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

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SECTION A. General description of project activity

A.1 Title of the project activity:

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Optimal utilization of clinker by increasing the additives in cement production at Holcim Lanka Ltd (HLL), Sri Lanka.

Version 04, 23/03/2007

A.2. Description of the project activity:

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The project activity consists of a reduction of the clinker content in the current Portland Limestone Cement (PLC) produced in Puttalam cement plant (PA) by increasing the additive percentage using natural additives namely limestone and dolomite and artificial pozzolanic materials such as slag and potentially later on fly ash. The current average percentage blend produced in Puttalam cement plant is made of natural additives namely limestone and dolomite and represents 12.6% of the blend. The project activity is expected to enable HLL to increase the additives in the order of 29% (gypsum not included).

The current blend level represents a plateau and to increase the blend above the current level, it requires significant efforts and investment and encounters a number of barriers. To help overcoming these barriers HLL is utilizing the CDM.

The project activity will displace clinker with the mentioned additives and therefore will decrease the associated CO_2 emissions per tonne of cement produced.

The project activity contributes to sustainable development in many ways. The key impact is environmental as the project activity will reduce the clinker content in the blended cement produced, by increasing the additives content. By reducing clinker content, the direct emissions on site generated by calcination will decrease per tonne of blended cement, as well as the connected emissions from fuel consumption. The direct emissions off site per tonne of blended cement, mainly at the power plant, will also drop thanks to the decrease of electrical consumption. The drop of clinker content preserves natural resources such as coal, a non renewable resource.

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
Sri Lanka (host)	Private entity: Holcim Lanka Ltd	No
Switzerland	Private entity: Holcim Group	No

	Support Ltd	

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>
The project takes place at Puttalam cement plant, which is owned by Holcim Lanka Ltd. The location is outlined below:

Puttalam Cement Plant
Post Office Box 1
Palavi
Puttalam
Sri Lanka

A.4.1.1. Host Party(ies):

>>
Sri Lanka

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

>>
North Western Provincial Council

A.4.1.3. City/Town/Community etc:

>>
District of Puttalam

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

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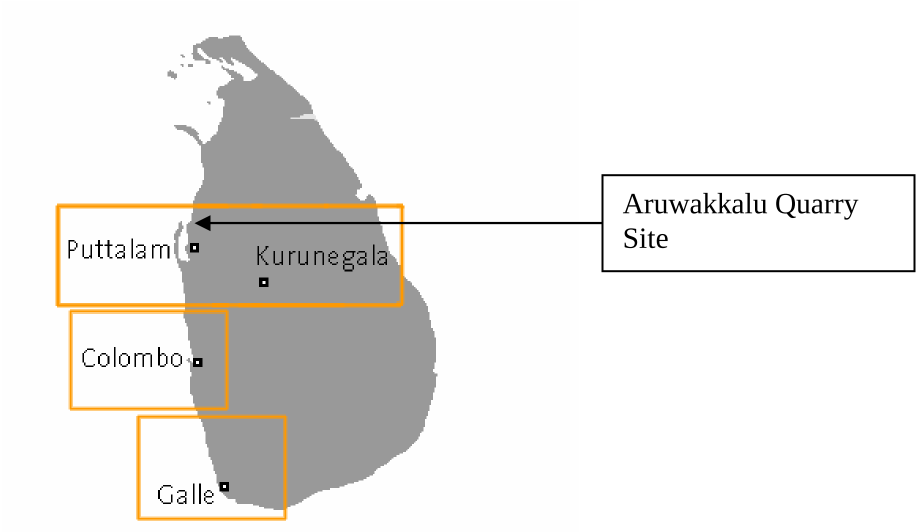
The location of the project activity is at Puttalam cement plant (PA) which produces clinker and blends cement. Puttalam is located 130 km north of Colombo and 4km from the North West Coast. The limestone mine is located in Aruwakkalu, about 40km from PA.



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

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Manufacturing Industries

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

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The cement plant undertaking the CDM project activity is ranging a capacity of about 550,000 tonnes of clinker production.

In order to optimize the clinker content per tonne of cement, the laboratory of Holcim Group Support Ltd (HGRS) located in Holderbank has conducted meticulous Research and Development (R&D). The knowledge was transferred to HLL which has made many experiments varying the percentage of limestone, dolomite, slag and fly ash. HLL has tested the impact on the quality in order to combine final impacts on strength properties and appropriate blended mixture for end users.

The trial and development team of Holcim Lanka Ltd works also closely with the product innovation department of Holcim Group in order to find the appropriate product with regards to minimization of manufacturing constraints and minimization of CO_2 emission.

By conducting tests and experiments on site, HLL is developing its own blend by mixing additives. The forecasted optimal mix combines in a short term limestone, dolomite and slag and potentially later on fly ash.
By reducing direct and indirect CO_2 emissions the project activity is improving global and local environment. Air pollution control and dust collection together with the ISO 14001 environment management system assure that the project is environmentally safe.

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.

