity: Holcim Group Support Ltd	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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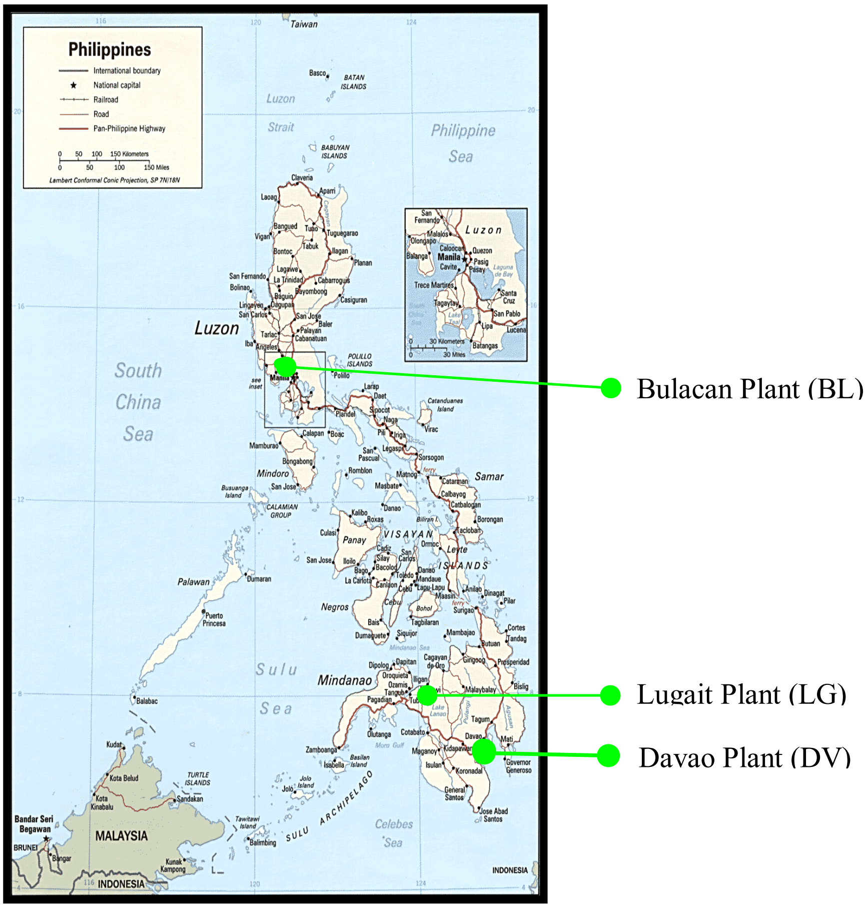

A.4.1.1. Host Party(ies):

>>
The Philippines

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

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Bulacan Plant	(BL)	: Region 3 – Central Luzon
Lugait Plant	(LG)	: Region 10 – Northern Mindano
Davao Plant	(DV)	: Region 11 – Davao Region

A.4.1.3. City/Town/Community etc:

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Bulacan Plant (BL) : Bulacan
Lugait Plant (LG) : Lugait
Davao Plant (DV) : Davao City

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

>>
Bulacan Plant (BL)
Bo. Matictic, Norzagaray
Bulacan, 3013
(Region 3)
N 14^0 53' 42.1"
E 121^0 4' 34.1"
Z 125m ASL
UTM Position 51P

Lugait Plant (LG)
Lugait, Misamis Oriental, 9025
(Region 10)
N 8^0 19' 45" to 8^0 20' 15"
E 124^0 14' 30" to 124^0 15' 30"
Z 75m ASL
UTM Position 51N

Davao Plant (DV)
Bo. Ilang, Davao City, 8000
(Region 11)
N 70 10' 37.49"
E 1250 39' 7.75"
Z 3.25m ASL
UTM Position 51N

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

>>
Manufacturing Industries

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

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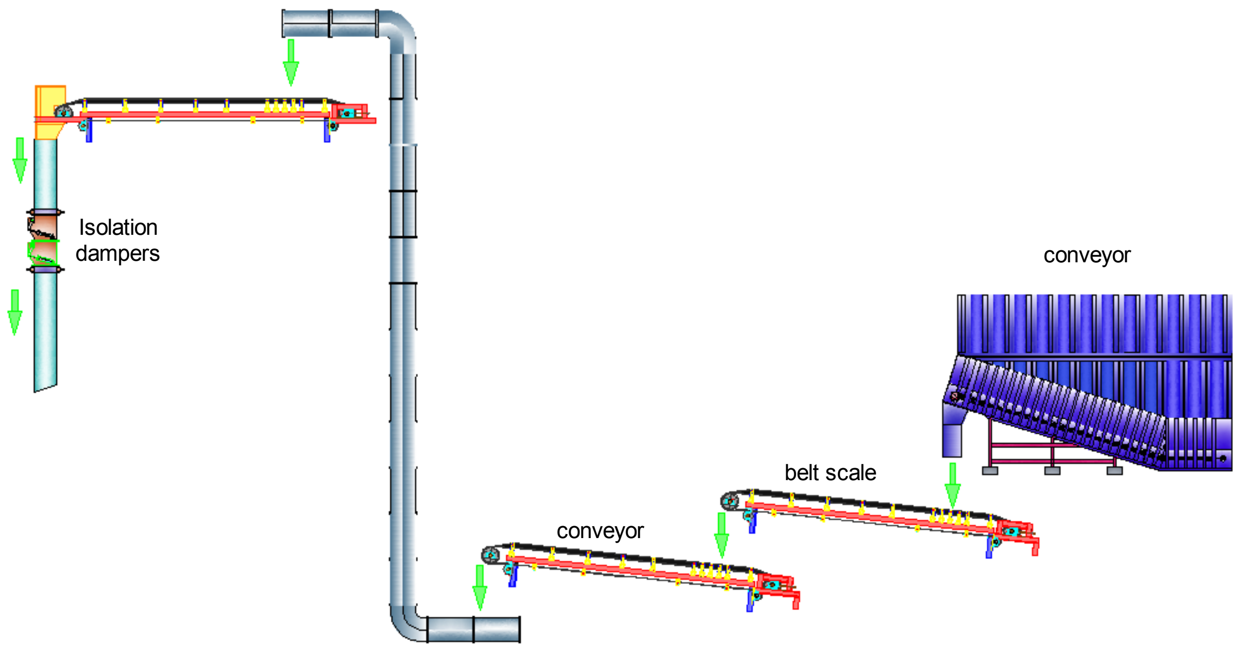
The technology, described below, that will be employed to co-process agricultural by-products and sorted municipal solid waste has been developed by HPHI with the support of experts from Holcim Group. A similar system will be set up in the 3 plants. The department of alternative fuels and raw materials (AFR) of Holcim Group Support (HGRS) provides an insight on the state of the art technologies, exchanges experiences in the alternative fuels selection plus design of installations, develops tools to limit the impact on production loss and clinker quality and establishes quality control procedures.

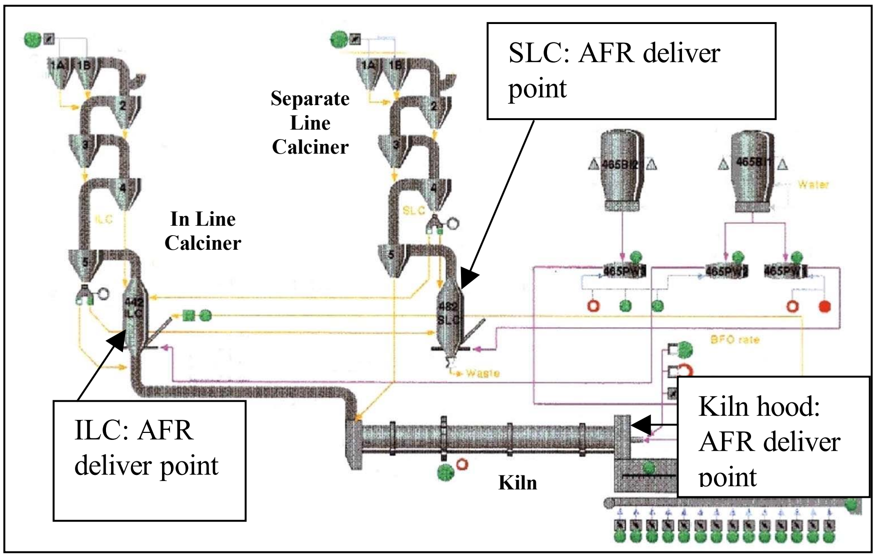
The system to be used will be set-up in different segments. The first segment aims to install a specific feeding system for each of the 3 cement plants with a dedicated covered area to receive the biomass. For Bulacan plant, the alternative fuels are fed into the separate-line calciner (SLC) and in-line calciner (ILC). For Lugait and Davao plants, the alternative fuels will be fed into the in-line calciner (ILC). The second segment includes the setting-up of the pre-processing facilities, consisting of shredder, screening and conveying system. The third segment aims to increase the capacity by optimizing the installations and replacing the coal to as much as 15%, the thermal substitution rate design capacity.

The figure below shows the feeding facility that will be installed.



All civil structure, mechanical equipment and supporting structure shall have its standard safety devices such as local emergency stop switch, automatic shut-off damper, pull rope switches, access platforms and stairways, handrails, etc.

Alternative fuels such as shredded plastics and rubbers, as well as the agricultural by-products bigger than 20 mm, will be fed through the belt conveyor to the designated feeding point (either to the calciner or through the kiln hood). A weigh feeder or dosing system will ensure feed rate accuracy. The feeding system will be monitored and controlled. The delivery, dosing and storage systems for the biomass and MSW may be further modified and enhanced as experience is gained The latter will be covered in the third segment.



All alternative fuels will be sampled and analyzed before these will be used. Strict parameters shall guide the quality control process which includes continuous monitoring of emission of specific pollutants using the Continuous Emission Monitoring System (CEMS) that has been installed in all the 3 plants. Holcim Philippines, Inc. (HPHI) implements a comprehensive environmental management system in all its cement plants, accordingly, all plants are ISO14001 certified. With this certification, HPHI is committed to manage responsibly any impacts in the environment of its operations.

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

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A crediting period of 10 years has been chosen for the project activity.

Year	**Annual estimation of emission reductions in tonnes of CO2** Bulacan (BL)	**Annual estimation of emission reductions in tonnes of CO2** Lugait (LG)	**Annual estimation of emission reductions in tonnes of CO2** Davao (DV)	**Annual estimation of emission reductions in tonnes of CO2** HPHI Total
Year A	52,358	36,~~154~~006	29,~~958~~883	118,~~470~~248
Year B	76,204	57,~~212~~005	47,~~392~~289	180,~~808~~499
Year C	96,246	6~~8,017~~7,853	56,~~434~~316	220,~~697~~414
Year D	96,246	67,853~~68,143~~	56,316~~56,434~~	220,414~~220,822~~
Year E	96,246	67,853~~68,143~~	56,316~~56,434~~	220,414~~220,822~~
Year F	96,246	67,853~~68,143~~	56,316~~56,434~~	220,414~~220,822~~
Year G	96,246	67,853~~68,143~~	56,316~~56,434~~	220,414~~220,822~~
Year H	96,246	67,853~~68,143~~	56,316~~56,434~~	220,414~~220,822~~
Year I	96,246	67,853~~68,143~~	56,316~~56,434~~	220,414~~220,822~~
Year J	96,246	67,853~~68,143~~	56,316~~56,434~~	220,414~~220,822~~
Total estimated reductions (tonnes of CO_2e)	898,530	~~638,382~~635,832	~~528,818~~527,699	2,06~~5,731~~2,061
Total number of crediting years	10	10	10	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	89,853	63,~~838~~583	52,~~882~~770	206,~~573~~206

A.4.5. Public funding of the project activity:

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The project activity has received no public funding.

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

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ACM0003 / Version 04
Approved baseline methodology and approved monitoring methodology "Emissions reduction through partial substitution of fossil fuels with alternative fuels in cement manufacture".

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

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The approved baseline methodology ACM0003 is appropriate for HPHI's project activity since all the applicability conditions are fulfilled.

The applicability is justified in the following:

- Fossil fuels used in cement manufacturing are partially replaced by alternative fuels such biomass residues (rice husk, coconut waste, tobacco leave, bagasse, etc.) and sorted municipal waste (plastics, rubbers, etc.).

- The biomass residues are available as an excess by-product and, in the absence of the project activity, would be landfilled or burned in an uncontrolled manner without utilizing them for energy purpose.

  Rice husk, the main agricultural by-product that will be used, is readily available in abundant supply. Republic Act 9003, known as the Ecological Solid Waste Management Act of 2000, prohibits the open burning of solid wastes which includes, amongst others, agricultural wastes.

- The biomass residue used by the project activity doesn't necessitate preparation requiring the use of a significant quantity of energy. Except for one supplier wherein a small amount of energy is used to prepare the husk, the only activity requiring the use of energy is in the transport of the rice husks to the cement plant.

- CO_2 emission reduction is only related to the CO_2 emission generated by fuel burning requirement and not by decarbonisation of raw material.

- The methodology is applicable **only** for the ~~currently~~ installed ~~capacity~~ **capacity that exit by the time of validation. The installed capacity has been validated on site based on the original designed capacity supported by suppliers' documents and has been cross-checked with the Best Demonstrate Practice of 2005.** ~~presented below.~~**Here below the installed capacity per plant.**

Bulacan Plant	(BL)	: 5'500 tonnes of clinker/day
Lugait Plant Line 2	(LG)	: 4'000 tonnes of clinker/day
Davao Plant	(DV)	: 3'500 tonnes of clinker/day

- The amount of alternative fuels available is at least 1.5 times the amount required to meet the consumption of all users consuming the same alternative fuels.

The alternative fuels to be used in the project activity, i.e., agricultural waste (mainly rice husk) and sorted municipal solid waste (MSW), are available in abundance in the Philippines. The table below shows that the estimated amount of rice husk available in each region is more than 9 times the amount proposed to be used by the project activity. The official data on availability of rice husk, coconut waste and bagasse as well as the data on sorted MSW (mainly plastic) are presented in Appendix 1. The CDM country guide for the Philippines also confirms that there is abundant supply of biomass in the Philippines and that the amount is increasing.

Availability of the main alternative fuels proposed to be used in the project activity.

HPHI plants	**Rice husk** Average of rice husk proposed to be used by he project per year during the crediting period (t)	**Rice husk** Official availability[1] in the region per year (t)
Bulacan (BL)	62,827	705,808
Lugait (LG)	50,763	573,010
Davao (DV)	41,906	373,702

[1]Source: Philippine Bureau of Agricultural Statistics / computed at 15% of the total palay rice husk volume. See details in appendix 1.

To support the official data, HPHI has conducted during the stakeholder's meetings and in the following weeks, an additional investigation in order to know the alternative usage of the rice husk and therefore to determine the net availability including all other users. A form was given to owners of rice mills. The percentage which is either landfilled (no distinction of anaerobic, aerobic or stockpiled), burned in open air, used for fertilizer, brought to companies, sent to haulers, used as fuel, given or used as food to animal was asked. The investigation has been done on a limited number of rice mills owners, the most active one in term of rice husk utilization and therefore the investigation is highly conservative. An update of the investigation will be done during verification. The investigation gives a conservative overview of the current practice in each region. In combination with the official data, an estimation of the net amount available (taking out the amount consumed by other users) is possible. As written above, the survey is very conservative due to the limited amount of rice mill's owners which are the active one and therefore we consider that the amount available is the amount that will be either landfilled, burned in open air and the amount which is already sent to HPHI. The table below resumes the investigation which is available in detail per region and rice mill owners. The number of rice mills'owners is indicated.

Investigation on the current practice of rice husk disposal

HPHI plants	**Rice husk** Number of rice mills owners asked during the investigation	**Rice husk** % sent to uncontrolledl andfill (no distinction)	**Rice husk** % burned in open air	**Rice husk** % brought to HPHI (2006 **and 2008**)	**Rice husk** % brought to other companies or to haulers	**Rice husk** % used as fertilizer	**Rice husk** % used as fuel	**Rice husk** % given, used as animals food or others
		Amount available	Amount available	Amount available	Amount not available	Amount not available	Amount not available	Amount not available
Bulacan (BL)	~~25~~**53**	~~16~~**53**%	0%	~~22~~**13**%	~~54~~**27**%	2%	~~5~~**4**%	1%
Lugait (LG)	4	22%	21%	25%	0%	7%	8%	18%
Davao (DV)	~~14~~**32**	~~31~~**64**%	~~1~~**7**%	~~0.6~~**10**%	**1**~~60.7~~**6**%	~~6~~1%	~~1~~**2**%	0%

Taking into account the amount available as only the amount sent to uncontrolled landfill and the amount burned in open air the percentage are:

HPHI plants	**Rice husk** Number of rice mills owners asked during the investigation	**Rice husk** % sent to uncontrolle dlandfill (no distinction)	**Rice husk** % burned in open air	**Rice husk** Amount available in compariso n with the amount proposed to be used
		Amount available	Amount available	
Bulacan (BL)	~~25~~**53**	~~16~~**53**%	0%	~~1.2x~~**5.9x**
Lugait (LG)	4	22%	21%	~~1.8x~~**4.9x**
Davao (DV)	~~14~~**32**	~~31~~**64**%	~~1~~**7**%	~~1.5x~~**6.3x**

As the investigation is very conservative and take into account only active rice mills' owner, we can combined the official source and the investigation and conclude that for Bulacan ~~16~~ **53**% means ~~112,929t~~**374,078t** available therefore ~~1.8x~~**5.9x**, for Lugait 43% means 246,394t therefore 4.9x and for Davao ~~32~~**71**% means ~~119,585~~**265,328** t therefore ~~2.9x~~**6.3x**. The availability in each region is more than 1.5 time the amount to be used by all users.

The distances are:

HPHI plants	**Distance** from the existing furthest suppliers to the plant (km)
Bulacan (BL)	~~40~~**150**
Lugait (LG)	159
Davao (DV)	200

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

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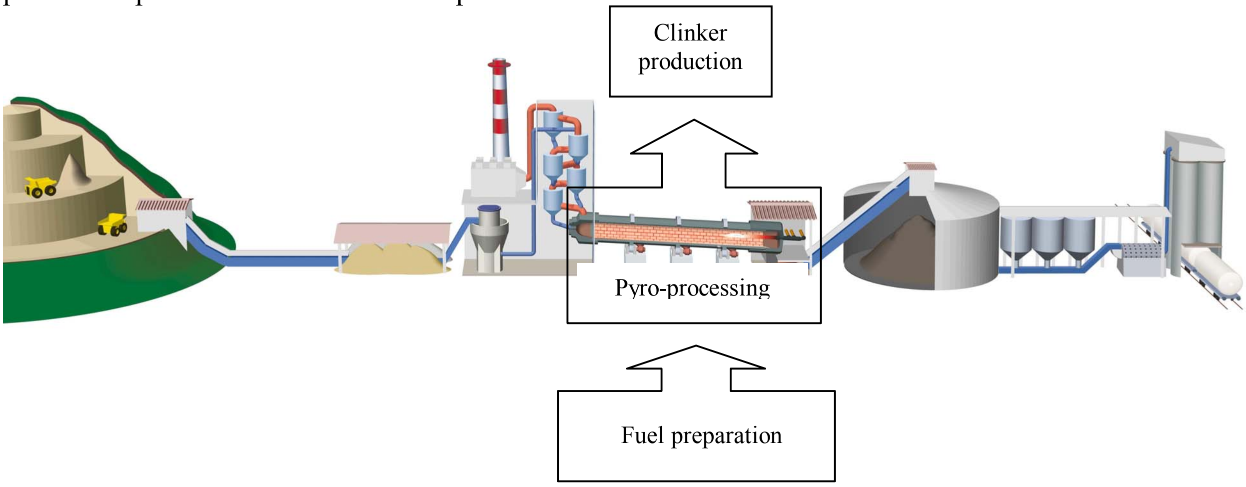
The figure below shows the cement manufacturing process. The physical project boundary covers all production processes related to clinker production.