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
Year A (2007)	25,665
Year B	43,165
Year C	49,900
Year D	52,422
Year E	62,159
Year F	59,953
Year G	69,581
Year H	67,291
Year I	76,810
Year J	74,431
Total estimated reductions (tonnes of CO_2e)	581,377
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	58,138

A.4.5. Public funding of the project activity:

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The project activity has received no funding.

SECTION B. Application of a baseline and monitoring methodology

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

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ACM0005
"Consolidated Baseline Methodology for Increasing the Blend in Cement production" and "Consolidated Monitoring Methodology for Increasing the Blend in Cement Production", Version 03

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

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The methodology used has been specifically designed for project activities of this kind. In terms of specific applicability conditions:

- There is no shortage of additives related to the lack of blending materials. The project activity will result in an increase of the percentage of limestone, dolomite, slag and potentially later on fly ash in the blended cement produced at the HLL plants.

This is the case; there is no shortage of those additives. HLL owns a limestone mine in Aruwakkalu where limestone is amply available. HLL has solid contracts with the suppliers of Dolomite in the districts of Kandy and Matale in Sri Lanka, where dolomite is abundantly available. Holcim group has a long term contract where about 500,000 MT of slag/y are available, from which HLL will be supplied. Since a coal power plant is planned to be construct in the region of Puttalam, there is an opening for HLL to use fly ash around 2010. As the availability and the quality of the fly ash are not yet defined, HLL will demonstrate availability before ever using it.

- The methodology is applicable to domestically sold output of the project activity and excludes export of blended cement types.

This is the case, as the produced cement is sold on the national market.

- Adequate data are available on cement types in the market.

This is the case. An independent benchmark covering Sri Lanka market was done specifically for the project activity.

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

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The table below describes which emission sources and gases are included in the project boundary for the purpose of calculating project emissions and baseline emissions. The project boundary includes the cement production plant and the power generation in the grid.

Transport related emissions for the delivery of additional additives are included in the project activity emissions as leakage.

	Source	Gas	Included ?	Justification / Explanation
Baseline	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
	Calcination	CO_2	YES	Direct emissions due to calcination of limestone
		CH_4	NO	NO CH_4 emission
		N_2O	NO	NO N_2O emission
	Electricity from the grid	CO_2	YES	Indirect emissions from fossil fuels combustion of power plants from the grid due to electricity used for: crushing the raw materials used for clinker production, driving the kiln and kiln fans, grinding of cement, processing of additives.
		CH_4	NO	CH_4 emissions are considered negligible.
		N_2O	NO	N_2O emissions are considered negligible.
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
	Calcination	CO_2	YES	Direct emissions due to calcination of limestone
		CH_4	NO	NO CH_4 emission
		N_2O	NO	NO N_2O emission
	Electricity from the grid	CO_2	YES	Indirect emissions from fossil fuels combustion of power plants from the grid due to electricity used for: crushing the raw materials used for clinker production, driving the kiln and kiln fans, grinding of cement, processing of additives.

		CH_4	NO	CH_4 emissions are considered negligible.
		N_2O	NO	N_2O emissions are considered negligible.

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

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Identification of the baseline scenario

In Sri Lanka, cement characteristics are subject to the Sri Lankan Standards (SLS). The standard SLS 1253 "Specification for Portland Limestone Cement (PLC)" specifies that PLC should have 6 to 15% limestone and 0 to 5% minor constituents. The SLS 1253 doesn't allow any artificial pozzolanic materials like fly ashes or slag. The current blend level of limestone and dolomite is around 12.6% with namely 9.9% limestone and 2.7% dolomite. This is an optimal level that has been reached based on the clinker and limestone quality and can not be increased for technical reasons.

This probable baseline scenario is the continuation of the blend level.

In addition to the project activity and continuation of the current blend level, other theoretically possible baseline scenarios consist of:

- A reduction in the blend level
- A switch to production of Ordinary Portland Cement
- A switch to production of Blended Hydraulic Cement

Regarding the barriers related to the blend of natural additives, HLL might reduce the blend level of natural additives or even go back to OPC. However, this is highly improbable and to be conservative, we exclude this course of action. Given the barriers, mostly financial, we cannot consider switching our production of Portland Limestone Cement to a production of Portland Blast Furnace Slag Cement or Pozzolanic material Cement.

The realistic and credible alternatives can consequently be restricted to two - the existing practice of cement production and the proposed project activity of adding natural additives plus slag and potentially later on fly ash.

HLL has made considerable efforts and continues to be able to sell its lower emission blended cement under the Sri Lankan Standards (SLS). Indeed, the present related standard defined in 2003 (after important efforts from HLL) consists of one (standard) for blended hydraulic cement and one (standard) for Portland Limestone Cement. The proposed mix, which will reduce the emissions per tonne of cement, is not in line with the two Sri Lankan Standards but combines them. HLL wishes that the CDM will give an incentive to the SLS to re-evaluate the SLS with the EN standards.

HLL, together with HGRS, is doing large R&D work and will continue to enable the increase of the additives percentage and reduce the emissions per tonne of cement, whilst crucially maintaining the quality and reputation of the brands.

At the same time, substantial marketing and educational effort must be undertaken to ensure that customers are aware that the quality remains despite the increase of additives, as well as additional marketing effort to establish the higher blend cement in the market.