The table below shows that CO_2 emissions from the fuel combustion, fuel transportation and fuel preparation are considered for the purpose of calculating project emissions and baseline emissions.

	Source	Gas	Included?	Justification / Explanation
Baseline	Kiln fuel use	CO_2	YES	Direct emissions from firing the kiln and processing
		CH_4	NO	CH4 emissions from combustion processes are considered negligible and excluded because these emissions by the cement industry are negligible (see WBCSD / WRI Cement protocol)
		N_2O	NO	see CH_4
Project activity	Kiln fuel use	CO_2	YES	Direct emissions from firing the kiln and processing (including supplemental fuels used in the precalciner)
		CH_4	NO	CH4 emissions from combustion processes are considered negligible and excluded because these emissions by the cement industry are negligible (see WBCSD / WRI Cement protocol)
		N_2O	NO	see CH_4

	On site transportation and preparation of alternative fuels	CO_2	YES	Direct emissions due to AF transportation and indirect emissions from fossil fuels combustion of power plants from the grid due to electricity used.
		CH_4	NO	NO CH_4 emission
		N_2O	NO	NO N_2O emission

Additional emissions included in the project activity as leakage are:

- Emissions (CO_2) from off site transportation of alternative fuels (reduction of fossil fuels transportation are neglected to be conservative).
- Emissions (CO_2) from off site preparation of alternative fuels.

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

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Baseline scenario selection

Baseline scenario 1: Utilization of fossil fuels based on global agglomerate data from 2002, 2003 and 2004 level.

Utilization of fossil fuel is the common practice in the cement industry in the Philippines. The Cement Manufacturers Association of the Philippines (CeMAP[1]) doesn't publish details of the fuel portfolio of its members. CeMAP report however identifies coal (and the origin or source) as the fossil fuel use in the cement industries. The historical data of HPHI from 2002, 2003 and 2004 is available in the annual technical report and is presented in the calculation data sheet.

Baseline 1 is a global average of 2002 to 2004 HPHI's fuel portfolio.

Fuel	**Percentage (%) Baseline 1**
Coal	82.4
Anthracite	9.8
Petcoke	6.4
Heavy oil	1.1
Light oil/ Diesel	0.0
Waste oil	0.0
Industrial waste originating from fossil sources	0.3
Emission factor (tCO2/TJ)	**95.04**

The global emission factor of the baseline 1 is 95.~~05~~ **04** tCO2/TJ.

[1] www.**cemap**.org.ph

Baseline scenario ~~2~~1a: Utilization of fossil fuels based on plant specific agglomerate data from 2002, 2003 and 2004 level.

As each plant has a slightly different fuel portfolio, therefore a second baseline based on plant specific fossil fuels used is proposed.

Below is scenario 2, "**Utilization of fossil fuels based on plant specific agglomerate data from 2002, 2003 and 2004 level.**":

Fuels	**Percentage (%) Baseline 2 Bulacan**	**Percentage (%) Baseline 2 Lugait**	**Percentage (%) Baseline 2 Davao**
Coal	79.6	84.2	83.3
Anthracite	18.6	1.7	11.0
Petcoke	0.0	12.5	5.2
Heavy oil	0.9	1.5	0.5
Light oil/ Diesel	0.1	0.0	0.0
Waste oil	0.0	0.1	0.0
Industrial waste originating from fossil sources	0.8	0.0	0.0
Emission factor (tCO_2/TJ)	95.09	94.69	95.22

The baseline 2 presented above is more accurate than the baseline scenario 1 as the specific emission factor of each plant is used.

Baseline scenario 2: likely evolving fuel mix

The table below indicates the foreseen price in PhP of fossil fuels per MJ as per the forecast of 2006. The price includes the FOB and the freight. The detail of the forecast is presented in Annex E– Fuel price. The last shipment of Petcoke was received in 2005. Indeed, the use of petcoke is not foreseen anymore mainly due to the high sulphur concentration in comparison with the price[2]. The consumption of heavy oil and diesel is used only to start the kiln as it is expensive fuels. The consumption will remain more less the same as planned and unplanned stoppages of the kiln don't change much over the years. The local coal Semirara from the Philippines is not always available and the quality is lower than the one from Indonesia. Anthracite from vietnam will most likely remain use as in the previously year on occasional basis.

Bulacan

Price (Php/MJ)	**2006**	**2007**	**2008**	**2009**	**2010**
Coal indo	**0.1326**	**0.1327**	**0.1507**	**0.1646**	**0.1801**

[2] 0.085PhP/MJ in 2005 (see annex ~~D~~ F-~~xx~~**Petcoke price**)

(Indonesia)					
Coal semirara (Philippines)	0.0866	0.0904	0.0980	0.1069	0.1168
Anthracite (Vietnam)	0.1331	0.1389	0.1509	0.1646	0.1799

Lugait

Price (Php/MJ)	2006	2007	2008	2009	2010
Coal indo (Indonesia)	0.1115	0.1165	0.1269	0.1389	0.1524
Coal semirara (Philippines)	0.0816	0.0851	0.0927	0.1015	0.1114
Anthracite (Vietnam)	0.1269	0.1323	0.1440	0.1575	0.1727

Davao

Price (Php/MJ)	2006	2007	2008	2009	2010
Coal indo (Indonesia)	0.1189	0.1244	0.1358	0.1491	0.1639
Coal semirara (Philippines)	0.0870	0.0910	0.0992	0.1087	0.1194
Anthracite (Vietnam)	0.1326	0.1388	0.1517	0.1666	0.1833

The tables above show that the fuel price of coal and anthracite is very similar. However the Indonesian coal has a higher quality and it is available. Therefore we can consider that any fuel switch will be in favour of coal from Indonesia.

Regarding the price and availability analysis above, the fuel mix scenario would most likely be the same than scenario 1a but instead of petcoke, coal would be used.

Scenario 2 - likely evolving fuel mix portfolios

Fuels	Percentage (%) Baseline 2 Bulacan	Percentage (%) Baseline 2 Lugait	Percentage (%) Baseline 2 Davao
Coal	79.6	96.7	88.5
Anthracite	18.6	1.7	11.0
Petcoke	0.0	*0.0*	*0.0*
Heavy oil	0.9	1.5	0.5
Light oil/ Diesel	0.1	0.0	0.0
Waste oil	0.0	0.1	0.0
Industrial waste originating from fossil sources	0.8	0.0	0.0
Emission factor (tCO_2/TJ)	95.09	94.33	95.08

Baseline scenario 3: Fossil fuels are partially substituted with alternative fuels (i.e the proposed CDM project activity)

The third scenario is the project activity, i.e., utilization of fossil fuels plus a significant amount of alternative fuels (AF).

As there are no legal incentives nor obligations for cement companies to use alternatives fuels such as agricultural waste or sorted municipal waste, cement plants will not, most likely, shift from the use of fossil fuels to alternative fuels.

In 2004, HPHI had discussion during the annual Energy Technology Conference (ETC 2004) held in Mandaluyong city in the Philippines on the potential to develop a project activity using alternative fuels under the Clean Development Mechanism. The speakers under the CDM projects and applications' panel were consulting HPHI on the process and potential of such a project (see letter from ENPAP).

In 2005, with the incentives of potential CDM revenues, tests using agricultural by-products as alternative fuels were conducted using manual installations. Aside from rice husks tested in Bulacan, waste carbon (coconut carbon) coming from a supplier's large stockpile was tested in Davao (see letter from the environmental management bureau of Davao city).

Since the first test in Bulacan in 2005, the local and corporate AFR technical team are studying the process behaviour and technical barriers to be overcome to ensure that production losses are minimized and the quality of the clinker is not compromised. With technical support from corporate office and with investments on new alternative fuel facilities, HPHI would partially replace fossil fuels with alternative fuels, using a significant amount of biomass. With the CDM incentives, it is estimated that 15% and 3.8% of the fossil fuel requirements will be replaced by biomass and sorted MSW, respectively. The thermal substitution rate has been estimated by taking into account the technical barriers to be overcome using the tools developed by Holcim on minimizing production losses and maintaining the clinker characteristics. These estimates will be re-evaluated during the verification stage.

Below is HPHI's fuel mix composition for the proposed project activity (average for all 3 plants):

HPHI	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017-8**
Coal	~~75.4~~**80.2**	~~70.4~~**75.4**	~~64.6~~**70.4**	64.6	64.6	64.6	64.6	64.6	64.6	64.6
Anthracite	11.0	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9
Petcoke	~~4.1~~**0.0**	**0.0**~~4.1~~	**0.0**~~4.1~~	**0.0**~~4.1~~	**0.0**~~4.1~~	**0.0**~~4.1~~	**0.0**~~4.1~~	**0.0**~~4.1~~	**0.0**~~4.1~~	**0.0**~~4.1~~
Heavy oil	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Light oil /Diesel	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Waste oil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial waste	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Agricultural waste	6.0	10.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
Sorted MSW	2.00	3.00	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8

Since the amount of fossil fuel replacement by alternative fuels is slightly different for each plant, separate emission reduction calculations are done for each plant and are given in the calculation sheet as well as in section B.6.3.

Baseline scenario selection

Option 2: Select baseline scenario through barriers analysis

Alternative scenario	Investment barriers	Technological barriers	Barriers due to prevailing practices	Other barriers
Scenario 1 and 1a	No initial capital investment required.	No technological barriers.	This is the prevailing practice	No
Scenario 2	No initial capital investment required	No technological barriers. **The plant will operate with this scenario in the absence of the project activity and the emission factor is more conservative.**	This is the prevailing practice	No
Scenario 3	Capital investment	A number of trials have been done (mainly in Bulacan) and are still required for the proposed project activity to optimize the feeding of alternative fuels by keeping the clinker characteristics. New facilities and upgrades of some technical components are required.	Operators are not familiar with handling and feeding of alternative fuels and specific installations have to be developed.	The use of alternative fuels reduces the production capacity.

Based on the above barriers analysis, scenario 2 is most likely to happen in the absence of the proposed project activity. Therefore, scenario 2 is selected as the baseline scenario. The data for the baseline estimation are taken from the annual technical report (ATR) of the 3 HPHI's cement plants i.e. Davao, Lugait and Bulacan.

Description of the selected baseline

Fuels	**Percentage (%) Baseline 2**	**Percentage (%) Baseline 2**	**Percentage (%) Baseline 2**

	Bulacan	Lugait	Davao
Coal	79.6	96.7	88.5
Anthracite	18.6	1.7	11.0
Petcoke	0.0	*0.0*	*0.0*
Heavy oil	0.9	1.5	0.5
Light oil/ Diesel	0.1	0.0	0.0
Waste oil	0.0	0.1	0.0
Industrial waste originating from fossil sources	0.8	0.0	0.0
Emission factor (tCO2/TJ)	95.09	94.33	95.08

~~**Fuels**~~	~~**Percentage (%) Baseline 2 Bulacan**~~	~~**Percentage (%) Baseline 2 Lugait**~~	~~**Percentage (%) Baseline 2 Davao**~~
~~Coal~~	~~79.6~~	~~84.2~~	~~83.3~~
~~Anthracite~~	~~18.6~~	~~1.7~~	~~11.0~~
~~Petcoke~~	~~0.0~~	~~12.5~~	~~5.2~~
~~Heavy oil~~	~~0.9~~	~~1.5~~	~~0.5~~
~~Light oil/ Diesel~~	~~0.1~~	~~0.0~~	~~0.0~~
~~Waste oil~~	~~0.0~~	~~0.1~~	~~0.0~~
~~Industrial waste originating from fossil sources~~	~~0.8~~	~~0.0~~	~~0.0~~
~~**Emission factor (tCO2/TJ)**~~	~~95.09~~	~~94,69~~	~~95.22~~

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): >>

The tool for the demonstration and assessment of additionality version 3 has been used.

The incentives of CDM were undeniably considered in the decision to proceed with the proposed project activity. Discussions have started in October 2004 regarding the technological feasibility and the administrative procedures. In 2005, with the belief in CDM incentives, manual tests and trials have started. The Energy Efficiency Practioners Association of the Philippines who has followed the progress of HPHI in this matter has confirmed the various steps (see letter). Today, HPHI is still in the industrial testing phase as only limited installations (one conveyor) have been implemented in Bulacan and manual feeding is done in Lugait and Davao. The CEO will allow engineering works to overcome the technological barriers which have been pointed out to reach the level proposed once the project will be registered.

STEP 1. Identification of alternatives to the project activity consistent with current laws and regulations.

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

Three alternatives have been discussed above to select the most plausible baseline scenario. Alternative 2 is the most probable scenario for the following reasons: it is the prevailing practice, it is technically the most feasible scenario and it does not seek any investment. In addition, in comparison to scenario 1, it is the most specific scenario..

Alternative 3 is the project activity and it is not the most plausible scenario as there are major technical barriers, investment barriers, production losses plus maintenance issues. The barriers associated with the use of the alternative fuels proposed in the project activity are enumerated below.

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

All alternatives are in compliance with applicable laws and regulations.

Step 2. Investment analysis

Option III "Benchmark analysis" is the more relevant analysis method as the financial indicator is compared with the standard return of the company and of the market and not to a specific project type
like the Option II "Comparison analysis". The option I "Simple cost analysis" is relevant only if the project activity doesn't generate any other benefit than the CDM income and therefore doesn't apply for
the project activity.

Sub-step 2b. – Option III Apply benchmark analysis

Since scenario 1, 1a and 2 don't seek investment, the investment analysis is done only on scenario 3 which is the proposed project. A proposal of an investment plan is in study by the process engineers and has been part of the validation process to determine the prohibitive nature of the technological barriers. Here below an overview of the proposal by plant.

Bulacan					
Currency: PhP	**2006**	**2007**	**2008**	**2009**	**2010+**
Feeding system to SLC (Pneumatic transport)	**16,000,000**[3]				**nd**
Warehouse building		**2,741,926**	**17,950,000**		
Pre-process facility and flexible feeding system		**21,787,565**	**77,112,435**		
Fire protection system				**10,000,000**	

[3] Remove in 2008 due to feeding issue.

Hammers mills – 2 units				1,600,000	
Technical assessment – Process evaluation to optimize alternative fuels usage				2,000,000	
Budget for modifications as a result of the technical assessment.				10,000,000	
Rice husk feeding system (burner)				25,000,000	
Replacement of burner pipe (fine feeding)				34,000,000	
Heavy equipment to feed rice husk				5,000,000	
Baler/Compactor				1,200,000	
Truck scale for weighing				5,100,000	
Plattform, mixing and staging area			6,000,000	19,000,000	
Shredder and storage				20,000,000	
Dumptruck			1,000,000		
Forklift			1,200,000		
Payloaders (shredded material)			3,200,000		
Payloaders (biomass)			1,000,000		
Total in PhP	16,000,000	24,529,491	107,462,435	132,900,000	nd

Lugait					
Currency: PhP	2006	2007	2008	2009	2010+
Storage facility			1,500,000	23,500,000	
Fire protection system				10,000,000	
Forklift to unload rice husk				1,200,000	
Pre-processing facility and flexible feeding system		21,787,565	77,112,435		
Technical assessment – Process evaluation to optimize alternative fuels usage				2,000,000	
Budget for modifications as a result of the technical assessment.				10,000,000	
Rice husk feeding system (burner)				25,000,000	
Hammer mills – 1 unit				8,000,000	
Baler, Compactor				1,2000,000	
Total in PhP		21,787,565	78,612,435	73,700,000	nd

Davao					
Currency: PhP	2006	2007	2008	2009	2010+
Coarse facility		1,559,000	3,491,000		
Storage area			15,000,000	23,500,000	
Fire protection system				10,000,000	
Rice husk feeding system (cleated belt)				80,000,000	
Payloader and forklift				5,000,000	
Technical assessment – Process evaluation to optimize alternative fuels usage				2,000,000	
Budget for modifications as a result of the technical assessment.				10,000,000	
Rice husk feeding system (burner)			7,000,000	8,000,000	
Hammers mills – 1 unit				800,000	
Shredder system for MSW					10,000,000
Compactor				1,200,000	
Total in PhP	0	1,559,000	11,991,000	140,500,000	10,000,000 (nd)

In order to assess the potential investment, although post 2010 is not defined, an investment comparison analysis has been calculated with the investment plan proposal (annex B – investment plan) and the fin plan fuel forecast of 2006. The draft investment analysis shows that the proposed investment would lead to a negative IRR without CER and to an IRR of about 28% with CER. As the usual rate for investment of HPHI is 13.8%, the comparison confirms that HPHI needs the CER to overcome the barrier and go on with the installations. In any case, this value is a conservative estimation as the totality of the needed installations and process modifications are not yet finalized. The analysis will be reviewed once the project is registered and the final investment plan completed and accepted. The table below shows the summary of the IRR calculation. The details have been added in the revised PDD version 03.

Year	Investment (US$ K)	Incremental cash flow (US$ K)	Depreciation	Taxable income	Tax	Net benefit	Cash flow without CER	Cash flow with CER (price assumed at $10)

2006	306	-	-	-	-	-	(306)	(306)
2007	917	-	71	(71)	-	-	(917)	(917)
2008	4'537	421	420	1	0	420	(4'116)	(3'175)
2009	7'687	887	1'011	(124)	-	887	(6'800)	(5'280)
2010	214	1'768	1'027	740	222	1'546	1'331	3'536
2011		2'171	1'027	1'144	343	1'828	1'828	4'032
2012		2'089	1'027	1'062	319	1'771	1'771	3'975
2013		1'773	1'027	746	224	1'549	1'549	3'754
2014		1'439	1'027	412	123	1'315	1'315	3'520
2015		1'085	1'027	58	17	1'068	1'068	3'272
2016		711	1'027	(316)	-	711	711	2'915
2017		315	1'027	(712)	-	315	315	2'519
2018	-1'366	(104)	1'027	(1'131)	-	(104)	1'263	4'729
IRR							-1.70%	28.47%
NPV – WACC 13.80%							($3'841)	$4'487
NPV - GOVT BOND 8%							($3'361)	$9'089

It was assessed during the validation on site that HPHI is in the starting phase of the project activity with limited usage of biomass and non continuous feeding. The barriers are highly prohibitive as they required an optimization of the process which can only be overcome with iterative trials regarding the process as well a customized installations regarding the handling of biomass. The bottlenecks have been presented and assessed by the DOE as well as the proposition of investment. Indeed, the various steps will lead to significant investment.

Step 3. Barrier analysis

Step 3. Barrier analysis is selected

Step 3a. Identify barriers that would prevent the implementation of the type of the proposed project activity

The use of alternative fuels in the cement kiln is not yet well-established in the Philippines. Hence, this project will likely face major barriers and risks which, without the CDM benefits, would prevent HPHI from its implementation. These barriers are discussed as follows.

Technological barriers

There are mainly 2 types of technological barriers when using alternative fuels. These are the direct one, due to the feeding of the alternative fuels, and the indirect one, caused by the process in regard to keeping production losses minimum and maintaining the clinker characteristics within regulatory standards.

Using alternative fuels in a power plant to generate electricity is different from using one in a kiln. In a power plant, the alternative fuels are burned directly and the heat produced is used to generate electricity. In a cement kiln, the alternative fuels come directly in contact with the raw materials that are used to produce the clinker. In the process, the mineral components of the alternative fuels, in addition to the heat, are recovered and becomes part of the clinker. For this reason, optimizing the use of alternative fuel is a case by case study which, depending on the type of kiln used and the characteristics of the raw materials, may vary from kiln to kiln. To ensure that the clinker characteristics are not compromised, all parameters that could influence the clinker features need to be considered and solutions to mitigate whatever impacts implemented. Holcim Philippines, with the supporting tools developed by Holcim Group Support Ltd such as the fuel mix optimizer (FMO) and low grade fuel study, has identified all bottlenecks and process limitations of each cement plant for the successful implementation of the project activity (shown during validation).

The detailed analyses of the 3 plants have allowed HPHI to set up 3 specific road maps regarding the current project activity. Some of the indirect issues that have been identified and needed to be addressed for each of the 3 plants when using alternative fuels (demonstrated with the tools during validation) are: a) high variation in the quality of the main fuel and limestone, b) high percentage of calcination, c) very low burner momentum, and d) very low oxygen level at the kiln inlet. Technical solutions have been proposed, addressing each issue one at a time. As this is a learning process, a team reviews and analyzes all process conditions anew in order to fully understand the consequence of any modification or solution implemented. The appendix 4 shows the details of the bottleneck analysis as well as one example of the fuel mix optimizer.

Some of the direct technological barriers related to the use of alternative fuel are: a) the receiving area of the materials, b) safe and proper handling of the materials, c) variation in the characteristics of the materials, d) high moisture content, and e) proper AFR feeding facility to be able to reach the target reduction in fossil fuel.

In 2006, part of the project activity industrial tests, a feeding system, consisting of a hopper and conveyor to transport biomass to the calciner, was installed in Bulacan plant. Since then, many modifications have been (and are still being) made in order to optimize the system. The industrial tests show that the process of feeding alternative fuels is more challenging compared to using traditional fuels. For one, alternative fuels are not homogeneous and therefore, are technically more difficult to feed. They have lower calorific value, higher moisture content and lower density than traditional fuels. Consequently, a higher volumetric feed rate is needed, resulting in jamming and instability in the process. To attain the target thermal substitution, the feeding and handling facility in Bulacan has to be improved. Further, a dosing system has to be installed to regulate the introduction of alternative fuels. Although Holcim Bulacan plant has a designated receiving concrete area, a covered storage will have to be considered, especially during the rainy season.

For the cement plants in Davao and Lugait, alternative fuels are for now fed manually into the kiln using basic handling equipment. A hoist is used to transport the materials from ground level to preheater and the materials are then manually fed into the "feeding point" protected by a double-flap gate. An improved feeding and handling system and covered storage area have to be set-up for each of these 2 plants also to attain to desired thermal substitution rate.

Hazards and corresponding mitigating measures have been identified and safe working procedures have been developed to ensure proper handling of alternative fuels. Improvement in the procedures and continuous training of employees on specific methods and other safety measures is ongoing.

Additional informations

The project activity involves the setting up of the indirect technical barriers as well as several new infrastructures such as feeding systems (conveyor, hoppers, etc.), covered designated area to receive the alternative fuels, controlling and monitoring devices, and safety equipment. Equipment, as well as installation and commissioning activities, entail upfront cost. Taking into account CDM incentives, HPHI has since 2006 invested around PhP1 million in AFR facilities to achieve the industrial tests. Once the project will be registered, HPHI will dedicate a team to analysis further more the direct and indirect technical barriers that have been shown and will propose solution with the related cost. Once solution will be set, an investment plan will be done and presented to the CEO as so far the CEO didn't accept any more investment without registration.

Besides direct investment, the project activity will generate indirect costs resulting from consultancy, training, monitoring, and maintenance of the equipment and cost of additional personnel.

Further, indirect costs related to losses in clinker production as a result of increased use of alternative fuels have to be taken into account as a barrier to the proposed activity. The clinker production loss is estimated using the fuel mix optimizer and was demonstrated during the validation.

Barriers due to prevailing practice

The use of a significant amount of alternative fuels in clinker production is not the current practice in the Philippines. Fossil fuels are the preferred choice and therefore the prevailing practice within the cement industry. The representative of the Philippine DNA has confirmed that it does not have any similar project for validation so far. It is aware though that another company has been considering CDM incentives.

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)

In the case of the baseline scenario 1 and 2, they would not face the barriers associated with the proposed project activity. It is currently the prevailing practice and the technical barriers are business as usual. The table above evaluates all alternatives and shows that alternative 2 is the most probable scenario.

Step 4 Common practice analysis

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

The use of significant amounts of alternative fuels is not the current practice in the cement manufacturing industries in the Philippines. Based on information from the Cement Manufacturers Association of the Philippines (CeMAP), coal is the major source of thermal energy in the local cement industry.

Sub-step 4b. Discuss any similar options that are occurring

With the major barriers (investment, production losses, technological issues and prevailing practice standards) and lack of incentives available, the proposed project activity or similar projects are not likely to happen without the Clean Development Mechanism incentives.

The step approach shows that the project is additional.

Impact of CDM Registration

The CDM allows HPHI to overcome the barriers related to the substitution of fossil fuels with alternative fuels.

CDM status provides many key benefits to HPHI

- Prospect of CDM revenue and decrease of the financial risk
- Significant reduction of the GHG emissions
- CDM revenue will encourage HPHI (and even other Holcim Group companies) to come up with new ideas and projects reducing GHG emissions
- Gain of experience in CDM projects

The cement industry is aware of the CO2 emissions associated with clinker production and CDM provides real incentives encouraging the industry to reduce CO2 emissions by using alternative fuels. The key benefits cited allow not only HPHI, but as well as the other Holcim Group of Companies, to dedicate financial and technical resources to overcome the barriers.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Details of the calculation choices are shown in section B.6.2 “Data and parameters available at validation” and section B.7.1 “Data and parameters monitored”.

Below are the main methodological choices:

- Waste fuel and industrial waste originating from fossil fuels are part of the baseline and the related heat input and emissions are computed within the fossil fuel calculation.
- Emissions saving from reduction of on site transport of fossil fuels are not taken into account
- Emission savings from reduction in the preparation of fossil fuels are not taken into account.
- Leakages due to biomass residues that would be burned in the absence of the project activity or landfill in an uncontrolled manner are not taken into account.
- Leakage due to reduced off-site transport of fossil fuel is not taken into account.

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

All data used to calculate the baseline and estimate of the project activity emissions reduction are available. The baseline data are presented in this section. The project activity data (estimation) is part of the monitoring data and presented in section B.7.

The data and parameters are taken from the annual technical report (ATR), a report that each plant within the Holcim group completes and submits to the Corporate every January of the year.

Since the values applied are not always the same for the 3 plants, the abbreviation of each plant is given when necessary.

Data / Parameter:	**C_{BI}**
Data unit:	Tonne
Description:	Annual production of clinker
Source of data used:	Annual technical report
Value applied:	See calculation database
Justification of the choice of data or description of measurement methods and procedures actually applied :	Quantity of clinker produced. Daily production monitoring based on clinker factor multiplied by weight of kiln feed. Daily usage of kiln feed is obtained from kiln feed weight totalizer readings while clinker factor is obtained using a drop test. Cross- check with automatic weight system of the cement grinding input and clinker sold. ISO 9001:2000.
Any comment:	None

Data / Parameter:	**$Q_{FF,BA\ coal}$**
Data unit:	Tonne
Description:	Quantity of fossil fuel (coal) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:145,644 LG:~~175,366~~**201,448** DV:~~110,391~~**117,617**
Justification of the choice of data or description of measurement methods	The amount of each fossil fuel is automatically daily weighted with the weight totalizer of the bin and cross-checked with the delivery and inventory. ISO 9001:2000.

and procedures actually applied :	
Any comment:	None

Data / Parameter:	$Q_{FF,BA\ anthracite}$
Data unit:	Tonne
Description:	Quantity of fossil fuel (anthracite) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:30,745 LG:3,407 DV:20,080
Justification of the choice of data or description of measurement methods and procedures actually applied :	The amount of each fossil fuel is automatically daily weighted with the weight totalizer of the bin and cross-checked with the delivery and inventory. ISO 9001:2000.
Any comment:	None

Data / Parameter:	$Q_{FF,BA\ petcoke}$
Data unit:	Tonne
Description:	Quantity of fossil fuel (petcoke) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL: 0 LG:~~20,442~~0 DV: ~~5,283~~0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The amount of each fossil fuel is automatically daily weighted with the weight totalizer of the bin and cross-checked with the delivery and inventory. ISO 9001:2000.
Any comment:	None

Data / Parameter:	$Q_{FF,BA\ heavy\ oil}$
Data unit:	Tonne
Description:	Quantity of fossil fuel (heavy oil) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL: 1,021 LG:2,232 DV:480
Justification of the choice of data or description of measurement methods and procedures actually applied :	Daily flowmeter readings and cross check with the delivery and inventory. ISO 9001:2000.
Any comment:	None

Data / Parameter:	$Q_{FF,BA\ light\ oil}$
Data unit:	Tonne

Description:	Quantity of fossil fuel (light oil) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:72 LG:0 DV:0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Daily flowmeter readings and cross check with the delivery and inventory. ISO 9001:2000.
Any comment:	None

Data / Parameter:	$\mathbf{Q_{FF,BA\ \ waste\ oil}}$
Data unit:	Tonne
Description:	Quantity of fossil fuel (waste oil) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:0 LG:82 DV:0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Daily flowmeter readings and cross check with the delivery and inventory. ISO 9001:2000.
Any comment:	None

Data / Parameter:	$\mathbf{Q_{FF,BA\ \ industrial\ waste\ originating\ from\ fossil\ fuel}}$
Data unit:	Tonne
Description:	Quantity of fossil fuel (industrial waste originating from fossil fuel) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:2,255 LG:0 DV:0
Justification of the choice of data or description of measurement methods and procedures actually applied :	The amount of each fossil fuel is weighted by batch and cross check with the delivery. ISO 9001:2000.
Any comment:	None

Data / Parameter:	$\mathbf{HV_{FF\ \ coal}}$
Data unit:	TJ/tonne
Description:	Lower heating value of fossil fuel (coal) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:0.025 LG:0.026 DV:0.024
Justification of the choice of data or	Laboratory analysis cross check with supplier and third party laboratory every delivery. A weighted average is computed.

description of measurement methods and procedures actually applied :	ISO 9001:2000.
Any comment:	None

Data / Parameter:	**$HV_{FF\ anthracite}$**
Data unit:	TJ/tonne
Description:	Lower heating value of fossil fuel (anthracite) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:0.027 LG:0.027 DV:-
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory analysis cross check with supplier and third party laboratory every delivery. ISO 9001:2000.
Any comment:	None

Data / Parameter:	**$HV_{FF\ petcoke}$**
Data unit:	TJ/tonne
Description:	Lower heating value of fossil fuel (petcoke) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:- LG:~~0.034~~ DV:~~0.033~~
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory analysis cross check with supplier and third party laboratory every delivery. ISO 9001:2000.
Any comment:	None

Data / Parameter:	**$HV_{FF\ heavy\ oil}$**
Data unit:	TJ/tonne
Description:	Lower heating value of fossil fuel (heavy oil) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:0.040 LG:0.038 DV:0.039
Justification of the choice of data or description of measurement methods and procedures actually applied :	Supplier laboratory analysis every delivery.
Any comment:	None

Data / Parameter:	$HV_{FF\ light\ oil}$
Data unit:	TJ/tonne
Description:	Lower heating value of fossil fuel (light oil) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:0.038 LG:- DV:-
Justification of the choice of data or description of measurement methods and procedures actually applied :	Supplier laboratory analysis every delivery.
Any comment:	None

Data / Parameter:	$HV_{FF\ waste\ oil}$
Data unit:	TJ/tonne
Description:	Lower heating value of fossil fuel (waste oil) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL: - LG:0.035 DV:-
Justification of the choice of data or description of measurement methods and procedures actually applied :	Supplier laboratory analysis cross check with third party laboratory every delivery. ISO 9001:2000.
Any comment:	None

Data / Parameter:	$HV_{FF\ industrial\ waste\ originating\ from\ fossil\ fuel}$
Data unit:	TJ/tonne
Description:	Lower heating value of fossil fuel (industrial waste originating from fossil fuel) used in the baseline
Source of data used:	Annual technical report
Value applied:	BL:0.016 LG:- DV:-
Justification of the choice of data or description of measurement methods and procedures actually applied :	Third party laboratory every delivery. A weighted average is computed. ISO 9001:2000.
Any comment:	None

Data / Parameter:	EE_{FF}
Data unit:	tCO_2/TJ
Description:	Weighted average annual CO2 emission factor for the fossil fuel that would have been consumed in the baseline
Source of data used:	Annual technical report

Value applied:	BL:96.29 LG:95.95 DV:96.40
Justification of the choice of data or description of measurement methods and procedures actually applied :	Specific CO_2 emission factor from each fossil fuels come from IPCC value (2006). The weighted average is computed. ISO 9001:2000.
Any comment:	None

Data / Parameter:	**HC_{FF}**
Data unit:	TJ/tClinker
Description:	Specific fuel consumption in the baseline
Source of data used:	Annual technical report
Value applied:	BL:0.00324 LG:0.00334 DV:0.00331
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is computed. The amount of each fuel is weighted and cross-checked with the amount bought. The lower heating value is fixed by laboratory analysis. ISO 9001:2000.
Any comment:	None

B.6.3 Ex-ante calculation of emission reductions:

>>

Step 1. Project heat input from alternative fuel

$HI_{AF} = \Sigma Q_{AF} \times HV_{AF}$

Where:

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/tonne fuel).

BL	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
$Q_{AF\_biomass}$	34,024	45,532	68,589	68,589	68,589	68,589	68,589	68,589	68,589	68,589	68,589
$HV_{AF\_biomass}$	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
$Q_{AF\_sorted\ MSW}$	6,239	9,392	15,721	15,721	15,721	15,721	15,721	15,721	15,721	15,721	15,721
$HV_{AF\_sorted\ MSW}$	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
HI_{AF}	522	716	1,107	1,107	1,107	1,107	1,107	1,107	1,107	1,107	1,107

LG	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
$Q_{AF\_biomass}$ (rice husk)	18,617	37,424	56,449	56,449	56,449	56,449	56,449	56,449	56,449	56,449	56,449
$HV_{AF\_biomass}$ (rice husk)	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Q_{AF_sorted} MSW	5,121	7,720	7,763	7,763	7,763	7,763	7,763	7,763	7,763	7,763	7,763
HV_{AF_sorted} MSW	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
HI_{AF}	315	589	820	820	820	820	820	820	820	820	820

DV	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
$Q_{AF\_biomass}$ (rice husk)	15,373	30,907	46,598	46,598	46,598	46,598	46,598	46,598	46,598	46,598	46,598
$HV_{AF\_biomass}$ (rice husk)	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Q_{AF_sorted} MSW	4,228	6,376	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408
HV_{AF_sorted} MSW	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
HI_{AF}	260	486	677	677	677	677	677	677	677	677	677

Step 2. Estimation of the project specific moisture "penalty"

$MP_y = C_{Pr,y} \times (HC_{AF} - HC_{FF})$

Where:
MP_y = moisture penalty (TJ/yr) for year y
$C_{Pr,y}$ = is the clinker production for year y
HC_{AF} = is the specific fuel consumption on project case (TJ/tClinker) in year y
HC_{FF} = is the specific fuel consumption in the baseline when only fossil fuel is used, in TJ/tClinker.

BL	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017-8
MP_y	35.052	55.236	78.784	78.784	78.784	78.784	78.784	78.784	78.784	78.784
HC_{AF}	0.00326	0.00328	0.00329	0.00329	0.00329	0.00329	0.00329	0.00329	0.00329	0.00329
HC_{FF}	0.00264									

LG	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017-8
MP_y	24.228	45.391	73.840	71.563	71.563	71.563	71.563	71.563	71.563	71.563
HC_{AF}	0.00335	0.00337	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339	0.00339
HC_{FF}	0.003337									

DV	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017-8

MP_y	19.299	38.772	57.974	57.974	57.974	57.974	57.974	57.974	57.974	57.974
HC_{AF}	0.00333	0.00334	0.00336	0.00336	0.00336	0.00336	0.00336	0.00336	0.00336	0.00336
HC_{FF}	0.00331									

Step 3 GHG emissions from the use of alternative fuels in kilns:

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

Where:
AF_{GHG} = GHG emissions from alternative fuels (tCO2e/yr)
Q_{AF} = monitored alternative fuels input in clinker production (tonnes/yr).
HV_{AF} = heating value(s) of the alternative fuel(s) used (TJ/tonne fuel).
EF_{AF} = emission factor(s) of alternative fuel(s) used (tCO_2e/TJ).

CO_2 emissions from burning biomass residues are CO_2-neutral assuming that the generation of the biomass residues occurs independently of the project activity.

CO_2 emissions from waste originating from fossil sources in the specific case sorted MSW could be CO_2 neutral if it can be clearly demonstrated that the heat would not be used for energy purposes without the project activity.
The heating value is estimated today at 0.02TJ/t (lab analysis shown during validation). It will be reviewed when receiving sorted MSW. The IPCC 2006 estimates the emission factor of municipal solid waste (non biomass fraction) at 91.7 tCO2/TJ and tyres at 143tCO2/TJ. In order to be conservative an estimation of the potential emission from sorted MSW has been calculates with 143t CO2/TJ in the table below.

	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017-8**
BL	15,702	23,639	39,567	39,567	39,567	39,567	39,567	39,567	39,567	39,567
LG	12,887	19,430	19,538	19,538	19,538	19,538	19,538	19,538	19,538	19,538
DV	10,642	16,046	16,128	16,128	16,128	16,128	16,128	16,128	16,128	16,128

Step 4 Baseline GHG emissions from the fossil fuel(s) displaced by the alternative fuel(s)

$FF_{GHG} = [(Q_{AF} \times HV_{AF}) - MP_{total}] \times EF_{FF}$

Where:
FF_{GHG} = GHG emissions from fossil fuels displaced by the alternatives (tCO_2/yr)
$Q_{AF} \times HV_{AF}$ = total actual heat provided by all alternative fuels (TJ/yr)
MP_{total} = total moisture penalty (TJ/yr)
EF_{FF} = emissions factor(s) for fossil fuel(s) displaced (tCO_2/TJ).