Without the CDM project activity, these actions would not be undertaken, and the additives of PLC produced by HLL would remain at the current level or lower and would lead to higher GHG emissions. The additionality demonstration tool is used in section B.5 to determine the most likely baseline scenario: the current practice of cement production.

Description of the baseline scenario
The first element in the calculation of baseline emissions is the benchmark share of clinker. The benchmark share of clinker must be the lowest vale among the following:

(i) The average (weighted by production) mass percentage of clinker for the 5 highest blend cement brands for the relevant cement type in the region. If the region comprises less than 5 blend cement brands, the national market should be used as the default market; or

(ii) The production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region. If 20% falls on part capacity of a plant, that plant is included in the calculation; or

(iii) The mass percentage of clinker in the relevant cement type produced in the proposed project activity plant before the implementation of the CDM project activity, if applicable (For Greenfield project activity this option may be excluded)

The market in Sri Lanka consists of 8 companies plus HLL selling bags of cement all year long. As the national market face all over the country mostly the same barriers, the region chosen is the national market.

To determine (i) and (ii), the methodology stipulates either to do a statistically significant random sampling or to use reliable and up-to-date annual data from a reputable and verifiable source. Since there is no up-to-data annual data from reputable and verifiable source about the Sri Lankan’s market, the data regarding the percentage of additives and therefore the percentage of clinker has been determined by an independent benchmarking. Statistically significant random bag sampling covering all cement brands in Sri Lanka has been carried out by an independent agency. The samples were sent by the agency to the Material Technology (MT) Laboratories in Holderbank where the percentage of additives and the clinker content were analyzed.

Briefly the methodology which has been used is the following:

First two methods have been used, namely Leco and Thermo Gravimetric Analysis (TGA). The Leco method allows a first screening as it gives the total carbon content. The TGA method measures the loss of weight between 600-900 °C, and therefore the results are very specific for decomposition of Ca/Mg-carbonates ($CaCO_3$).

If the Leco method shows a total of carbon significantly higher than the CO_2 content shows with the TGA method, it is possible to state that the cement contains also other carbon sources. In this case a semi quantitative assessment for fly ash and slag/pozzolanic material by light microscope was done.

The quantitative assessment by light microscope states the final amount of all constituents and then we can determine the clinker content.

The results are available and will be presented during validation.
The laboratory's analysis shows that HLL is the only producer that blends the type Portland Limestone Cement (6 to 15% limestone in the blend regarding the Sri Lanka Standards). The market of cement bags in Sri Lanka consists mainly of Ordinary Portland Cement, with some companies offering as well for specific use blended hydraulic cement with pozzolanic material.

The first (i) and second methods (ii) are not applicable since HLL is the only producer of the relevant cement type, PLC, in Sri Lanka and the PLC produced represents about a quarter of all the cement sold in Sri Lanka. The details are available.

Since the mass percentage of clinker is the lowest in HLL, the method iii) is applicable.

Given that the analysis provides the chemical composition (i.e. pure $CaCO_3$), and in view of the fact that the standards - SLS and EN – allow a limestone purity of 75%, the mass percentage of clinker for Portland Limestone Cement in Sri Lanka is based on the HLL level of blend for Portland Limestone Cement detailed in the HLL annual technical report of 2005.

Region	Selected benchmark baseline for base year 2005
Sri Lanka	83.1%

Trends increase in additive blend.
As outlined in the methodology, we have selected the default 2% increase per year in additives for continuous improvement. The following table outlines the baseline clinker content for the project activity cement plants over the crediting period with the added default 2% increase per year in additives.

Region	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Sri Lanka	82.6	82.3	82.1	81.8	81.5	81.2	80.9	80.6	80.3	80.0

Baseline emission factors
Having determined the benchmark share of clinker, specific baseline emission factors must be calculated. As outlined in the methodology, baseline CO_2 emissions per tonne of blended cement type are:

$BE_{BC,Y} = [BE_{clinker} * B_{Blend,y}] + BE_{ele\_ADD\_BC}$

Calculation of $BE_{clinker}$
$BE_{clinker} = BE_{calcin} + BE_{fossil\_fuel} + BE_{ele\_grid\_CLNK} + BE_{ele\_sg\_CLNK}$

The table below outlines the values for clinker production in Puttalam cement plant for the year 2005, calculated from current company data.

Plant PA	**(tCO_2/ton clinker)**
BE_{calcin} (tCO_2/tonne clinker)	0.535
BE_{fossil_fuel} (tCO_2/tonne clinker)	0.355
$BE_{ele\_grid\_CLNK}$ (tCO_2/tonne clinker)	0.061
$BE_{ele\_sg\_CLNK}$ (tCO_2/tonne clinker)	0.000

Due to the global commitment of HLL to decrease CO2, we expect (depending on incentive) that the emissions per tonne of clinker during the crediting period will be less than baseline emissions per tonne of clinker ($PE_{Clinker,y} < BE_{Clinker}$). In this case due to the methodology requirement the baseline value will be substituted by the project activity value. This parameter will be check during the verification.

Plant PA	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
$PE_{clinker,y}$ (tCO_2/tonne clinker)	0.896	0.889	0.882	0.876	0.876	0.876	0.876	0.876	0.876	0.876
$BE_{clinker}$ (tCO_2/tonne clinker)	0.952	0.952	0.952	0.952	0.952	0.952	0.952	0.952	0.952	0.952

Calculation of $BE_{ele\_ADD\_BC}$
$BE_{ele\_ADD\_BC} = BE_{ele\_grid\_BC} + BE_{ele\_sg\_BC} + BE_{ele\_grid\_ADD} + BE_{ele\_sg\_ADD}$

The table below outlines the value for BC production in Puttalam cement plant for the year 2005, calculated from current company data. Puttalam cement plant doesn't self-generate electricity. The cement plant does not carry out electricity consumption data separated for grinding and preparation of additives, hence $BE_{ele\_grid\_BC}$ includes $BE_{ele\_grid\_ADD}$.

Plant PA	**(tCO_2/tonne BC)**
$BE_{ele\_grid\_BC}$ (tCO_2/tonne BC)	0.031
$BE_{ele\_sg\_BC}$ (tCO_2/tonne BC)	0.000
$BE_{ele\_grid\_ADD}$ (tCO_2/tonne BC)	Included in $BE_{ele\_grid\_BC}$
$BE_{ele\_sg\_ADD}$ (tCO_2/tonne BC)	0.000

The following table outlines the global baseline emission $BE_{BC,Y}$ (tCO_2/tonne BC) for the project activity cement plants over the crediting period as well as the expected clinker production manufacture to produce PLC (t clinker), the Portland Limestone Cement production made with self produced clinker (t BC) and the estimation of baseline emission (tCO2).

Plant PA Year	**Baseline emission over the crediting**	**Estimation clinker**	**Estimation of PLC production**	**Estimation of baseline emissions**

	period (tCO_2/tonne BC)	production used for PLC (tonnes)	(tonnes)	(tCO_2e)
2007	0.772	474,301	610,190	470,820
2008	0.764	497,283	665,439	508,101
2009	0.756	462,150	635,433	480,077
2010	0.747	509,458	700,478	523,575
2011	0.745	495,448	700,478	521,866
2012	0.743	495,448	700,478	520,123
2013	0.740	481,439	700,478	518,345
2014	0.737	481,439	700,478	516,531
2015	0.735	467,429	700,478	514,681
2016	0.732	467,429	700,478	512,794

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): >>

As outlined in the methodology, we used the additionality tool developed by the EB.

STEP 0: Preliminary screening of projects started after 1 January 2000 and prior to December 2005.

A first phase started in 2002 with the switch of OPC to PLC. The project activity does not claim retroactive CERs and therefore this step is not applicable.

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

As outlined in the methodology and confirmed in section B.4., the available alternatives are restricted to:

- The proposed project activity
- The continuation of the current practice

Sub-step 1b. Enforcement of applicable laws and regulations:

There is no legal requirement that forces a cement supplier to obtain an official standard awarded by the Sri Lanka Standards Institution (SLSI). Hence, it is neither illegal nor impossible to sell cement in Sri Lanka which does not comply with the prevailing SLSI standards. Therefore, we conclude that both alternatives are in compliance with applicable laws and regulations.

Step 2. Investment analysis
OR
Step 3. Barrier analysis

Step 3a. Barrier analysis is selected

As highlighted, the increase of the additives which will result from the project activity will take the blend level to a level that exceeds common practice in Sri Lanka.
There are a number of important barriers preventing implementation of the target rate. These barriers can be characterized as:

1. Technological barriers

   It is difficult to increase the percentage of additives to the level anticipated in the project activity. Increase of each individual additive faces specific technical issues as well as the prospective project activity's mix.

Since HLL started in 2002 with the objective of decreasing the emissions with regards to the early efforts from Holcim Group to reduce CO_2, HLL has the technical know-how to blend limestone (with dolomite) up to the current level. However, there are technical barriers to reach the level anticipated in the project activity. Indeed, to keep the strengths (from 1 day to 28 days), the blend would have be ground finer and strengths enhancer would have be used.

Concerning blending with slag, there is as well technical issues to add slag in PLC. The plant hasn't got large over grinding capacities and since the product comes from India in the form of granulated slag, it should either be grinded in Sri Lanka - which means the grinding capacity must be implemented-, or be imported already grinded. The last option encounters logistic and storage barriers and the first option encounters mostly financial barriers, but also technical barriers as well as set-up and maintenance issues.

The technical difficulty with adding fly ash resides mainly in its sourcing. Today there is no fly ash available in Sri Lanka and handling and storage barriers are substantial. Since a coal power plant is planned to be constructed in the region of Putttalam around 2010, an opening of using Sri Lankan's fly ash could be at earliest in 2011 a possibility. In this case, trials would have to be done since the quality of fly ash remains up to now unknown.

Regardless the individual barriers that each additive provokes, there are also technical issues in maintaining the feature of the cement when blending these different additives together. As in Sri Lanka the cost of additives is also problematic matters, HLL may, to increase the blend, use a mix of the one mentioned.