EF_{FF} is the estimated baseline value and would be the lowest of the following CO2 emission factors:
- the weighted average annual CO2 emission factor for the fossil fuel(s) consumed and monitored ex ante during the year before the validation,

- the weighted average annual CO2 emission factor for the fossil fuel(s) consumed and monitored during the corresponding verification period (e.g. the period during which the emission reductions to be certified have been achieved),
- the weighted average annual CO2 emission factor for the fossil fuel(s) that would have been consumed according to the baseline scenario determined in section 1 and 2 of the "Additionality and baseline scenario selection".

For the estimation of the present calculation, the weighted average annual CO2 emission factor for the fossil fuels consumed and monitored ex ante during the year before the validation has been used. This value is also the weighted average annual CO2 emission factor for the fossil fuels that would have been consumed according to the baseline scenario.

BL	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
EF_{FF}	95.09	95.09	95.09	95.09	95.09	95.09	95.09	95.09	95.09	95.09	95.09
FF_{GHG}	**46,261**	**62,863**	**97,749**	**97,749**	**97,749**	**97,749**	**97,749**	**97,749**	**97,749**	**97,749**	**97,749**

2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
94,~~69~~33	**94,33~~94,69~~**	**94,33~~94,69~~**	**94,33~~94,69~~**	**94,33~~94,69~~**	**94,33~~94,69~~**	**94,33~~94,69~~**	**94,33~~94,69~~**	**94,33~~94,69~~**	**94,33~~94~~**
27,~~573~~534	**51,~~452~~151**	**70,~~632~~557**	**70,557~~70,847~~**	**70,557~~70,847~~**	**70,557~~70,847~~**	**70,557~~70,847~~**	**70,557~~70,847~~**	**70,557~~70,847~~**	**70,557~~70~~ ~~7~~**

2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
95.~~22~~08	**95.08~~95.22~~**	**95.08~~95.22~~**	**95.08~~95.22~~**	**95.08~~95.22~~**	**95.08~~95.22~~**	**95.08~~95.22~~**	**95.08~~95.22~~**	**95.08~~95.22~~**	**95.08~~95~~**
23,~~964~~903	**42,~~610~~518**	**58,~~919~~801**	**58,801~~58,919~~**	**58,801~~58,919~~**	**58,801~~58,919~~**	**58,801~~58,919~~**	**58,801~~58,919~~**	**58,801~~58,919~~**	**58,801~~58~~ ~~9~~**

Step 5. GHG emissions due to on-site transportation and drying of alternative fuels

$$OT_{GHG} = OF_{AF} \times (VEF\_CO_2 + VEF\_CH_4 \times GWP\_CH_4/1000 + VEF\_N_2O \times GWP\_N_2O/1000) + (FD \times FD\_HV \times VEF_D) + OP_{AF} \times EF_{op}$$

Where:

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),
VEF_CO_2	= CO_2 emission factor for the transportation fuel (tCO_2/tonne),
VEF_CH_4	= CH_4 emission factor for the transportation fuel (kg CH_4/tonne),
VEF_N_2O	= N_2O emission factor for the transportation fuel (kg N_2O/tonne),
GWP_CH_4	= global warming potential for CH_4 (21),
GWP_N_2O	= global warming potential for N_2O (310),
FD	= fuel used for drying alternative fuels (t/yr),
FD_HV	= heating value of the fuel used for drying (TJ/t fuel)

VEF_D = emission factor of the fuel used for drying (tCO_2/TJ)
OP_{AF} = Power consumption in transporting alternative fuel (MWh)
EF_{op} = CO_2 emission factor due to power generation (tCO_2/MWh)

The GHG emission generated by the use of conveyors to carry the alternative fuels is computed in this section. The CO_2 emission factor due to power generation (tCO_2/MWh) is based on the tool to calculate the emission factor for an electricity system - Annex 12 EB 35 (step 6 combined margin). The data stems from the official guidebook CDM baseline construction for the electricity grids in the Philippines which has been published in 2006. No more recent data were available when writing the latest version of the PDD. The data will be updated during verification.

BL	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
OF_{AF}	35.72	47.81	72.02	72.02	72.02	72.02	72.02	72.02	72.02	72.02	72.02
FD	0	0	0	0	0	0	0	0	0	0	0
OP_{AF}	347	473	726	726	726	726	726	726	726	726	726
EF_{op}	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531	0.531
OT_{GHG}	**299**	**404**	**616**	**616**	**616**	**616**	**616**	**616**	**616**	**616**	**616**

LG	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
OF_{AF}	19.55	39.30	59.27	59.27	59.27	59.27	59.27	59.27	59.27	59.27	59.27
FD	0	0	0	0	0	0	0	0	0	0	0
OP_{AF}	204	389	553	553	553	553	553	553	553	553	553
EF_{op}	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453
OT_{GHG}	**155**	**302**	**440**	**440**	**440**	**440**	**440**	**440**	**440**	**440**	**440**

DV	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
OF_{AF}	16.14	32.45	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93	48.93
FD	0	0	0	0	0	0	0	0	0	0	0
OP_{AF}	169	321	456	456	456	456	456	456	456	456	456
EF_{op}	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453
OT_{GHG}	**128**	**249**	**364**	**364**	**364**	**364**	**364**	**364**	**364**	**364**	**364**

Step 6. Emission savings from reduction of on-site transport of fossil fuels

$OT\_GHG_{FF} = OF_{FF} \times EF_{T\ CO2e}$

Where:
$OT\text{-}GHG_{FF}$ = 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)

For conservativeness, the emissions savings are not computed.

Leakage

Step 1. CH_4 emissions due to biomass residues that would be burned in the absence of the project

$BB_{CH4} = Q_{AF\text{-}B} \times BCF \times CH_4F \times CH_4/C \times GWP\_CH_4$

Where:

BB_{CH4} = GHG emissions due to burning of biomass residues used as alternative fuel (tCO_2e/yr)
$Q_{AF\text{-}B}$ = amount of biomass residues used as alternative fuel that would have been burned in the open field in the absence of the project (t/yr)
BCF = carbon fraction of the biomass residue (tC/t biomass) estimated on basis of laboratory analysis (0.30)
CH_4F = fraction of the carbon released as CH_4 in open air burning (expressed as a fraction)
CH_4/C = mass conversion factor for carbon to methane (16 tCH_4/12 tC)
GWP_CH_4 = global warming potential of methane (21).

Since the Republic Act 9003 or the Ecological Solid Waste Management Act of 2000 prohibits the open burning of all agricultural waste in open air, the related GHG emission reductions are not claimed.

Step 2. Calculate the CH_4 emissions due to anaerobic decomposition of biomass residues at landfills

$LW_{CH4,y} = \varphi \times 16/12 \times F \times DOC_f \times MCF \times \Sigma\,\Sigma QAFL_{j,x} \times DOC_j \times (1-e^{-kj}) \times e^{-kj\,(y-x)} \times NFL \times GWP_{CH4}$

Where:

$LW_{CH4,y}$ = Baseline GHG emissions due to anaerobic decomposition of biomass residues in landfills during the year y (tCO2e/yr)
$QAFL_{j,x}$ = amount of biomass residues of type j used as alternative fuel that would be landfilled in the absence of the project in the year x (t/yr)
Φ = Model correction factor (default 0.9) to correct for the model-uncertainties
F = Fraction of methane in the landfill gas (default value 0.5)
DOC_j = Percent of degradable organic carbon (by weight) in the biomass type j
DOC_f = Fraction of DOC dissimilated to landfill gas (default value 0.77)
MCF = Methane Correction Factor (fraction) (default value 0.4 for unmanaged site)
k_j = Decay rate for the biomass residue stream type j (default value 0.023)
j = is biomass residue type distinguished into the biomass residue categories
x = year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year for which emissions are calculated (x=y)
y = year for which LFG emissions are calculated
NFL = the non-flared portion of the landfill gas produced (%) (100%)
GWP_{CH4} = Global warming potential valid for the relevant commitment period

For conservativeness, the related GHG reductions are not claimed.

Step 3. Calculate emissions from off-site transport of alternative and fossil fuels

$LK_{trans} = LK_{AF} - LK_{FF}$
$LK_{AF} = (Q_{AF}/CT_{AF}) \times D_{AF} \times EF_{CO2e}/1000$
$LK_{FF} = (RQ_{FF}/CT_{FF}) \times D_{FF} \times EF_{CO2e}/1000$

Where:
LK_{trans} = leakage from transport of alternative fuel less leakage due to reduced transport of fossil fuels (tCO_2/yr)
LK_{AF} = leakage resulting from transport of alternative fuel (tCO_2/yr)
LK_{FF} = leakage due to reduced transport of fossil fuels (tCO_2/yr)
Q_{AF} = quantity of alternative fuels (tonnes)
CT_{AF} = average truck or ship capacity (tonnes/truck or ship)
D_{AF} = average round-trip distance between the alternative fuels supply sites and the cement plant sites (km/truck or ship)
RQ_{FF} = quantity of fossil fuel (tonnes) that is reduced due to consumption of alternative fuels estimated as:
CT_{FF} = average truck or ship capacity (tonne /truck or ship)
D_{FF} = average round-trip distance between the fossil fuels supply sites and the cement plant sites (km/truck or nautical mile/ship)
EF_{CO2e} = emission factor from fuel use due to transportation (kg CO_2e/km) estimated as:
$EF_{CO2e} = EF_{T\ CO2} + (EF_{T\ CH4} \times 21) + (EF_{T\ N2O} \times 310)$

Where:
$EF_{T\ CO2}$ = emission factor of CO_2 in transport (kg CO_2/km)
$EF_{T\ CH4}$ = emission factor of CH_4 in transport (kg CH_4/km)
$EF_{T\ N2O}$ = emission factor of N_2O in transport (kg N_2O/km)
21 and 310 are the Global Warming Potential (GWP) of CH_4 and N_2O respectively

To be conservative, leakage due to reduced transport of fossil fuel is not taken into account.

BL	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
$Q_{AF\_biomass}$	34,024	45,532	68,589	68,589	68,589	68,589	68,589	68,589	68,589	68,589	68,589
$CT_{AF\_biomass}$	10	10	10	10	10	10	10	10	10	10	10
$D_{AF\_biomass}$	80	80	80	80	80	80	80	80	80	80	80
$LK_{AF\_biomass}$	302	404	608	608	608	608	608	608	608	608	608
$Q_{AF\_sorted\ MSW}$	6,239	9,392	15,721	15,721	15,721	15,721	15,721	15,721	15,721	15,721	15,721
$CT_{AF\_sorted\ MSW}$	5	5	5	5	5	5	5	5	5	5	5
$D_{AF\_sorted\ MSW}$	80	80	80	80	80	80	80	80	80	80	80
$LK_{AF\_sorted\ MSW}$	111	166	279	279	279	279	279	279	279	279	279
LK_{AF}	412	570	887	887	887	887	887	887	887	887	887
$\mathbf{LK_{trans}}$	412	570	887	887	887	887	887	887	887	887	887

LG	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
$Q_{AF\ biomass}$	18,617	37,424	56,449	56,449	56,449	56,449	56,449	56,449	56,449	56,449	56,449
$CT_{AF\ biomass}$	10	10	10	10	10	10	10	10	10	10	10
$D_{AF\ biomass}$	318	318	318	318	318	318	318	318	318	318	318
$LK_{AF\ biomass}$	656	1,318	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989
$Q_{AF\ sorted\ MSW}$	5,121	7,720	7,763	7,763	7,763	7,763	7,763	7,763	7,763	7,763	7,763
$CT_{AF\_sorted\ MSW}$	5	5	5	5	5	5	5	5	5	5	5
$D_{AF\ sorted\ MSW}$	160	160	160	160	160	160	160	160	160	160	160
$LK_{AF\_sorted\ MSW}$	182	274	275	275	275	275	275	275	275	275	275
LK_{AF}	837	1,592	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
$\mathbf{LK_{trans}}$	837	1,592	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264

DV	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
$Q_{AF\ biomass}$	15,373	30,907	46,598	46,598	46,598	46,598	46,598	46,598	46,598	46,598	46,598
$CT_{AF\ biomass}$	10	10	10	10	10	10	10	10	10	10	10
$D_{AF\ biomass}$	400	400	400	400	400	400	400	400	400	400	400
$LK_{AF\ biomass}$	681	1,370	2,065	2,065	2,065	2,065	2,065	2,065	2,065	2,065	2,065
$Q_{AF\_sorted\ MSW}$	4,228	6,376	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408	6,408
$CT_{AF\_sorted\ MSW}$	5	5	5	5	5	5	5	5	5	5	5
$D_{AF\_sorted\ MSW}$	40	40	40	40	40	40	40	40	40	40	40
$LK_{AF\_sorted\ MSW}$	37	57	57	57	57	57	57	57	57	57	57
LK_{AF}	719	1,426	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122
$\mathbf{LK_{trans}}$	719	1,426	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122

Step 4. Emissions from off-site drying (and preparing) of alternative fuels

$$GHG_{PAFO} = FD_{AFO} \times HV_{FDAFO} \times EFF_{DAFO} + PD_{AFO} \times EF_{pO}$$

Where:

GHG_{PAFO} = GHG emissions that could be generated during the preparation of alternative fuels outside the project site (tCO_2/yr)

FD_{AFO} = fuel used in drying of alternative fuels outside the project site (t/yr)

HV_{FDAFO} = heating value of fuel used for drying alternative fuels outside the project site (TJ /tonne)

EFF_{DAFO} = emission factor for the fuel used for drying of alternative fuels outside the project site (tCO_2/TJ)

PD_{AFO} = power consumption in drying the alternative fuels (MWh/yr) outside the project site

EF_{pO} = CO_2 emission factor due to power generation outside the project where the drying of alternative fuels takes place.

A small amount of the agricultural waste is shredded in Lugait and therefore PD_{AFO} is replaced by power consumption (MWh/yr) used to prepare the alternative fuels outside the project site.

Lugait	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
PD_{AFO}	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
EF_{pO}	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453	0.453
GHG_{PAFO}	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**

Emission Reductions

Total emission reductions are given by the following formula:

$$AF_{ER} = FF_{GHG} - AF_{GHG} - OT_{GHG} - LK_{trans} + OT\_GHGFF + BB_{CH4} + LW_{CH4,y} - GHG_{PAFO}$$

Where:

FF_{GHG} = GHG emissions from fossil fuels displaced by the alternatives (tCO_2/yr)

AF_{GHG} = GHG emissions from alternative fuels (tCO_2e/yr)

OT_{GHG} = GHG emissions from on-site transport and drying of alternative fuels (tCO_2e/yr)

LK_{trans} = leakage from transport of alternative fuel less leakage due to reduced transport of fossil fuels (tCO_2/yr)

OT-GHGFF = emissions from reduction of on-site transport of fossil fuels (tCO_2e)

BB_{CH4} = GHG emissions due to burning of biomass residue that is used as alternative fuel (tCO_2e/yr)

$LW_{CH4,y}$ = baseline GHG emissions due to anaerobic decomposition of biomass residues at landfills (tCO_2e/yr)

GHG_{PAFO} = GHG emissions that could be generated during the preparation of alternative fuels outside the project site (tCO_2/yr)

BL	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
FF_{GHG}	46,261	62,863	97,749	97,749	97,749	97,749	97,749	97,749	97,749	97,749	97,749
AF_{GHG}	0	0	0	0	0	0	0	0	0	0	0
OT_{GHG}	299	404	616	616	616	616	616	616	616	616	616
LKtrans	412	570	887	887	887	887	887	887	887	887	887
OT-GHG_{FF}	0	0	0	0	0	0	0	0	0	0	0
BB_{CH4}	0	0	0	0	0	0	0	0	0	0	0
$LW_{CH4,y}$	0	0	0	0	0	0	0	0	0	0	0
GHG_{PAFO}	0	0	0	0	0	0	0	0	0	0	0
AF_{ER}	**45,550**	**61,888**	**96,246**	**96,246**	**96,246**	**96,246**	**96,246**	**96,246**	**96,246**	**96,246**	**96,246**

LG	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
FF_{GHG}	27,~~573~~ **534**	51,~~452~~ **151**	70,~~632~~**5** **57**	**70,557**~~7~~ ~~0,847~~	**70,557**~~7~~ ~~0,847~~	**70,557** ~~70,847~~	**70,557** ~~70,847~~	**70,557** ~~70,847~~	**70,557** ~~70,847~~	**70,557** ~~70,847~~	**70,557** ~~70,847~~
AF_{GHG}	0	0	0	0	0	0	0	0	0	0	0
OT_{GHG}	155	302	440	440	440	440	440	440	440	440	440
LKtrans	837	1,592	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264	2,264
OT-GHG_{FF}	0	0	0	0	0	0	0	0	0	0	0
BB_{CH4}	0	0	0	0	0	0	0	0	0	0	0
$LW_{CH4,y}$	0	0	0	0	0	0	0	0	0	0	0
GHG_{PAFO}	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
AF_{ER}	**26,~~580~~ 541**	**49,~~558~~ 257**	**67,~~927~~8 53**	**67,853~~6~~ ~~8,143~~**	**67,853~~6~~ ~~8,143~~**	**67,853 ~~68,143~~**	**67,853 ~~68,143~~**	**67,853 ~~68,143~~**	**67,853 ~~68,143~~**	**67,853 ~~68,143~~**	**67,853 ~~68,143~~**

DV	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
FF_{GHG}	22,~~964~~903	42,~~610~~518	58,~~919~~801	58,801~~58,919~~	58,801~~58,919~~	58,801 ~~58,919~~	58,801 ~~58,919~~	58,801 ~~58,919~~	58,801 ~~58,919~~	58,801 ~~58,919~~	58,801 ~~58,919~~
AF_{GHG}	0	0	0	0	0	0	0	0	0	0	0
OT_{GHG}	128	249	364	364	364	364	364	364	364	364	364
LKtrans	719	1,426	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122	2,122
OT-GHG_{FF}	0	0	0	0	0	0	0	0	0	0	0
BB_{CH4}	0	0	0	0	0	0	0	0	0	0	0
$LW_{CH4,y}$	0	0	0	0	0	0	0	0	0	0	0
GHG_{PAFO}	0	0	0	0	0	0	0	0	0	0	0
AF_{ER}	**22,~~117~~056**	**40,~~934~~842**	**56,~~434~~316**	**56,316~~56,434~~**	**56,316~~56,434~~**	**56,316 ~~56,434~~**	**56,316 ~~56,434~~**	**56,316 ~~56,434~~**	**56,316 ~~56,434~~**	**56,316 ~~56,434~~**	**56,316 ~~56,434~~**

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

>>

Year	**Estimation of project activity emissions (tonnes of CO2 e)**	**Estimation of baseline emissions (tonnes of CO2 e)**	**Estimation of leakage (tonnes of CO2 e)**	**Estimation of overall emission reductions (tonnes of CO2 e)**
Year A	738	121,~~851~~629	-2,643	118,~~470~~248
Year B	1,149	18~~6,248~~5,938	-4,290	180,~~808~~499
Year C	1,420	227,~~389~~107	-5,272	220,~~697~~414
Year D	1,420	227,107~~227,515~~	-5,272	220,414~~220,822~~
Year E	1,420	227,107~~227,515~~	-5,272	220,414~~220,822~~
Year F	1,420	227,107~~227,515~~	-5,272	220,414~~220,822~~
Year G	1,420	227,107~~227,515~~	-5,272	220,414~~220,822~~
Year H	1,420	227,107~~227,515~~	-5,272	220,414~~220,822~~
Year I	1,420	227,107~~227,515~~	-5,272	220,414~~220,822~~
Year J	1,420	227,107~~227,515~~	-5,272	220,414~~220,822~~
Total (tonnes of CO_2e)	13,249	2,~~128~~124,~~092~~422	-49,112	2,~~065~~062,~~731~~061

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

B.7.1 Data and parameters monitored:

All data used to calculate the project activity emissions reduction are available at verification stage. The values of data applied for each year of the crediting period are reported either automatically into the SAP system (global computerized system) or recorded in a logbook. Depending on the value, the record is done in continuous, daily or monthly. The measurement interval is mentioned in the table below under the description of the measurement method. Most of the data are then reported in the Annual Technical Report (ATR), which is the official document controlled by the corporate. Any additional information which is not in the ATR will be collected in a logbook. In the case of any erroneous measurement, a note will be done in the logbook and/or will be reported in the ATR under the section "comment".

The values which stem from external sources (for example values coming from IPCC) will be updated according to the source's publication. The data stemming from HPHI transport database and from geographical parameters will be updated, if needed, throughout the duration of the project activity.

All HPHI cement plants are ISO 9001:2000 and ISO 14001 accredited. Therefore, the uncertainty level of the data is relatively low. The quality control (QC) and quality assurance (QA) also includes cross-checking of data from other reports within the Holcim Group. The reliability and accuracy of the data depends on the equipment used. The equipment are subject to regular maintenance and calibration and can be validated during the verification stage. The monitoring data will be kept for at least 2 years after the end of the crediting period.

Most of the values applied for the purpose of calculating expected emission reductions are defined in section B.6.3 Ex-ante calculation of emission reductions.

Step 1
Monitoring heat input from alternative fuels

<table>
<tr><td>Data / Parameter:</td><td>$Q_{AF\ biomass}$</td></tr>
<tr><td>Data unit:</td><td>Tonne</td></tr>
<tr><td>Description:</td><td>Quantity of alternative fuel (rice husk)</td></tr>
<tr><td>Source of data to be used:</td><td>Annual technical report and project activity monitoring report</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td><table>
<tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr>
<tr><td>2008</td><td>34,024</td><td>18,617</td><td>15,373</td></tr>
<tr><td>2009</td><td>45,532</td><td>37,424</td><td>30,907</td></tr>
<tr><td>2010-2018</td><td>68,589</td><td>56,449</td><td>46,598</td></tr>
</table></td></tr>
<tr><td>Description of measurement methods</td><td>The amount of each product is weighed on delivery on the truck weighing scale (SAP) and cross-checked with the supplier's bills.</td></tr>
</table>

and procedures to be applied:	In the next years (potentially 2008-09), the amount of each product will most likely be weighed in the same manner and cross-checked with the delivery (SAP).
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	Any other biomass that could be used during the project activity will be monitored the same way than the rice husk.

Data / Parameter:	$Q_{AF\ sorted\ MSW}$
Data unit:	Tonne
Description:	Quantity of alternative fuel (sorted municipal solid waste)
Source of data to be used:	Annual technical report and project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr><tr><td>2008</td><td>6,239</td><td>5,121</td><td>4,228</td></tr><tr><td>2009</td><td>9,392</td><td>7,720</td><td>6,376</td></tr><tr><td>2010-2018</td><td>15,721</td><td>7,763</td><td>6,408</td></tr></table>
Description of measurement methods and procedures to be applied:	The amount of each product is weighed on delivery on the truck weighing scale (SAP) and cross-checked with the supplier's bills. In the next years (potentially 2008-09), the amount of each product will most likely be weighed in the same manner and cross-checked with the delivery (SAP).
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	The common practice (burn without energy purpose) will be checked and if it is not the case at the time of verification , the related emissions will be taken into account (see page 27 of the PDD).

Data / Parameter:	$HV_{AF\ biomass}$
Data unit:	TJ/tonne fuel
Description:	Lower heating value of the alternative fuels (rice husk)
Source of data to be used:	Annual technical report and project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr><tr><td>2008-2018</td><td>0.012</td><td>0.012</td><td>0.012</td></tr></table>
Description of measurement methods and procedures to be applied:	The lower heating value is measured by laboratory analysis using a bomb calorimeter and result is cross-checked with a third party. Monthly analysis will be conducted. The present estimation of the emission factor of rice husk has been determined using chemical analysis by a third party accredited laboratory.
QA/QC procedures to be applied:	ISO 9001:2000

Any comment:	None

Data / Parameter:	**$HV_{AF\ sorted\ MSW}$**
Data unit:	TJ/tonne fuel
Description:	Lower heating value of the alternative fuels (sorted MSW)
Source of data to be used:	Annual technical report and project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao: 2008-2018 / 0.02 / 0.02 / 0.02
Description of measurement methods and procedures to be applied:	The lower heating value is determined by laboratory analysis using a bomb calorimeter and result is cross-checked with a third party. Monthly analysis will be conducted. The present estimation of the emission factor of sorted MSW has been determined using chemical analysis by a third party accredited laboratory.
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Years	Bulacan	Lugait	Davao
2008-2018	0.02	0.02	0.02

Data / Parameter:	**HI_{AF}**
Data unit:	TJ/y
Description:	Heat input from alternative fuels
Source of data to be used:	Annual technical report and project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See table below
Description of measurement methods and procedures to be applied:	Compute
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Years	Bulacan	Lugait	Davao
2008	522	315	260
2009	716	589	486
2010-2018	1,107	820	677

Step 2
Monitoring project specific moisture penalty

Data / Parameter:	**$C_{Pr,y}$**
Data unit:	Tonne

Description:	Annual clinker production
Source of data to be used:	Annual technical report and project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See calculation database
Description of measurement methods and procedures to be applied:	Quantity of clinker produced. Weighed and cross-checked with the clinker content and merchandise sold.
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Data / Parameter:	**MP_y**
Data unit:	TJ/y
Description:	Moisture penalty for year y
Source of data to be used:	Annual technical report and project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr><tr><td>2008</td><td>35.052</td><td>24.228</td><td>19.299</td></tr><tr><td>2009</td><td>55.236</td><td>45.391</td><td>38.772</td></tr><tr><td>2010-2018</td><td>78.784</td><td>73.840</td><td>57.974</td></tr></table>
Description of measurement methods and procedures to be applied:	Compute with fuel mix optimizer tool.
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Data / Parameter:	**$HC_{AF,y}$**
Data unit:	TJ/t clinker
Description:	Specific fuel consumption in project case in year y
Source of data to be used:	Annual technical report and project activity monitoring report

<table>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td><table><tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr><tr><td>2008</td><td>0.00326</td><td>0.00335</td><td>0.00333</td></tr><tr><td>2009</td><td>0.00328</td><td>0.00337</td><td>0.00334</td></tr><tr><td>2010-2018</td><td>0.00329</td><td>0.00339</td><td>0.00336</td></tr></table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Compute</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>ISO 9001:2000</td></tr>
<tr><td>Any comment:</td><td>None</td></tr>
</table>

Step 3
Monitoring GHG emissions from the use of alternative fuels in kilns

<table>
<tr><td>Data / Parameter:</td><td>EF_{AF}</td></tr>
<tr><td>Data unit:</td><td>tCO2e/TJ</td></tr>
<tr><td>Description:</td><td>Emission factor of alternative fuel used</td></tr>
<tr><td>Source of data to be used:</td><td>Annual technical report and project activity monitoring report</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td><table><tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr><tr><td>2008-2018</td><td>0</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>IPCC</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>ISO 9001:2000</td></tr>
<tr><td>Any comment:</td><td>GHG emissions from alternative fuels are zero in the proposed project activity.
Waste oil and industrial waste originating from fossil fuel are calculated with the fossil fuel emissions (emissions are taken into account) since they are integrated in the baseline.
The common practice (burn without energy purpose) will be checked and if it is not the case at the time of verification , the related emissions will be taken into account (see page 27 of the PDD).</td></tr>
</table>

Data / Parameter:	**AF_{GHG}**
Data unit:	tCO2e/y
Description:	GHG emissions from alternative fuels

<table>
<tr><td>Source of data to be used:</td><td>Annual technical report and project activity monitoring report</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td><table><tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr><tr><td>2008-2018</td><td>0</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>-</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>ISO 9001:2000</td></tr>
<tr><td>Any comment:</td><td>GHG emissions from alternative fuels are zero in the proposed project activity. Waste oil and industrial waste originating from fossil fuel are calculated with the fossil fuel emissions (emissions are taken into account) since they are integrated in the baseline.</td></tr>
</table>

Step 4
Monitoring baseline GHG emissions from the fossil fuels displaced by the alternative fuels

<table>
<tr><td>Data / Parameter:</td><td>$EE_{FF,y}$</td></tr>
<tr><td>Data unit:</td><td>tCO2/TJ</td></tr>
<tr><td>Description:</td><td>Weight average annual CO2 emission factor for fossil fuel consumed and monitored during the corresponding verification period</td></tr>
<tr><td>Source of data to be used:</td><td>Annual technical report and project activity monitoring report</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td><table><tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr><tr><td>2008-2018 (estimation)</td><td>95.09</td><td>94.~~69~~33</td><td>95.~~22~~08</td></tr></table>The EF_{FF} would be the lowest CO2 emission factors between
- the one above which is the weighted average annual CO2 emission factor for the fossil fuels consumed and monitored during the 3 years prior to the project and
-the weighted average annual CO2 emission factor for the fossil fuels consumed and monitored during the corresponding verification period (e.g. the period during which the emission reductions to be certified have been achieved)</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Compute</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>ISO 9001:2000</td></tr>
</table>

Any comment:	None

Step5
Monitoring GHG emissions due to on site transportation and drying of alternative fuels

Data / Parameter:	**$OF_{AF\ biomass}$**
Data unit:	t/y
Description:	Transportation fuel used for alternative fuels (rice husk) on site during the year
Source of data to be used:	Annual technical report and project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao 2008: 35.72 / 19.55 / 16.14 2009: 47.81 / 39.30 / 32.45 2010-2018: 72.02 / 59.27 / 48.93
Description of measurement methods and procedures to be applied:	The amount of fuel (litre) used per day will be reported by the gasoline station for some days and an estimation will be done over the year (inside the plant).
QA/QC procedures to be applied:	IS0 9002
Any comment:	Rice husk is handled with a bobcat to the hopper.

Years	Bulacan	Lugait	Davao
2008	35.72	19.55	16.14
2009	47.81	39.30	32.45
2010-2018	72.02	59.27	48.93

Data / Parameter:	**$OT_{GHG\ transportation}$**
Data unit:	tCO2/y
Description:	GHG emissions from on site transport of alternative fuels
Source of data to be used:	Project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao 2008: 299 / 155 / 128 2009: 404 / 302 / 249 2010-2018: 616 / 440 / 364
Description of measurement methods and procedures to be applied:	Compute
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Years	Bulacan	Lugait	Davao
2008	299	155	128
2009	404	302	249
2010-2018	616	440	364

Data / Parameter:	**OP_{AF}**

Data unit:	MWh/y
Description:	Electricity consumption from on site alternative fuels transportation with conveyors.
Source of data to be used:	Project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao: 2008: 347 / 204 / 169 2009: 473 / 389 / 321 2010-2018: 726 / 553 / 457
Description of measurement methods and procedures to be applied:	Specific daily details are measured from a meter and either automatically recorded or written in a logbook depending on the installations. In any case to be conservative, the maximum theoretical (capacity of the motors) value could also be used.
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Years	Bulacan	Lugait	Davao
2008	347	204	169
2009	473	389	321
2010-2018	726	553	457

Data / Parameter:	$\mathbf{EF_P}$
Data unit:	tCO2/ MWh
Description:	Emission factor for electricity used
Source of data to be used:	Tool to calculate the emission factor for an electricity system - Annex 12 EB35 (step 6 combined margin) using published data stemming from the CDM baseline construction for the electricity grids in the Philippines, version 2006.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Bulacan (Luzon -Viyasay grid): 0.531 tCO_2/MWh Lugait and Davao (Mindanao grid): 0.453 tCO_2/MWh
Description of measurement methods and procedures to be applied:	None
QA/QC procedures to be applied:	none
Any comment:	None

Data / Parameter:	$\mathbf{OT_{GHG\ conveyor}}$
Data unit:	tCO2/y
Description:	GHG emissions from on site electricity consumption for alternative fuels transportation with conveyors.
Source of data to be used:	Project activity monitoring report
Value of data applied	

for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao 2008: 184 / 93 / 76 2009: 251 / 176 / 145 2010-2018: 386 / 251 / 207
Description of measurement methods and procedures to be applied:	Compute
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Years	Bulacan	Lugait	Davao
2008	184	93	76
2009	251	176	145
2010-2018	386	251	207

Data / Parameter:	**OT_{GHG}**
Data unit:	tCO2/y
Description:	GHG emissions from on site transport and drying of alternative fuels
Source of data to be used:	Project activity monitoring report
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao 2008: 299 / 155 / 128 2009: 404 / 302 / 249 2010-2018: 616 / 440 / 364
Description of measurement methods and procedures to be applied:	Compute
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Years	Bulacan	Lugait	Davao
2008	299	155	128
2009	404	302	249
2010-2018	616	440	364

Step 6

Monitoring emission saving from reduction of on site transport of fossil fuels

Not computed for conservativeness.

Leakage

Step 1

Monitoring CH4 emissions due to biomass residues that would be burned in the absence of the project

Not computed for conservativeness.

Step 2
Monitoring CH4 emissions due to anaerobic decomposition of biomass residues at landfills
Not computed for conservativeness.

Step 3
Monitoring emissions from off-site transport of alternative and fossil fuels

Data / Parameter:	**$CT_{AF\ biomass}$**
Data unit:	Tonnes/truck
Description:	Average truck capacity (rice husk)
Source of data to be used:	Weighting post database (SAP) and transporters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao: 2008-2018 / 10 / 10 / 10
Description of measurement methods and procedures to be applied:	Weighted and cross-checked with bills.
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	none

Years	Bulacan	Lugait	Davao
2008-2018	10	10	10

Data / Parameter:	**$D_{AF\ biomass}$**
Data unit:	Km/truck
Description:	Maximum round trip distance between the alternative fuel supply sites (rice husk) and the cement plant sites
Source of data to be used:	Geographical data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao: 2008-2018 / 80 / 318 / 400
Description of measurement methods and procedures to be applied:	Geographical data cross-checked with transporters
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	Based on current suppliers, to be updated during verification.

Years	Bulacan	Lugait	Davao
2008-2018	80	318	400

<table>
<tr><td>Data / Parameter:</td><td>$LK_{AF\ biomass}$</td></tr>
<tr><td>Data unit:</td><td>tCO_2/y</td></tr>
<tr><td>Description:</td><td>Leakage resulting from transport of alternative fuel (rice husk)</td></tr>
<tr><td>Source of data to be used:</td><td>Project activity database</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>
<table>
<tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr>
<tr><td>2008</td><td>302</td><td>656</td><td>681</td></tr>
<tr><td>2009</td><td>404</td><td>1,318</td><td>1,370</td></tr>
<tr><td>2010-2018</td><td>608</td><td>1,989</td><td>2,065</td></tr>
</table>
</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Compute</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>ISO 9001:2000</td></tr>
<tr><td>Any comment:</td><td>none</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>$CT_{AF\ sorted\ MSW}$</td></tr>
<tr><td>Data unit:</td><td>Tonnes/truck</td></tr>
<tr><td>Description:</td><td>Average truck capacity (sorted MSW)</td></tr>
<tr><td>Source of data to be used:</td><td>Weighting post database (SAP) cross-checked with transporters</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions in section B.5</td><td>
<table>
<tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr>
<tr><td>2008-2018</td><td>5</td><td>5</td><td>5</td></tr>
</table>
</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>Weighed and cross-checked with bill.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>ISO 9001:2000</td></tr>
<tr><td>Any comment:</td><td>None</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>$D_{AF\ sorted\ MWS}$</td></tr>
<tr><td>Data unit:</td><td>Km/truck</td></tr>
<tr><td>Description:</td><td>Average round trip distance between the alternative fuels supply sites (sorted MSW) and the cement plant sites</td></tr>
<tr><td>Source of data to be used:</td><td>Geographical data</td></tr>
<tr><td>Value of data applied for the purpose of</td><td>
<table>
<tr><td>Years</td><td>Bulacan</td><td>Lugait</td><td>Davao</td></tr>
</table>
</td></tr>
</table>

calculating expected emission reductions in section B.5	2008-2018 | 80 | 160 | 40
Description of measurement methods and procedures to be applied:	Geographical data cross-checked with transporters
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Data / Parameter:	**$LK_{AF\ sorted\ MSW}$**
Data unit:	tCO_2/y
Description:	Leakage resulting from transport of alternative fuels (sorted MSW)
Source of data to be used:	Project activity database
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years | Bulacan | Lugait | Davao 2008 | 111 | 182 | 37 2009 | 166 | 274 | 57 2010-2018 | 279 | 275 | 57
Description of measurement methods and procedures to be applied:	Compute
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Data / Parameter:	**LK_{AF}**
Data unit:	tCO_2/y
Description:	Leakage resulting from transport of all alternative fuels
Source of data to be used:	Project activity database
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years | Bulacan | Lugait | Davao 2008 | 412 | 837 | 719 2009 | 570 | 1,592 | 1,426 2010-2018 | 887 | 2,264 | 2,122
Description of measurement methods and procedures to be applied:	Compute

QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Data / Parameter:	**LK_{trans}**
Data unit:	tCO_2/y
Description:	Leakage resulting from transport of alternative fuels less leakage due to reduced transport of fossil fuels
Source of data to be used:	Project activity database
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao 2008 / 412 / 837 / 719 2009 / 570 / 1,592 / 1,426 2010-2018 / 887 / 2,264 / 2,122
Description of measurement methods and procedures to be applied:	Compute
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	To be conservative, leakage due to reduction of transport of fossil fuels is not taken into account.

Step 4
Monitoring emissions from off site drying (or preparing) of alternatives fuels

Data / Parameter:	**$Q_{AF\ prepared\ off\ site}$**
Data unit:	tonne
Description:	Quantity of alternative fuels (rice husk) prepares off site
Source of data to be used:	Project activity database and suppliers database
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao 2008-2018 / 0 / 800 / 0
Description of measurement methods and procedures to be applied:	Weighting database (SAP) cross-checked with suppliers' bills
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	Only 1 supplier in Lugait is preparing (shredding) the materiel.

Data / Parameter:	**$PP_{AF\ \text{prepared off site}}$**
Data unit:	MWh/y
Description:	Electricity used for preparation of alternative fuel (rice husk) shreds off site
Source of data to be used:	Project activity database and suppliers database
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Years / Bulacan / Lugait / Davao: 2008-2018 / 0 / 0.2 / 0
Description of measurement methods and procedures to be applied:	Suppliers'electricity database on a monthly basis cross-check with suppliers' bills.
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	Only 1 supplier in Lugait is preparing the material.