2. Institutional barriers

It is crucial that the increase in additives neither reduces the quality nor results in a customer's perception that the cement is of a lower quality. Therefore the cement sold by HLL should respect the Sri Lankan Standards (SLS). The standards were modified in 2003 after considerable efforts from HLL to have the SLS in line with the British Standards and be able to sell PLC.

The present standards, published in 2003, allow the use of only one additive in the blend. In comparison, the EN standard allows a mix of additives, such as slag, fly ash, limestone, etc.

Standards	Name	Type	Clinker %	Pozzolanic material %	Slag %	Limestone %	Minor constituents %
SLS 1247 I (2003)	Blended Hydraulic Cement	Portland Pozzolanic Cement	65-94	6-35	-	-	0-5
SLS 1247 II (2003)	Blended Hydraulic Cement	Portland Slag Cement	65-94	-	6-35	-	0-5
SLS 1253	Portland	Portland	85-94	-	-	6-15	0-5

(2003)	Limestone Cement	Limestone Cement					
EN 197 CEM II/B-M(2000)	Portland Composite Cement	Portland Composite Cement	65-79	21-35			0-5

As the project activity of HLL is to increase the blend as well with limestone as with dolomite, slag and potentially fly ash, the project activity is not in line with any of the Sri Lanka standards. For this reason, HLL is making extensive efforts to convince the SLS to align their type with the EN standards.

3. Market acceptability barriers

In Sri Lanka, the market is dominated by OPC. On the 9 companies that sell cement all year long, only HLL proposes Portland Limestone Cement. Three producers included HLL which represent 4 brands, are selling as well for specific use, Portland Pozzolanic Cement.

The market's acceptability of PLC is an important barrier due to prevailing practices and standards. The customer's resistance is high due to their low awareness regarding blended cements.

As the end users are mainly self-builders who buy bags, HLL has made since 2002-2003, with the introduction of PLC, large training- and awareness campaigns including more than 200 workshops with masons, and will continue so with regards to the present project activity. HLL organizes and conducts fifty masonry meets per annum. Also for 2005 already 20 dealers meetings were held and before the end of this year another 30 will be completed. In all these awareness sessions and practical workshops HLL promote application based on cement products and this is another platform where HLL aware the end user regarding PLC types and its environmental friendliness.

HLL is also making advertisement to increase awareness via the media.

HLL has to bring extra intensive awareness to customers since advertisement against blended cement with limestone was done by a competitor. This unfortunately contributes to market barriers and costs efforts and money.

4. Investment barriers

As stated in the technological barriers' chapter, the project activity which increases the blend by adding a mix of additives provokes important costs.

There are important expenses either with the increase of the grinding capacity or with the importation of already grinded slag, as well as major costs regarding handling and storage.

There are also major charges due to R&D activities to find a product that satisfies feature as well as availability and prices of the additives. A key committee - called the MIC committee - was set up at HLL with the aim to develop out of the current PLC, high blended limestone cement. Holcim Group has also largely contributed in time and trials.

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

The alternative to the project activity is the continuation of current practice. This would face much less intensively all the barriers outlined above.

Step 4. Common Practice Analysis

As outlined in Section B.4., the baseline level from which the project activity will increase the additives in the PLC is not at all common practice in Sri Lanka. The project is a “first of its kind” project in Sri Lanka. The only similar case was the introduction of PLC by Holcim Lanka Ltd in 2002-2003 although the level of blend was far below the proposed project.

Step 5. Impact of CDM Registration

The CDM will allow HLL to overcome the barriers to increase the additives in the PLC. CDM Status provides three key benefits to HLL, the first is the prospect of CDM revenue. The second benefit is to give a stimulus to the Sri Lankan Standards to modify the current standards and recognize the composite cement proposed by the project activity. The third benefit is the gain of experience in CDM projects and the ability to provide evidence that the company is making serious efforts to reduce GHG emissions. The cement industry is aware of the emissions associated to cement production and the CDM should give real incentive to reduce these.

The three above factors allowed and will continue to allow the company to dedicate R&D and technical resources, financial and marketing efforts to overcome the barriers.

Institutional and marketing
As mentioned above, the discussion with Sri Lankan Standards is on-going. At the time of writing (second and third trimesters of 2006) SLS has rejected the proposition of modification and HLL has officially objected to this refusal. Some more efforts will have to be made by HLL to induce the desired modification. If the modification gets approved, the standards will be in line with sustainable development and this will enable HLL to reduce emissions as well as give the chance to the global cement market in Sri Lanka to reduce their emissions by blending composite cement type.
The marketing department is working with the R&D teams to assure customers about the quality of the cement produced by HLL as well as the concern of Holcim Lanka to reduce emissions. These marketing efforts will consist of a series of training, workshops and advertisements.

R&D and technical resources
A team of 10 persons is forming the Mineral Component and Composite Cements (MIC) Committee within HLL, and 4 persons from HGRS are supporting the development of the project activity. The laboratories HLL and Holcim group are doing several trials that, hopefully, will

enable the increase of the additives. The team is also actively looking for technical solutions regarding logistics, handling, storage and preparation of the additives.