Years	Bulacan	Lugait	Davao
2008-2018	0	0.2	0

Data / Parameter:	**EF_{Po}**
Data unit:	tCO_2/MWh
Description:	CO2 emission factor due to power generation
Source of data to be used:	Tool to calculate the emission factor for an electricity system - Annex 12 EB35 (step 6 combined margin) using published data stemming from the CDM baseline construction for the electricity grids in the Philippines, version 2006.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Bulacan (Luzon -Viyasay grid): 0.531 tCO_2/MWh Lugait and Davao (Mindanao grid): 0.453 tCO_2/MWh
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	-

Data / Parameter:	**GHG_{PAFO}**
Data unit:	tCO2/y
Description:	GHG emissions that could be generated during the preparation of alternative fuels outside the project
Source of data to be used:	Project activity database
Value of data applied for the purpose of	

Years	Bulacan	Lugait	Davao

calculating expected emission reductions in section B.5	2008-2018 | 0 | 0.09 | 0
Description of measurement methods and procedures to be applied:	Compute
QA/QC procedures to be applied:	ISO 9001:2000
Any comment:	None

Additional step: Biomass residues' reserves

Data / Parameter:	**Biomass residues**
Data unit:	type
Description:	Availability of a surplus of biomass residue
Source of data to be used:	Survey and/or study
Value of data applied for the purpose of calculating expected emission reductions in section B.5	-
Description of measurement methods and procedures to be applied:	Interview, contact and/or study.
QA/QC procedures to be applied:	ISO 9000
Any comment:	none

B.7.2 Description of the monitoring plan:

>>

Most of the data are already collected in the annual technical report (ATR). To facilitate internally the monitoring process, a specific report (project activity CDM database) will be prepared. Further, to ensure accurate, reliable and easily accessible data for the project emission reduction calculation, the report will also include information on the following

- Method of collection and reporting of data
- Periodic analysis of traditional and alternative fuels by in-house and accredited 3rd party
- Regular monitoring of operating parameters
- Equipment used to measure, monitor & control usage of traditional and alternative fuels
- Equipment used to analyze quality of traditional and alternative fuels
- Laboratory methods and procedures in the analysis

- Regular maintenance and calibration of equipment by in-house and accredited 3rd party

The SVP for Manufacturing, responsible for the CDM project, has assigned a team to be responsible for the overall monitoring and specific reporting of the project activity. The same team will likewise be responsible for the collection and monitoring of all relevant data, including transportation of the alternative fuels to the cement plant.

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)

>>

~~15~~**18**/~~03~~**09**/2008

Holcim Philippines Ltd: Maria Rosario Chan, CDM Project team

Holcim Group: Bruno Vanderborght, Catherine Martin-Robert

The two entities above are the project participants. Contact information is available in Annex 1.

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:

>>

The project activity has started in January 2005 with tests and trials.

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

>>

15 years

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

C.2.1. Renewable crediting period

Not applicable for the project activity.

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

01/06/2008

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

>>

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

>>
As mentioned, the environmental management system of the 3 cement plants of HPHI is ISO14001 certified. This means that HPHI has undertaken a systematic review of the key environmental impacts of its operations, has identified appropriate management and monitoring measures of these impacts, and has undertaken a regular management review of its environmental performance.

While HPHI is responsible for compliance with local regulatory environmental standards such as the Philippine Clean Air Act, it is also subject to the Holcim Group Emissions Monitoring and Reporting Standard, which, amongst others, requires the installation of a continuous emissions monitoring equipment for specific air pollutants such as dust, SO_2, NOx and VOC and the (at least) annual spot measurement of a range of stack gas emission parameters by an accredited third party. Stack gas emission results, along with other environmental data and information, are collated and reported annually in a standard format to Holcim Group Support in Switzerland. The results are benchmarked across the Group. Regional and plant management receive feedback on their environmental performance.

In 2005, the quality, environment and safety management systems of all the plants have been integrated. The ISO/IMS certification together with the Holcim Group Emissions Monitoring and Reporting Standards provide a safety net of proactive measures, to ensure that the use of alternative fuels is environmentally safe for the community,

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
The project is in full compliance with all local regulatory standards, including the Philippine Clean Air, and with international standards including those set by the Alternative Fuels and Raw Materials Group of Holcim Corporate.

An Environmental Impact Statement (EIS) was submitted by Holcim Philippines, Inc. (then known as Union Cement Corporation, UCC for La Union, Bulacan and Davao, and Alsons Cement Corporation for Lugait) to the Department of Environment and Natural Resources - Environmental Management Bureau (DENR-EMB) in connection with its application for an amendment of its Environmental Compliance Certificate (ECC) allowing its cement plants to use various agricultural and industrial wastes as alternative fuels for its kiln operation. Environmental impacts were predicted and corresponding mitigating measures were identified during the various stages of the project. As part of the EIS process, consultation meetings with various stakeholders were conducted to ensure that their concerns and suggestions were appropriately taken. An Environmental Management Plan was likewise developed for the project.

SECTION E. Stakeholders' comments

>>

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

>>

As a responsible corporate member dedicated to sustainable development, Holcim Philippines' plan to use alternative fuels in its kiln systems has been communicated to identified stakeholders.

Meetings have been done with various stakeholders at barangay and municipal level in November 2006 for Bulacan and Lugait, and in March 2007, for Davao. Identified stakeholders involved local impacted communities, local government units, non-government and government organizations and suppliers of agricultural wastes. A public notice in the local newspapers of each region has been published indicating the major line of the project activity and informing that a stakeholders' meeting will be held. In addition specific invitations have been sent to identified stakeholders.

Participants' attendance in each region

	Bulacan	Lugait	Davao
Officer and Local Government Unit (LGUs)	30	22	45
Representative from Education/Schools	9	1	10
Department of Environment & Natural Resources	--	8	5
NGO	--	6	6
Youth Representatives	7	--	20
Community	68	40	70
Rice Millers/Farmers	80	7	26

In the meeting, HPHI representatives discussed causes and impacts of global warming, increasing waste disposal problem in the Philippines, Kyoto protocol, details of the project on use of alternative fuels such as agricultural by-products and industrial wastes in HPHI cement plants, and the benefits associated with the project.

E.2. Summary of the comments received:

>>

The stakeholders' meetings have allowed the participants to understand the concepts related to climate change issues, its link with the Kyoto Protocol and the details the project undertaken by Holcim Philippines on the use of alternative fuels.

The stakeholders have recognized the positive environmental impacts of the project. During discussions, the efficiency of the cement kiln technology in co-processing alternative fuels had been well-communicated to the participants, as well as the proper procedures in the waste handling, receiving and feeding to ensure the safety of all concerned. The major issues raised were the economic gains of the communities and suppliers of alternative fuels.

The stakeholders have expressed their satisfaction and appreciation of the project, not only as a tool for efficient waste management, but also in helping mitigate climate change. The project was regarded as a win-win partnership between HPHI and stakeholders. It was viewed favourably due to the anticipated benefits in terms of providing long-term solution to the waste management and in helping improve local and global environmental conditions.

A write-up of each meeting is available. A summary of concerns and measures to address it is listed in annex.

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

>>

All comments and issues raised were documented. HPHI is committed to a continuous Information, Education, Communication (IEC) program to update stakeholders and to sustain appreciation and deepen awareness about environment protection and conservation.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Holcim Philippines Inc
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Middle Name:	--
First Name:	Ian
Department:	-
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Represented by:	Bruno Vanderborght
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been received for the project activity.

Annex 3

BASELINE INFORMATION

All data are included in the PDD. Additional information is detailed in the calculation database.

Annex 4

MONITORING INFORMATION

All data are included in the PDD. Additional information is detailed in the calculation database.

- - - - -

Appendix 1

Official data and self survey (existing suppliers) on alternative fuels availability

Self Survey on Biomass/Residual Wastes/Tires

Rice hull	Distance fr Plant in km	LA UNION	BULACAN	LUGAIT	DAVAO
		67,824	**182,400**	**97,500**	**74,607**
Muñoz	212	27,180			
Sto. Niño	266	27,180			
Umingan	137	4,680			
San Jacinto, Pangasinan	107	1,296			
San Fabian, Pangasinan	81	1,296			
Asingan, Pangsinan	127	2,304			
Damortis, La Union	64	2,592			
Mangaldan, Pangasinan	89	1,296			
Intercity, Bulacan	40		182,400		
Aurora	123			24,300	
Molave	144			18,600	
Maranding	96			18,600	
Pagadian	159			36,000	
Saranggani Province	200				3,036
South Cotabato Province	200				31,255
NFA Tagum	80				29,814
NFA Sultan Kudarat	180				3,712
North Cotabato	150				6,790

Source: Lugait, Bulacan & La Union- existing Suppliers; Davao- NFA Offices

Coconut Waste	Distance fr Plant in km	LA UNION	BULACAN	LUGAIT	DAVAO
		-	-	-	-

No study conducted yet

Bagasse	Distance fr Plant in km	LA UNION	BULACAN	LUGAIT	DAVAO
		-	-	-	-

Study in progress

Residual Wastes	Distance fr Plant in km	LA UNION	BULACAN	LUGAIT	DAVAO
		-	-	-	-

No study conducted yet

Tires	Distance fr Plant in km	LA UNION	BULACAN	LUGAIT	DAVAO
		-	-	-	-

No study conducted yet

Official Data on Current generation of the biomass, waste and tires

Rice hull (t)	Distance fr Plant in km	LA UNION 537,922	BULACAN 705,808	LUGAIT 573,010	DAVAO 373,702
CAR	0-700	53,164			
Ilocos	0-250	207,431			
Cagayan Valley	0-400	277,327			
Central Luzon	0-400		381,877		
Calabarzon	0-370		58,848		
Mimaropa	0-940		117,796		
Bicol Region	0-1500		147,287		
Western Visayas	0-250			270,123	
Central Visayas	0-150			31,325	
Eastern Visayas	0-310			118,328	
Zamboanga Peninsula	0-450			84,383	
Northern Mindanao	0-300			68,851	
Davao Regioin	0-200				70,512
SOCCKSARGEN	0-300				163,515
ARMM	0-300				81,781
Caraga	0-760				57,894

Source : Philippine Bureau of Agricultural Statistics, 2005

Computed at 15% of the total palay production in 2005 - print source of 15% (www.knowledgebank.irri.org)

Coconut Waste (t)	Distance fr Plant in km	LA UNION 74,897	BULACAN 2,807,308	LUGAIT 4,644,343	DAVAO 3,951,868
CAR	0-700	319			
Ilocos	0-250	10,669			
Cagayan Valley	0-400	26,460			
Central Luzon	0-400		69,223		
Calabarzon	0-370		593,440		
Mimaropa	0-940		266,860		
Bicol Region	0-1500		474,130		
Western Visayas	0-250			200,005	
Central Visayas	0-150			141,676	
Eastern Visayas	0-310			705,858	
Zamboanga Peninsula	0-450			655,129	
Northern Mindanao	0-300			619,503	
Davao Region	0-200				997,421
SOCCKSARGEN	0-300				319,726
ARMM	0-300				468,163
Caraga	0-760				389,246

Source : Philippine Bureau of Agricultural Statistics, 2005

Computed at 40% of the total coconut production in 2005 - verify the 40% assumption (Cereals division/BAS)

Bagasse (t)	Distance fr Plant in km	LA UNION	BULACAN	LUGAIT	DAVAO
		105,106	1,078,140	4,439,816	1,455,564
CAR	0-700	-	-	-	-
Ilocos	0-250	-	-	-	-
Cagayan Valley	0-400	105,106	-	-	-
Central Luzon	0-400	-	486,588	-	-
Calabarzon	0-370	-	505,833	-	-
Mimaropa	0-940	-	-	-	-
Bicol Region	0-1500	-	85,719	-	-
Western Visayas	0-250	-	-	4,283,313	-
Central Visayas	0-150	-			
Eastern Visayas	0-310	-	-	156,503	-
Zamboanga Peninsula	0-450	-	-	-	-
Northern Mindanao	0-300	-	-	-	1,102,562
Davao Region	0-200	-	-	-	239,020
SOCCKSARGEN	0-300	-	-	-	113,982
ARMM	0-300	-	-	-	-
Caraga	0-760	-	-	-	-

Source: Sugar Regulatory Administration, p 35. of the Annual Synopsis for the Crop Year 2003-2004

Residual Wastes (plastics from MSW)	Distance fr Plant in km	LA UNION	BULACAN	LUGAIT	DAVAO
		17,249	51,645	39,033	22,501
CAR	0-700	2,801			
Ilocos	0-250	8,720			
Cagayan Valley	0-400	5,729			
Central Luzon	0-400		17,128		
Calabarzon	0-370		19,898		
Mimaropa	0-940		4,965		
Bicol Region	0-1500		9,653		
Western Visayas	0-250			12,797	
Central Visayas	0-150			11,840	
Eastern Visayas	0-310			7,488	
Zamboanga Peninsula	0-450			5,875	
Northern Mindanao	0-300			7,306	
Davao Region	0-200				7,459
SOCCKSARGEN	0-300				4,808
ARMM	0-300				5,922
Caraga	0-760				4,312

Source: National Statistics Office (www.census.gov.ph) & Solid Waste Management Manual
0.000005 tons residual waste per day per capita

Appendix 2

Grid emission factor calculations

REF: Tool to calculate the emission factor for an electricity system

(The complete calculation sheets have been shown during validation)

Luzon-Visayas grid emission factor

Step 1. Identify the relevant electric power system

Bulacan plant is connected to the Luzon-Visayas grid.

Step 2. Select an operating margin (OM) method

The simple OM has been chosen as the low cost must run resources constitute less than 50% of the total grid generation.

Step 3 and 4. Calculate the operating margin emission factor according to the selected method and identify the cohort of power units to be included in the build margin

	(C)	(D)	(F)	(H)	(I)	(J)
Item	**Fuel Consumption Impact**		**Unadjusted Annual Carbon Emission Impact**	**Actual Carbon Emission Impact**	**Annual Carbon Dioxide Emission Impact**	**Simple OM EF**
Abbreviation	**FCI**		**CEI**	**Adjusted CEI**	**tCO2**	
Data Source	(A) x (B)	[(C) x 1055]/10^12	(D) x (E)	(F) x (G)	(H) x (44/12)	(I) / (A/1000)
Unit	BTU	TJ	tC/yr	tC/yr	tCO2/yr	tCO2/MWh
Combined-Cycle	4'204'320'768'333	4'435.56	89'598.28	89'598.28	328'527.03	
Diesel	34'241'696'121'701	36'124.99	729'724.79	729'724.79	2'675'657.55	
Gas Turbine	773'227'872'000	815.76	16'478.26	16'478.26	60'420.28	
Oil Thermal	10'189'812'770'000	10'750.25	226'830.33	226'830.33	831'711.20	

Coal	140'207'764'662'623	147'919.19	3'964'234.34	3'964'234.34	14'535'525.91	
Natural Gas	74'876'818'891'833	78'995.04	1'208'624.17	1'208'624.17	4'431'621.96	
Total					22'863'463.93	**0.695**

Step 5. Calculate the build margin emission factor

Column	(B)	(C)	(E)	(G)	(H)	(I)
Item	**Fuel Consumption Impact**	**Type of Fuel Used**	**Unadjusted Annual Carbon Emission Impact**	**Actual Carbon Emission Impact**	**Annual Carbon Dioxide Emission Impact**	**Build Margin Emission Factor**
Abbreviation	**FCI**		**CEI**	**Adjusted CEI**	**tCO2**	**EF BM**
Data Source	NPC, MERALCO, KEPCO ILIJAN, ERC	NPC, MERALCO , KEPCO ILIJAN, ERC	(B) x (D)	(E) x (F)	(G) x [44/12]	(H) / (A)
Unit	TJ/yr		tC/yr	tC/yr	tCO2/yr	tCO2/MWh
PMDP	287.63	Diesel Oil	5'810.05	5'810.05	21'303.51	
San Roque Hydro Power Plant	-	Hydro	-	-	-	
San Lorenzo Natural Gas Fired Combine Cycle Power Plant	18'530.05	Natural Gas	283'509.69	283'509.69	1'039'535.54	
	43.46	Diesel Oil	877.93	877.93	3'219.08	
Ilijan Combined Cycle Natural Gas Power Plant	28'730.78	Natural Gas	439'580.90	439580.90	1'611'796.65	
	11.23	Diesel Oil	226.78	226.78	831.54	
Casecnan Hydro Power Plant	-	Hydro	-	-	-	
Sta. Rita Natural Gas	41'222.18	Natural Gas	630'699.28	630'699.28	2'312'564.03	
	157.37	Diesel Oil	3'178.81	3178.81	11'655.62	
Total					**5'000'905.96**	**0.368**

Step 6. Calculate the combined margin emission factor

Step 6 Combined margin
EF grid = EF OM X 0.5 + EF BM X 0.5

Simple OM	0.695
BM	0.368
Combined margin	0.531

[redacted]

Mindanao grid emission factor

Step 1. Identify the relevant electric power system

Davao and Lugait plants are connected to the Mindanao grid.

Step 2. Select an operating margin (OM) method

The low cost must run resources constitute more than 50% of the total grid generation.

	2002	2003	2004	Average 2002-2004	Percentage	
	(MWh)				%	
Oil-Based	1'016'537	1'713'693	1'915'799	1'548'676	23.66%	24%
Combined-Cycle	-	-	-	-	0.00%	
Diesel	1'016'082	1'711'563	1'915'500	1'547'715	23.65%	
Gas Turbine	-	-	-	-	0.00%	
Oil Thermal	455	2'129	299	961	0.01%	
Coal	-	-	-	-	0.00%	
Natural Gas	-	-	-	-	0.00%	
Geothermal	857'912	861'015	909'815	876'247	13.39%	76%
Hydro	4'107'289	3'989'013	4'261'525	4'119'276	62.95%	
Total	5'981'738	6'563'721	7'087'140	6'544'199		

(light green)	Fossil-fuel fired
(blue)	low-cost/ must run

Step 3 and 4. Calculate the operating margin emission factor according to the selected method and identify the cohort of power units to be included in the build margin

The average OM have been calculated as the low cost must run resources constitute more than 50% of the total grid generation.