As highlighted earlier, the CDM project status is a key factor that enables the above institutional, marketing and R&D initiatives to be undertaken.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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As written in the section B.4 an independent benchmarking was done to establish the percentage of additives as well as the clinker content in the cement brands sold in the national market. Since the laboratory analysis has clearly showed that within Portland Limestone Cement HLL is blending with the lowest clinker content, the benchmark share of clinker was established regarding the mass percentage of clinker produced in Puttalam before the implementation of the CDM project activity. Given that the analysis provides the chemical composition (i.e. pure $CaCO_3$) the mass percentage of clinker for the baseline is based on the Puttalam cement plant's level of blend as detailed in the HLL annual technical report of 2005.

Since we have assumed that the CaO and MgO content in the raw material should not change significantly in the next years, estimations of the project emissions from calcination were done with the raw material composition values of 2005.

Given that the Puttalam cement plant will in order to achieve its commitment to reduce CO2, hopefully increase its use of biomass as alternative fuels, the estimation of the project emissions from fossil fuels take this parameters into account by showing a decrease of CO2 emission per tonne of clinker.

Concerning the electricity consumption we have made the hypothesis that the national market grid emission factor will stay unchanged and therefore the electricity consumption for grinding clinker will remain as in 2005. We have extrapolated the electricity consumption for grinding both blended cement and additives regarding the increase of additive as well as regarding the increase in the PLC production.

Puttalam cement plant is currently not generating electricity.

In view of the fact that the project activity aims to add natural additives plus slag along with fly ash and regarding the uncertainty of fly ash availability and quality, the project emission calculation has - as first estimation – excluded fly ash from the calculation. An update of the computation will be done annually.

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

All data used to calculate the baseline and estimate the project activity emission reduction are available. The baseline data is reported in this section and the project emission data is reported in the section B.7. The data variables which derive from a computation of the data below and which are specified in the methodology are not mentioned in the following tables but are reported in the calculation data.

The main data and parameter which stem from the annual technical report (ATR) 2005, a report that every plant within the Holcim group has to fulfil and send to the local head office and to the corporate, are outlined below.

Data / Parameter:	**$InCaO_{BSL}$**
Data unit:	Percentage (%)
Description:	CaO content of the raw material
Source of data used:	ATR
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory analysis. ISO 9002.
Any comment:	None

Data / Parameter:	**$OutCaO_{BSL}$**
Data unit:	Percentage (%)
Description:	CaO content of the clinker
Source of data used:	ATR
Value applied:	67.06
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory analysis. ISO 9002.
Any comment:	None

Data / Parameter:	**$InMgO_{BSL}$**
Data unit:	Percentage (%)
Description:	MgO content in the raw material
Source of data used:	ATR
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Laboratory analysis. ISO 9002.
Any comment:	None

Data / Parameter:	**$OutMgO_{BSL}$**
Data unit:	Percentage (%)
Description:	MgO content of the clinker
Source of data used:	ATR
Value applied:	0.81
Justification of the	Laboratory analysis. ISO 9002.

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	None

Data / Parameter:	**Raw material quantity**
Data unit:	Tonne
Description:	Quantity of raw material used to produce the clinker
Source of data used:	ATR
Value applied:	823,282
Justification of the choice of data or description of measurement methods and procedures actually applied :	Quantity of raw material used to produce the total amount of clinker manufactured for each type of cement and cement product. This value is used to calculate the emission from calcination. Weight and cross-check with the clinker content and the quantity of clinker used. ISO 9002.
Any comment:	None

Data / Parameter:	**$CLNK_{BSL}$**
Data unit:	Tonne
Description:	Annual production of clinker
Source of data used:	ATR
Value applied:	494,330
Justification of the choice of data or description of measurement methods and procedures actually applied :	Quantity of clinker used to produce each type of cement and cement product. This value is used to calculate the emission from clinker production. Weight and cross-check with the clinker content and merchandise sold. ISO 9002.
Any comment:	None

Data / Parameter:	**FF_{i1BSL}**
Data unit:	Tonne
Description:	Tonne of bituminous coal used to feed the kiln
Source of data used:	ATR
Value applied:	79,130
Justification of the choice of data or description of measurement methods and procedures actually applied :	Quantity of bituminous coal used to produce the total amount of clinker manufactured for each type of cement and cement product. This value is used to calculate the emission from calcination. Automatically weight and cross-check with the amount bought. ISO 9002.
Any comment:	None

Data / Parameter:	FF_{i2BSL}
Data unit:	Tonne
Description:	Tonne of heavy oil used to feed the kiln
Source of data used:	ATR
Value applied:	521
Justification of the choice of data or description of measurement methods and procedures actually applied :	Quantity of heavy oil used to produce the total amount of clinker manufactured for each type of cement and cement product. This value is used to calculate the emission from calcination. Automatically weight and cross-check with the amount bought. ISO 9002.
Any comment:	None

Data / Parameter:	FF_{i3BSL}
Data unit:	Tonne
Description:	Tonne of used/waste oil used to feed the kiln
Source of data used:	ATR
Value applied:	1,126
Justification of the choice of data or description of measurement methods and procedures actually applied :	Quantity of used/waste oil used to produce the total amount of clinker manufactured for each type of cement and cement product. This value is used to calculate the emission from calcination. Automatically weight and cross-check with the amount bought. ISO 9002.
Any comment:	None