	(C)	(D)	(F)	(H)	(I)	(J)
Item	**Fuel Consumption Impact**		**Unadjusted Annual Carbon Emission Impact**	**Actual Carbon Emission Impact**	**Annual Carbon Dioxide Emission Impact**	**Simple OM EF**
Abbreviation	**FCI**		**CEI**	**Adjusted CEI**	**tCO2**	
Data Source	(A) x (B)	[(C) x 1055]/10^12	(D) x (E)	(F) x (G)	(H) x (44/12)	(I) / (A/1000)
Unit	BTU/yr	TJ/yr	tC/yr	tC/yr	tCO2/yr	tCO2/MWh
Combined-Cycle	0	-	-	-	-	
Diesel	1.37747E+13	14'532.27	293'551.87	293'551.87	1'076'356.84	
Gas Turbine	0	-	-	-	-	
Oil Thermal	8265861047	8.72	184.00	184.00	674.67	
Coal	0	-	-	-	-	
Natural Gas	0	-	-	-	-	
Total					1'077'031.52	**0.695**

c	(C)	(D)	(F)	(H)	(I)	(J)
Item	**Fuel Consumption Impact**		**Unadjusted Annual Carbon Emission Impact**	**Actual Carbon Emission Impact**	**Annual Carbon Dioxide Emission Impact**	**Average OM EF**
Abbreviation	**FCI**		**CEI**	**Adjusted CEI**	**tCO2**	
Data Source	(A) x (B)	[(C) x 1055]/10^12	(D) x (E)	(F) x (G)	(H) x (44/12)	(I) / (A/1000)
Unit	BTU	TJ	tC/yr	tC/yr	tCO2/yr	tCO2/MWh

Combined-Cycle	0	-	-	-	-	
Diesel	1.37747E+13	14'532.27	293'551.87	293'551.87	1'076'356.84	
Gas Turbine	0	-	-	-	-	
Oil Thermal	8265861047	8.72	184.00	184.00	674.67	
Coal	0	-	-	-	-	
Natural Gas	0	-	-	-	-	
Geothermal						
Hydro						
Total					1'077'031.52	**0.165**

Step 5. Calculate the build margin emission factor

	(B)	(C)	(E)	(G)	(H)	(I)
Item	**Fuel Consumption Impact**	**Type of Fuel Used**	**Unadjusted Annual Carbon Emission Impact**	**Actual Carbon Emission Impact**	**Annual Carbon Dioxide Emission Impact**	**Build Margin Emission Factor**
Abbreviation	**FCI**		**CEI**	**Adjusted CEI**	**tCO2**	**EF BM**
Data Source	SPPC and WMPC Info Sheets	SPPC and WMPC Info Sheets	(B) x (D)	(E) x (F)	Table 6.13	(H) / (A)
Unit	TJ/yr		tC/yr	tC/yr	tCO2/yr	tCO2/MWh
Mindanao II	-	Geothermal	-	-	-	
Talomo	-	Hydro	-	-	-	
SPPC	2'045	Diesel	41306.02	41306.02	151'455.41	
WMPC	2'232	Diesel	45079.57	45079.57	165'291.76	
Mindanao I	-	Geothermal	-	-	-	
Total					**316'747.17**	**0.211**

Step 6. Calculate the combined margin emission factor

Step 6 Combined margin
EF grid = EF OM X 0.5 + EF BM X 0.5

Simple OM	0.695
BM	0.211
Combined margin	0.453

Appendix 3

Stakeholders' Meeting : Summary of Issues and Concerns and proposed measures to address them

Holcim Philippines Bulacan Plant

What are the benefits to the community of using alternative fuel?

The implementation of the project shall require manpower and thus, shall be a source of additional income to the farmers, millers and other members of the community. Project stakeholders, supported by Holcim know how shall be able to enhance their capabilities in handling, proper health and safety practices. The use of alternative fuels results in the reduction of GHG thus resulting in an improvement of the climate and therefore our life quality.

What is the specific role of Holcim and the community in the undertaking?

Holcim, as a responsible company, is proactive and participates in project that protects the climate and support sustainable development of the country. The community is part of the project as the opportunities giving by the project bring a win-win situation.

How can the schools/institutions with MRF participate in the project?

The main objective of this initiative is the reduction of GHG emission, in particular CO2. CO2 results from burning. By taking the current project as an example and educating the Schools/institutions, they can help reduce GHG emission by applying waste hierarchy in the treatment of their wastes. As much as possible, the practice of open burning of wastes should be eliminated. Schools can teach their students the importance of proper segregation of wastes – reuse and recycle wastes that can still be of value. Wastes that cannot be recycled nor reused, provided it will not harm the environment, product quality, process and safety can then go to cement plant as alternative fuel.

What is the economic return to the rice millers if they will supply the rice husks that will be used as alternative fuel in the cement processing?

During the milling season, in order to have more storage space, rice husks are usually landfilled in an uncontrolled manner or openly burned in the fields by rice millers. With this project, economic incentives to cover transportation and labor costs will be given to rice millers/farmers when the rice husks are brought to Holcim. In addition, there will be employment opportunities (direct and indirect) during the construction of the facilities and operation of the project.

Holcim Philippines La Union Plant

What is the purpose and goal of implementing this project?

Holcim implements this project to help in the global effort of reducing emissions of CO2 that cause climate change and to reduce the use of coal which is non-renewable.

What are the materials that will qualify as AFR for this project?

Because of the abundance of agricultural by products and the current waste problems in the Philippines, the project will primarily use these waste materials (sorted MSW and the agricultural by- products) to reduce the use of fossil fuels.

What is the incentive of the rice millers and the community in providing the materials that will be used as AFR?

During the milling season, in order to have more storage space, rice husks are usually landfilled in an uncontrolled manner or openly burned in the fields by rice millers. With this project, economic incentives to cover transportation and labor costs will be given to rice millers/farmers when the rice husks are brought to Holcim. In addition, there will be employment opportunities (direct and indirect) during the construction of the facilities and operation of the project.

How can the project help mitigate climate change if it will also require burning the rice husks and plastics?

Mitigation of climate change takes place first because of the reduction in the corresponding GHG that would have been emitted if coal was used as the fuel in the cement process. Second, in open burning, the heat generated is lost to the atmosphere and methane, as well as dust particles, are released. Third by landfilling the biomass, methane is alsol released. In the cement kiln, the heat generated by the rice husks and plastics is now recovered by the kiln system and replaces the heat that would have been been supplied by coal. GHG emission coming from coal is therefore not released. Further, the methane that would have been released if the rice husks were landfilled are not released.

How can you prove that emissions coming from the cement plant have no harmful effects to the impacted community?

HPHI ensures that it complies with the standards set, not only by local regulators but also by international agencies. Test runs have already been conducted showing that the use of these alternative materials does not impact the quality of the product, process, health & safety, and the environment. In additions, annual emission measurement is conducted by an accredited 3rd party. HPHI plants have CEMS that continuously monitor the emission of inorganic pollutants from the stack. These results are submitted to EMB and are available to the public. In addition to providing a sustainable solution to the waste problem, Holcim can help in subsidizing the transport

In what ways can Holcim assist the LGU?

In addition to providing a sustainable solution to the waste problem, Holcim can help in subsidizing the transport collection of the segregated wastes from an MRF to its cement plant. In can also assist the LGUs in information and education campaign on sustainable development such as solid waste management.

<u>Holcim Philippines Lugait Plant</u>

What are the materials that will qualify as alternative fuels for this project?

Because of the abundance of agricultural by-products and the current waste problems in the Philippines, sorted municipal solid waste and the agricultural by products will be the major materials used as alternative fuel.

What is the incentive of the rice millers and the community in providing the materials that will be used as AFR?

During the milling season, in order to have more storage space, rice husks are usually landfilled in an uncontrolled manner or openly burned in the fields by rice millers. With this project, economic incentives to cover transportation and labor costs will be given to rice millers/farmers when the rice husks are brought to Holcim. In addition, there will be employment opportunities (direct and indirect) during the construction of the facilities and operation of the project.

How can this project help in mitigating climate change if it will also require burning?

Mitigation of climate change takes place first because of the reduction in the corresponding GHG that would have been emitted if coal was used as the fuel in the cement process. Second, in open burning, the heat generated is lost to the atmosphere and methane as well as dust particulates, are released. Third by landfilling the biomass, methane is also released. In the cement kiln, the heat generated by the rice husks and plastics is now recovered by the kiln system and heat that would have been supplied by coal is not needed. Its GHG emissions are not released. Methane, as well as dust particulates, that would have been released by burning in open air or landfilling are not released.

How can you prove that emissions coming from the cement plant have no harmful effects to the impacted community?

HPHI ensures that it complies with the standards set, not only by local regulators but also by international agencies. Test runs have already been conducted showing that the use of these alternative materials does not impact the quality of the product, process, health & safety, and the environment. In additions, annual emission measurement is conducted by an accredited 3rd party. HPHI plants have CEMS that continuously monitor the emission of inorganic pollutants from the stack. These results are submitted to EMB and are available to the public.

What is the objective of implementing this project?

Holcim implements this project in support of the global effort to reduce emissions of CO2 that cause climate change and to reduce the use of coal which is non-renewable.

In what ways can Holcim assist the LGU in the collection of waste?

Holcim can help in subsidizing the transport collection of the segregated wastes from an MRF to its cement plant. It can also assist the LGUs in the information and education campaign on sustainable development such as solid waste management.

What will be the role of the LGU to help in this project?

LGUs play a very important role in this project, especially in the implementation of proper segregation of solid wastes / in accordance to Solid Management Waste Act. It can help ensure that wastes are properly segregated and only those that cannot be recycled nor reuse then goes to the MRF for final disposal to Holcim

What are the potential effects of utilizing alternative fuel?

Test runs have been conducted and the results showed that there are no negative impacts when using agricultural byproducts and sorted MSW in the cement kilns to reduce the use of fossil fuels. The following safeguard measures are inplace to ensure that risks are managed well when these materials : a) stack gas emissions are measured by 3rd party accredited laboratory / Continuous Emission Monitoring System, b) product quality is regularly checked, and c) process conditions are regularly monitored.

What are the benefits that will be given to the contributors of alternative fuels?

First and foremost will be the improvement in the environmental condition of the people. Contributors or suppliers of alternative fuels will have additional income. For example, during the milling season, in order to have more storage space, rice husks are usually dumped or left to decay or openly burned in the fields by rice millers. With this project, economic incentives to cover transportation and labor costs will be given to rice millers/farmers when the rice husks are brought to Holcim. In addition, there will be employment opportunities (direct and indirect) during the construction of the facilities and during operation of the project.

Why are hospital wastes cannot be accepted as alternative fuels?

Holcim follows strictly its protocol in the use of any materials as alternative fuels. There are specific wastes that are known to pose danger either to the process or the health and safety of the people. For hospital wastes, the main issue is the safe handling of such materials.

What is the transportation scheme for the materials that will be collected?

A subsidy will be given to cover the transportation cost of the materials and labor costs.

<u>Holcim Philippines Davao Plant</u>

How much is the economic return to the rice millers if they will give the rice husks that will be used for the project?

It is difficult to state at this point how much would be the economic return to the rice millers. The current practice during the milling season is to burn the rice husks, in order to free up some space, or to landfill it in an uncontrolled manner . With this project, economic incentives to cover transportation and labor costs will be given to rice millers/farmers when the rice husks are brought to Holcim. In addition, there will be employment opportunities (direct and indirect) and investment opportunities during the construction of the facilities and operation of the project.

What are the materials that will qualify as alternative fuels for this project?

Because of the abundance of agricultural by products and the current waste problems in the Philippines, the project will primarily use these waste materials (sorted MSW and the agricultural by- products) to reduce the use of fossil fuels.

Is Holcim legally compliant if alternative fuels will be used in the system?

Yes. Holcim is compliant to all regulations. It has its ECC amended allowing it to use alternative fuels to replace coal in the manufacture cement.

What is the operating scheme to implement the collection of municipal wastes and rice husk that will give incentives to the community?

Holcim can subsidize the cost of transporting the rice husks and municipal wastes from the community to its cement plant. What is more important however is that the community has now, by implementing proper segregation of its waste and in accordance to the Solid Management Waste Act, has a sustainable solution to its waste problem. Details of how this will be operationalized can be further discussed.

Is it possible that Holcim will help in the collection of wastes to ease the dues of the community they pay for the garbage collection?

Holcim may help by subsidizing the collection of the segregated wastes from an MRF to its cement plant. LGU on the other hand can help by ensuring that wastes are properly segregated and only those that cannot be recycled nor reused then goes to the MRF.

What is the guarantee that the emissions produced by implementing this project are safe?

HPHI ensures that it complies with the standards set, not only by local regulators but also by international agencies. Test runs have already been conducted showing that the use of these alternative materials does not impact the quality of the product, process, health & safety, and the environment. In additions, annual emission measurement is conducted by an accredited 3rd party. HPHI plants have CEMS that continuously monitor the emission of inorganic pollutants from the stack. These results are submitted to EMB and are available to the public.

Appendix 4

Analysis of the technical barriers

BULACAN

Bottlenecks and potential for AFR use

Plant: BL
Date: 2/24/2006

Note: the values (min, max,…) herebelow are guidelines values and have to be adapted upon the specific plant experience

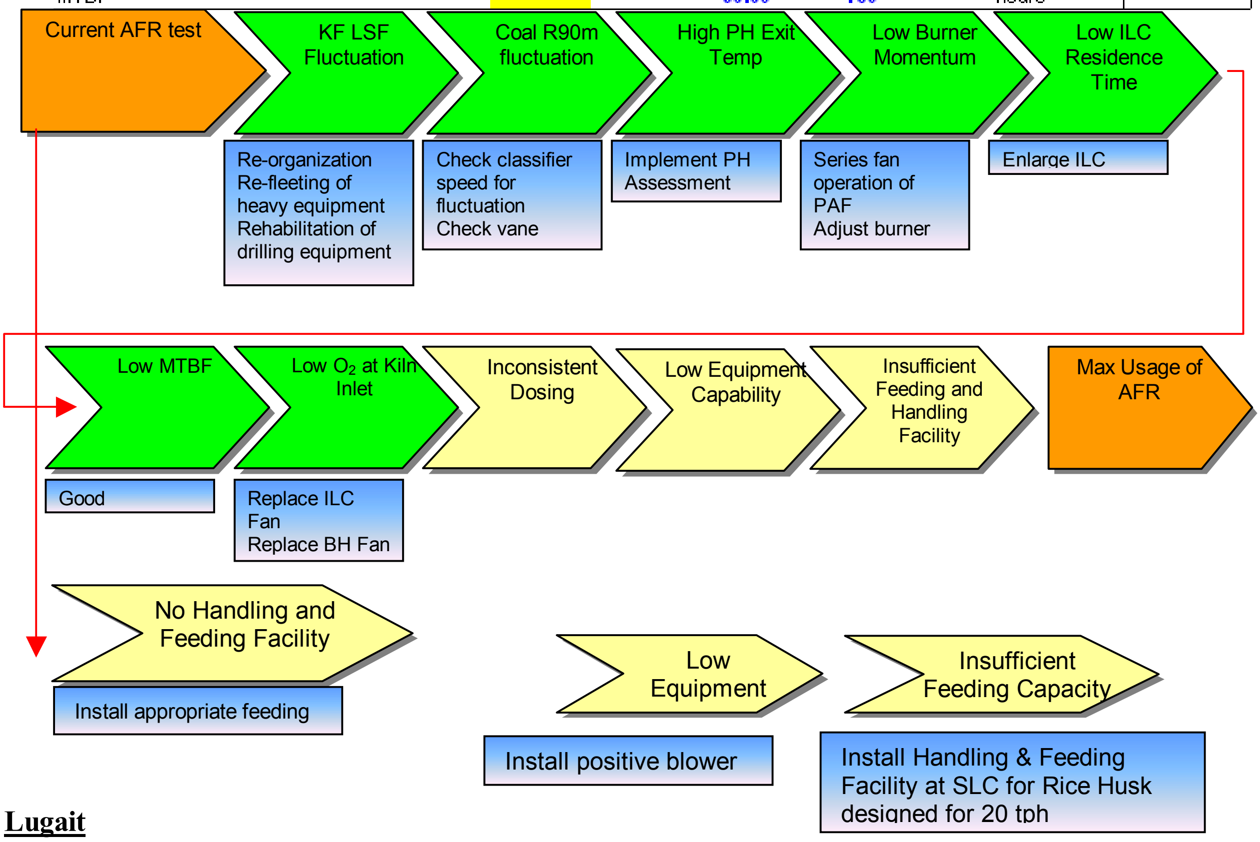
Process Type: Precalciner Kiln

		Current Value	Min Min	Min	Max	Max Max		Current status
1	**Material Preparation**							
1.1	**Kiln feed**	Current	Min Min	Min	Max	Max Max		Current status
	LSF fluctuations	3.00			1.2	1.5	sdv	
	Dosing fluctuations	2.0			0.5	2	%	
	Coefficient of variation R90µm	8.0			5	10	%	
1.2	**Coal / petcoke (at main burner)**							
	Fineness at R90 µm coal	17.0			15	20	%	
	Fineness R90 µm fluctuations	1.0			0.5	0.75	sdv	
	Dosing fluctuations	1.0			2	5	%	
	Pressure fluctuation at the burner within +/-5%	100.0		90.00			%	
	P fluctuation at the burner within +/- 5 and 7.5%	0.0			5		%	
2	**KILN OPERATION**							

		Current Value	Min Min	Min	Max	Max Max		Current status
2	**KILN OPERATION**							
2.1	**Combustion** (based on 5-days campaign)							
	O2 at kiln inlet	2.00	3.50	3.50	4	5	%O2	
	CO at kiln inlet	0.10			0.05	0.1	%CO	
	Temperature at kiln inlet	928	900.00	950.00	1050	1100	°C	
	Temperature at exit lowest cyclone ILC	845	840.00	845.00	850	860	°C	
	Temperature at exit lowest cyclone SLC	875	865.00	870.00	880	885	°C	
2.2	**Hot meal** (based on 5 days-campaign)							
	% calcination	98.0		92.50	94	95	%	
	SO3	1.70			2.3	2.7	%SO3	
	Cl	1.51			1.5	1.8	%Cl	
	K2O	1.07			1.5	1.6	%K2O	
	Sulfur Volatility	0.63			0.7	0.9	-	
2.3	**Main Firing**							
	Heat distribution to main firing	39.0	35.00	40.00	45	45	% total fuel	
	Ash input at burning zone	1.4			3	4	% in cli	
	Length of fixed coating	5.0			4	6	x $\varnothing_{kiln}$	
	Fine AFR powder in main flame (diam.<0.5mm)	0.0				25	% total fuel	
	Solid AFR diam.<1.5 mm in main flame	0.0			12	15	% total fuel	
	Solid AFR diam<5 mm or foils < 50 mm	0.0			10		% total fuel	
	Comment: all substitution refer to total sub. of the fuel and can not be accumulated							
2.4	**Kiln Inlet**							
	Heat distribution to kiln inlet	0.0			5	8	% total fuel	
	Whole tires	0.0			5		% total fuel	
	Lump fuel >50mm	0.0			5		% total fuel	
2.4	**ILC**	Current	Min Min	Min	Max	Max Max		Current status
	Heat distribution to precalcination	20.9	10.00	15.00	20	30	% total fuel	
	Lump fuel >50mm	0.0			5		% total fuel	
	Solid AFR < 50 mm	0.0					% total fuel	
	Gas residence time in calciner	1.9	4.50	5.00			seconds	
2.4	**SLC**							
	Heat distribution to precalcination	50.2	30.00	40.00	50	60	% total fuel	
	Lump fuel >50mm	0.0			5		% total fuel	
	Solid AFR < 50 mm	0.0					% total fuel	
	Gas residence time in calciner	4.3	4.50	5.00			seconds	
3	**MAIN BURNER**							
	% Primary Air(radial/axial)	12.8	10.00	12.00	18	20	%	
	Axial Momentum	7.3	9.00		10		N/MW	
	Coal injection velocity	58		25.00	30		m/s	

green: min / max requirements respected
yellow: min / max exceeded but within min min / max max
red: min min / max max exceeded