Data / Parameter:	FF_{i4BSL}
Data unit:	Tonne
Description:	Tonne of used/waste oil low quality used to feed the kiln
Source of data used:	ATR
Value applied:	101
Justification of the choice of data or description of measurement methods and procedures actually applied :	Quantity of used/waste oil low quality used to produce the total amount of clinker manufactured for each type of cement and cement product. This value is used to calculate the emission from calcination. Automatically weight and cross-check with the amount bought. ISO 9002.
Any comment:	None

Data / Parameter:	$BELE_{grid\_clnk,BSL}$
Data unit:	MWh
Description:	Grid electricity consumption for the total amount of clinker manufactured for each type of cement and cement product.
Source of data used:	ATR
Value applied:	44,297

Justification of the choice of data or description of measurement methods and procedures actually applied :	Compute ever 24 hours and cross-check with the electricity bill.
Any comment:	None

Data / Parameter:	**$BELE_{grid\_BC,BSL}$ (included $BELE_{grid\_ADD,BSL}$)**
Data unit:	MWh
Description:	Grid electricity consumption for grinding all BC type PLC
Source of data used:	ATR
Value applied:	27,659
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value represents the total amount of BC grinded and included the consumption for grinding additives. Compute ever 24 hours and cross-check with the electricity bill.
Any comment:	None

Data / Parameter:	**$BC_{, BSL}$**
Data unit:	Tonne
Description:	Annual production of BC
Source of data used:	ATR
Value applied:	603,226
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is used to calculate the baseline emission (tonne CO2/tonne BC) Weight and cross-check with the clinker content and merchandise sold. ISO 9002.
Any comment:	None

Data / Parameter:	**$BC_{PAclnk, BSL}$**
Data unit:	Tonne
Description:	Annual production of BC excluding BC produced with imported clinker
Source of data used:	ATR
Value applied:	555,250
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value is used to calculate the net emission (tonne CO_2) ISO 9002.
Any comment:	None

Data / Parameter:	$ADD_{,BSL}$_limestone
Data unit:	Tonne
Description:	Annual consumption of additives :limestone
Source of data used:	ATR
Value applied:	59,067
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value excluded the amount of limestone which is mixed with imported clinker. Automatically weight and cross-check with the clinker content and merchandise sold. ISO 9002.
Any comment:	None

Data / Parameter:	$ADD_{,BSL}$_dolomite
Data unit:	Tonne
Description:	Annual consumption of additives: dolomite
Source of data used:	ATR
Value applied:	16,001
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value excluded the amount of dolomite which is mixed with imported clinker. Automatically weight and cross-check with the clinker content and merchandise sold. ISO 9002.
Any comment:	None

Data / Parameter:	$ADD_{,BSL}$_slag
Data unit:	Tonne
Description:	Annual consumption of additives: dolomite
Source of data used:	ATR
Value applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

Data / Parameter:	$ADD_{,BSL}$_fly ash
Data unit:	Tonne
Description:	Annual consumption of additives: dolomite
Source of data used:	ATR
Value applied:	0

Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

This data stems from HLL transport data base and from geographical parameters.

Data / Parameter:	**Distance limestone**
Data unit:	Km
Description:	Distance between the Aruwakkalu mine and the plant
Source of data used:	geographical parameter
Value applied:	86
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	Round trip

Data / Parameter:	**Distance dolomite**
Data unit:	Km
Description:	Distance between the Kandy district and the plant
Source of data used:	geographical parameter
Value applied:	240
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	Round trip

Data / Parameter:	**Distance slag (ship)**
Data unit:	Nautical miles
Description:	Distance between Visakapatam and port
Source of data used:	geographical parameter
Value applied:	791
Justification of the choice of data or description of measurement methods and procedures	None

actually applied :	
Any comment:	None

Data / Parameter:	Distance slag (truck)
Data unit:	Km
Description:	Distance between the port and the plant
Source of data used:	geographical parameter
Value applied:	300
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	Round trip

Data / Parameter:	Qadd dolomite
Data unit:	Tonne of additives
Description:	Quantity of additives in one trip per vehicle
Source of data used:	Puttalam cement plant transport data
Value applied:	17
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

Data / Parameter:	Qadd slag (ship)
Data unit:	Tonne of additives
Description:	Quantity of additives in one ship
Source of data used:	Puttalam cement plant transport data
Value applied:	6,000
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

Data / Parameter:	Qadd slag
Data unit:	Tonne of additives
Description:	Quantity of additives in one trip per vehicle

Source of data used:	Puttalam cement plant transport data
Value applied:	33.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

This data stems from external sources.