		Current	Min Min	Min	Max	Max Max		Current status
4	**CHEMISTRY**							
4.1	**Clinker**	**Current**	**Min Min**	**Min**	**Max**	**Max Max**		**Current status**
	Liquid phase 1450°C of main clinker	28.16		25.00	26		% in cli	
	CaO free	1.04		0.80	1.5		% in cli	
	% off-spec clinker	1.6			3	5	% in cli	
	P_2O_5 in Clinker	0.06			0.45	0.5	% in cli	
4.2	**Alkali & Sulfur** (based on A/S balance)							
	"Calculated" Alk/S - ratio in clinker	1.01	0.75	0.80	1.2	1.25	-	
	"Calculated" SO3 in clinker	0.67				1.5	% in cli	
	Alkali input (process point of view)	0.54				1.5	% in cli	
4.3	**Chlorine & Dust**							
	Relevant Cl input from raw materials & fuels	162			200	300	g/t cli	
	Chlorine output through all cement	138			800	1000	g/t cem	
5	**KILN PERFORMANCE**							
		Current	**Min Min**	**Min**	**Max**	**Max Max**		**Current status**
	OEE net	82.60	75.00	85.00			%	
	Rate	90.70	90.00	95.00			%	
	Availability	91.00	85.00	90.00			%	
	MTBF	217	300.00	400.00			hours	
	Number of kiln stops	31	n		40	80	stop/a	
	Stops due to cyclones plug-ups	0			5	10	stop/a	
	Refractory consumption (4 years rolling av.)	623			400	600	g/tcli	
	Emissions (below legal limits: "Yes" or "No")	Yes					-	
6	**AFR: for each AFR installation individually**							
		Current	**Min Min**	**Min**	**Max**	**Max Max**		
6.1	***AFR Installation 1: Rice Hull at SLC***							
	Storage capacity	120.00	507.72	134.40			t	
	Feeding capacity	2.80	10.58	2.80			t/h	
	NCV Fluctuation of AFR 1				1000		+/-kJ/kg	
	Solid AFR injection velocity (if used at main burner)			20.00	30		m/s	
	OEE net	60.00	75.00	85.00			%	
	MTBF			50.00	180		hours	



Lugait

Bottlenecks and potential for AFR use

Plant: HPHI LG2
Date: 4/7/2006

Note: the values (min, max,…) herebelow are guidelines values and have to be adapted upon the specific plant experience

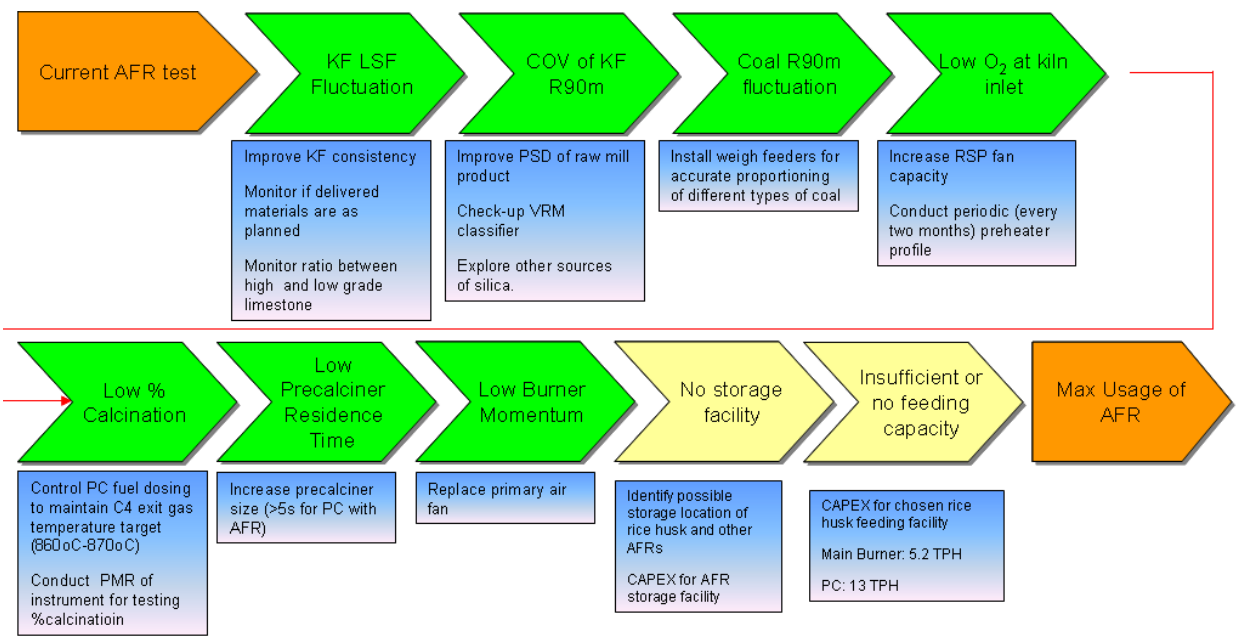
Process Type: Precalciner

		Current Value	Min Min	Min	Max	Max Max		Current status
1	**Material Preparation (based on 5-days campaign)**							
1.1	**Kiln feed**							
	LSF fluctuations	1.88			0.7	1	sdv	□
	Dosing fluctuations	0.10		0.1	0.2		%	□
	Coefficient of variation R90♦m	4.3			3	5	%	□
1.2	**Coal / petcoke (at main burner)**							
	Fineness at R90 ♦m	19.60				22	%	□
	Fineness R90 ♦m fluctuations	0.83			0.5	0.75	sdv	□
	Fineness at R200 ♦m	0.00					%	□
	Dosing fluctuations	4.90			0.7	0.95	%	□
	Pressure fluctuation at the burner within +/-5mbar	10.00			4	5	%	□
	P fluctuation at the burner within +/- 5 and 7.5mbar						%	
2	**KILN OPERATION**							

		Current Value	Min Min	Min	Max	Max Max		Current status
2	**KILN OPERATION**							
2.1	**Combustion** (based on 5-days campaign)							
	O2 at kiln inlet	1.44	3	3.5	4	5	%O2	□
	CO at kiln inlet	0.00			0.05	0.1	%CO	□
	Temperature at kiln inlet	968		900	1050	1100	°C	□
	Temperature at exit lowest cyclone	847		860	870		°C	□
2.2	**Hot meal** (based on 5 days-campaign)							
	% calcination	93.90	94.25	94.5	96	96.5	%	□
	SO3	1.23			2.5		%SO3	□
	Cl	0.10			1		%Cl	□
	K2O	0.97			2		%K2O	□
	Sulfur Volatility	0.69			0.7	0.9	-	□
2.3	**Main Firing**							
	Heat distribution to main firing	41.50		40	45		% total fuel	□
	Ash input at burning zone	1.86			3	4	% in cli	□
	Length of fixed coating	5.00		4	5		x $\varnothing_{kiln}$	□
	Fine AFR powder in main flame (diam.<0.5mm)	0.00					% total fuel	□
	Solid AFR diam.<1.5 mm in main flame	0.00					% total fuel	□
	Solid AFR diam<5 mm or foils < 50 mm	0.00					% total fuel	□
							% total fuel	
	Comment: all substitution refer to total sub. of the fuel and can not be accumulated							
2.4	**Precalcination, secondary firing or MKF**							
	Heat distribution to precalcination	58.50		55	60		% total fuel	□
	Whole tires	0.00			5		% total fuel	□
	Lump fuel >50mm	0.00			5		% total fuel	□
	Solid AFR < 50 mm	0.00					% total fuel	□
	Gas residence time in calciner	3.10	4.5	5			seconds	□
3	**MAIN BURNER**							
	% Primary Air(radial/axial)	8.20	10	12	18		%	□
	Axial Momentum	4.10	7	9	11		N/MW	□
	Coal injection velocity	9.40		25	30		m/s	□

green: min / max requirements respected
yellow: min / max exceeded but within min min / max max
red: min min / max max exceeded

CHEMISTRY							
Clinker	**Current**	**Min Min**	**Min**	**Max**	**Max Max**		**Current status**
Liquid phase 1450°C of main clinker	25.07		24	26		% in cli	
CaO free	1.40	0.8	1	1.5	2	% in cli	
% off-spec clinker	2.10			3	5	% in cli	
P_2O_5 in Clinker	0.06			0.3	0.5	% in cli	
Alkali & Sulfur (based on A/S balance)							
"Calculated" Alk/S - ratio in clinker	3.14	0.06	0.8	1.2	1.3	-	
"Calculated" SO3 in clinker	0.39			0.8	1	% in cli	
Alkali input (process point of view)	1.10			1.9		% in cli	
Chlorine & Dust							
Relevant Cl input from raw materials & fuels	128.00			200	300	g/t cli	
Chlorine output through all cement	0.00					g/t cem	
Filler in cement	0.00					% in cem	
KILN PERFORMANCE							
	Current	**Min Min**	**Min**	**Max**	**Max Max**		**Current status**
OEE net	85.50		83			%	
Rate	95.00		96			%	
Availability	90.00		90			%	
MTBF		250	400			hours	
Number of kiln stops	9.00			12		stop/a	
Stops due to cyclones plug-ups	0.00			2		stop/a	
Refractory consumption (4 years rolling av.)	338.8			500		g/t cli	
Emissions (below legal limits: "Yes" or "No")	Yes			150		-	
AFR Installation 2: describe installation				***(Rice Hull)***			
Storage capacity	0.00		100			t	
Feeding capacity	1.50	14	2			t/h	
NCV Fluctuation of AFR 2	120.00			125	150	+/-kJ/kg	
Solid AFR injection velocity (if used at main burner)						m/s	
OEE net	75.00	75	85			%	
MTBF						hours	



Davao

Bottlenecks and potential for AFR use

Plant: 2
Date: 2005

Note: the values (min, max,…) herebelow are guidelines values and have to be adapted upon the specific plant experience

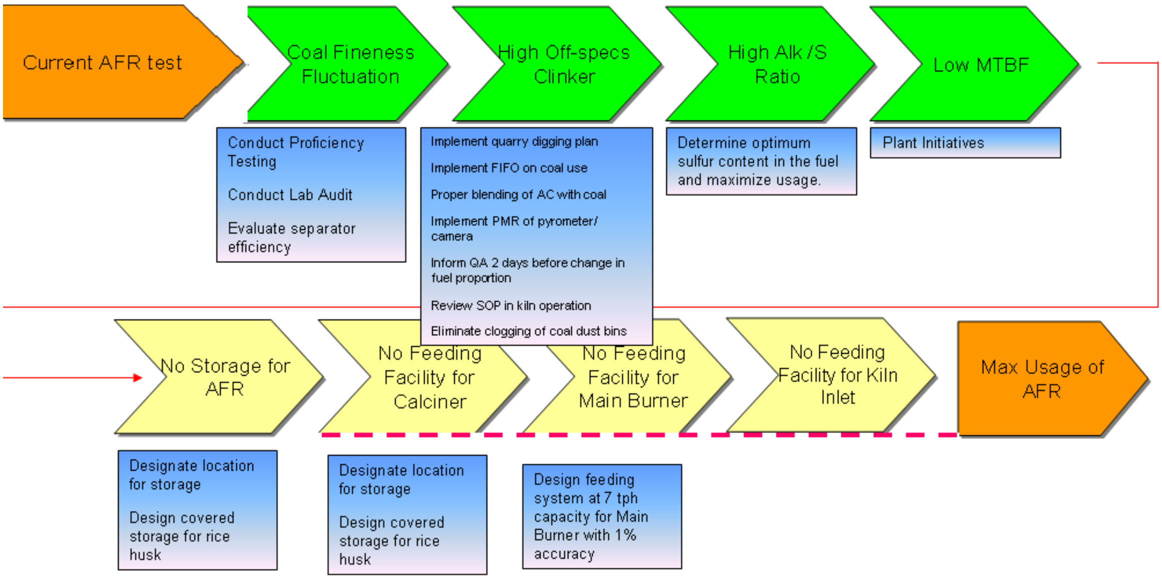
Process Type: Precalciner

	Current Value	Min Min	Min	Max	Max Max		Current status
1 Material Preparation (based on 5-days campaign)							
1.1 Kiln feed							
LSF fluctuations	0.80			1.2	1.5	sdv	
Dosing fluctuations				0.5	2	%	
Coefficient of variation R90µm	2.4			5	10	%	
1.2 Coal / petcoke (at main burner)							
Fineness at R90 µm	19.87	18	19	21	22	%	
Fineness R90 µm fluctuations	3.81			1	1.5	sdv	
Fineness at R200 µm	1.22					%	
Dosing fluctuations				0.7	0.95	%	
Pressure fluctuation at the burner within +/-5mbar		80	90	100	100	%	
P fluctuation at the burner within +/- 5 and 7.5mbar		70	75	80	100	%	
2 KILN OPERATION							

	Current Value	Min Min	Min	Max	Max Max		Current status
2 KILN OPERATION							
2.1 Combustion (based on 5-days campaign)							
O2 at kiln inlet	3.80	3	3.5	4	5	%O2	
CO at kiln inlet	0.01			0.05	0.1	%CO	
Temperature at kiln inlet	1030	950	1000	1050	1100	°C	
Temperature at exit lowest cyclone	869	860	865	875	890	°C	
2.2 Hot meal (based on 5 days-campaign)							
% calcination	95.70	92	94	95	96	%	
SO3	0.78			4	5	%SO3	
Cl				1.5	1.8	%Cl	
K2O	1.16			1.5	1.6	%K2O	
Sulfur Volatility				0.7	0.9	-	
2.3 Main Firing							
Heat distribution to main firing	40.00	30	35	40	45	% total fuel	
Ash input at burning zone				3	4	% in cli	
Length of fixed coating	3.08			4	6	x $\varnothing_{kiln}$	
Fine AFR powder in main flame (diam.<0.5mm)	0.00				25	% total fuel	
Solid AFR diam.<1.5 mm in main flame	0.00			12	15	% total fuel	
Solid AFR diam<5 mm or foils < 50 mm	0.00			10		% total fuel	
						% total fuel	
Comment: all substitution refer to total sub. of the fuel and can not be accumulated							
2.4 Precalcination, secondary firing or MKF							
Heat distribution to precalcination	60.00	55	60	65	70	% total fuel	
Whole tires	0.00			5		% total fuel	
Lump fuel >50mm	0.00			5		% total fuel	
Solid AFR < 50 mm	0.00					% total fuel	
Gas residence time in calciner	5.00	4.5	5			seconds	
3 MAIN BURNER							
% Primary Air(radial/axial)	14.90	10	12	15	20	%	
Axial Momentum	8.20	7		10		N/MW	
Coal injection velocity	60.00	20	25	60	65	m/s	

green: min / max requirements respected
yellow: min / max exceeded but within min min / max max
red: min min / max max exceeded

		Current	Min Min	Min	Max	Max Max	Unit	Current status
4	**CHEMISTRY**							
4.1	**Clinker**	Current	Min Min	Min	Max	Max Max		Current status
	Liquid phase 1450°C of main clinker	25.83		25	26		% in cli	
	CaOfree	1.38	0.8	1	1.5	2	% in cli	
	% off-spec clinker	8.8			3	5	% in cli	
	P_2O_5 in Clinker				0.45	0.5	% in cli	
4.2	**Alkali & Sulfur** (based on A/S balance)							
	"Calculated" Alk/S - ratio in clinker	1.41	0.75	0.8	1.2	1.3	-	
	"Calculated" SO3 in clinker	0.52				1.5	% in cli	
	Alkali input (process point of view)	1.01				1.5	% in cli	
4.3	**Chlorine & Dust**							
	Relevant Cl input from raw materials & fuels				200	300	g/t cli	
	Chlorine output through all cement				800	1000	g/t cem	
	Filler in cement	12.00					% in cem	
5	**KILN PERFORMANCE**							
		Current	Min Min	Min	Max	Max Max		Current status
	OEE net	74.22	75	85			%	
	Rate	93.74	90	95			%	
	Availability	79.18	85	90			%	
	MTBF	112.00	200	400			hours	
	Number of kiln stops	84.00			40	80	stop/a	
	Stops due to cyclones plug-ups	4.00			5	10	stop/a	
	Refractory consumption (4 years rolling av.)	369.90			400	600	g/tcli	
	Emissions (below legal limits: "Yes" or "No")	Yes					-	
6	**AFR: for each AFR installation individually**							
		Current	Min Min	Min	Max	Max Max		
6.1	**AFR Installation 1: Existing Raw Coal Hopper / Feeder for Activated Carbon**							
	Storage capacity	40,000	32400	3600			t	
	Feeding capacity	15.00	45	5			t/h	
	NCV Fluctuation of AFR 1(Activated Carbon)						+/-kJ/kg	
	Solid AFR injection velocity (if used at main burner)			20	30		m/s	
	OEE net	100.00	75	85			%	
	MTBF	250.00	40	50			hours	
6.2	**AFR Installation 2: *Rice Husk Feeding for Calciner***							
	Storage capacity	0.00	8800				t	
	Feeding capacity	0.00	12.2				t/h	
	NCV Fluctuation of AFR 2 (rice husk)				1000		+/-kJ/kg	
	Solid AFR injection velocity (if used at main burner)			20	30		m/s	
	OEE net		75	85			%	
	MTBF			50	180		hours	



Example of the fuel mix optimizer

Simulation

Clinker volume 1'682'000 t/year

	tons as fired					costs as fired				All properties as fired						
	Available on market	Main burner	PC/SF & MK	% total heat	Fuel category (l,d,g,5,50, lump,other)	Cost at plant gate	Prep& Handling costs	Costs at burner		NCV	H2O	Ash	SO3	K2O	Na2O	Cl
Name	tons/year	tons/year	tons/year	%		PHP/t	PHP/t	PHP/t	PHP/ GJ	GJ/ t	%	%	%	%	%	%
Traditional fuel																
Bituminous coal			**133'884**	59.63	d					24.6	4.8	17.9	0.75			
Heavy oil			**1'253**	0.90	l					39.7	0.0	0.0	0.15			
Light oil			**89**	0.06	l					38.1	0.0	0.0	2.27			
anthracite			**37'742**	**22.86**	d					27.3	0.9	18.0	0.46			
				-												
Alternative fuels				-												
Used / waste oils				-	l											No data
Industrial waste originating from fossil source			**2'769**	0.79	50					15.7						No data
Agricultural waste/rice husk (AF-biomass)			**68'589**	15.00	5					12.1	6.8	22.6	0.10			No data
sorted MSW (AF-non biomass)			**15'721**	5.00	5					17.6						No data
				-												No data
				-												
% total heat		0.0	100.0	20.79	%TSR											

Heat consumption: **3'290** kJ/kg cli Spec. act. costs of fuel: **0.00** PHP/t cli PHP -

Target: 3'300 kJ/kg cli Includes add heat consumption of AFR $ -

add heat by AF: 58 kJ/kg cli

Constraints:

Mainly process related:	add Prod loss by AF:*	Solids < 50 mm PC& SF	Lump fuel SF & MK	Solids < 5 main firing	Cl input RM & fuels	
Actual	80'316	20.8	-	-	200	
Limit	0	30	5	12	300	
	t/year	% TSR	% TSR	% TSR	g/t cli	

Mainly quality related:	SO3 in clinker	H_2O in BZ	Ash input in BZ	Fuels for hot flame **	Alk /S in cli ***	Sulfatization degree***
Actual	0.26	-	-	-	2.17	46%
Limit	2.0	2	3	Min 6	Min*** 0.4	Min 83%
	%	%	% in cli	% tot heat	Max 1.2	Max 250%

Legend:

- Possible
- Possible if kiln system optimized: High secondary air temp *1 High Momentum burner Good burnable raw mix Quality impact likely
- Strong influence on process and quality expected. Detailed studies may reveal additional potential
- ~~solid~~ Check input or feeding point

Strong impact on quality expected