Data / Parameter:	$\mathbf{EF_{grid}}$
Data unit:	tonne CO_2/MWh
Description:	Grid emission factor
Source of data used:	ACM002, see appendix
Value applied:	0.6816
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

Data / Parameter:	$\mathbf{EFF_{i1}}$
Data unit:	CO_2/tonne of fuel
Description:	Emission factor for bituminous coal used to feed the kiln
Source of data used:	IPCC 2006 and net calorific value
Value applied:	2.16
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	94.6 tCO2/TJ

Data / Parameter:	$\mathbf{EFF_{i2}}$
Data unit:	CO_2/tonne of fuel
Description:	Emission factor for heavy oil used to feed the kiln
Source of data used:	IPCC 2006 and net calorific value
Value applied:	2.98
Justification of the choice of data or description of	None

measurement methods and procedures actually applied :	
Any comment:	73.3 tCO2/TJ

Data / Parameter:	**EFF_{i3} and EFF_{i4}**
Data unit:	CO_2/tonne of fuel
Description:	Emission factor for used/waste oil and used/waste oil low quality used to feed the kiln
Source of data used:	IPCC 2006 and net calorific value
Value applied:	2.79
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	73.3 tCO2/TJ

Data / Parameter:	**NCV diesel**
Data unit:	TJ/kt
Description:	Net calorific value of diesel fuel
Source of data used:	Default CO_2 emission factor table: WBCSD Cement Sustainability Initiative CO_2 Emissions Inventory Protocol
Value applied:	43.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	73.3 tCO2/TJ

Data / Parameter:	**Carbon emission factor of diesel**
Data unit:	tCO2/TJ
Description:	Carbon emission factor of diesel fuel
Source of data used:	IPCC 2006
Value applied:	74.1
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

Data / Parameter:	Heating value of the ship fuel
Data unit:	GJ/tonne
Description:	Heating value of the ship fuel
Source of data used:	Default IPCC value
Value applied:	41.868
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

Data / Parameter:	Emission factor of the ship fuel
Data unit:	tCO_2/TJ
Description:	Emission factor of the ship fuel
Source of data used:	Default IPCC value
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	None
Any comment:	None

Data / Parameter:	Train consumption
Data unit:	litre fuel/tonne of limestone
Description:	Fuel consumption for the train (dolomite)
Source of data used:	Tested on site
Value applied:	0.50
Justification of the choice of data or description of measurement methods and procedures actually applied :	The factor tested on site is more conservative than the official data (India).
Any comment:	None

Data / Parameter:	Truck consumption
Data unit:	kg fuel per km
Description:	Fuel consumption for truck
Source of data used:	Supplier
Value applied:	0.4
Justification of the	The factor from the supplier is more conservative than the official data (India).

choice of data or description of measurement methods and procedures actually applied :	
Any comment:	None

B.6.3 Ex-ante calculation of emission reductions:

>>

Project emission factors

Project emissions per tonne of blended cement are calculated as follows:

$PE_{BC,Y} = [PE_{clinker} * P_{Blend,y}] + PE_{ele\_ADD\_BC}$

where:

$PE_{BC,Y}$ = CO_2 emissions per tonne of BC in the project activity plant in year y(tCO_2/tonne BC)

$PE_{clinker}$ = CO_2 emissions per tonne of clinker in the project activity plant in year y (tCO_2/tonne clinker) and defined below

$P_{Blend,y}$ = Share of clinker per tonne of BC in year y (tonne clinker/tonne BC)

$PE_{ele\_ADD\_BC}$ = Electricity emissions for BC grinding and preparation of additives in year y (tCO_2/tonne BC)

The following table outlines the projected decrease in share of clinker per tonne of PLC at Puttalam cement plant over the crediting period.

Plant PA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
$P_{Blend,y}$ (t clinker/tonne BC)	78%	75%	73%	73%	71%	71%	69%	69%	67%	67%

Calculation of $PE_{clinker}$

$PE_{clinker} = PE_{calcin} + PE_{fossil\_fuel} + PE_{ele\_grid\_CLNK} + PE_{ele\_sg\_CLNK}$

The table below estimates the values for clinker production in Puttalam cement plant for the project duration. Puttalam cement plant won't self-generate electricity and hence $PE_{ele\_sg\_CLNK}$ is nil.

Plant PA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PE_{calcin} (tCO_2/tonne clinker)	0.535	0.535	0.535	0.535	0.535	0.535	0.535	0.535	0.535	0.535
PE_{fossil_fuel} (tCO_2/tonne clinker)	0.300	0.293	0.286	0.279	0.279	0.279	0.279	0.279	0.279	0.279
$PE_{ele\_grid\_CLNK}$ (tCO_2/tonne clinker)	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061

Calculation of $PE_{ele\_ADD\_BC}$

$PE_{ele\_ADD\_BC} = PE_{ele\_grid\_BC} + PE_{ele\_sg\_BC} + PE_{ele\_grid\_ADD} + PE_{ele\_sg\_ADD}$

The table below estimates the values for PLC production in Puttalam cement plant for the project duration. Puttalam cement plant won't self-generate electricity and the cement plant doesn't carry out separate grinding and preparation of additives and hence $PE_{ele\_sg\_BC}$, $PE_{ele\_grid\_ADD}$ and $PE_{ele\_sg\_ADD}$ are nil.

Plant PA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
$PE_{ele\_grid\_BC}$ (tCO_2/tonne BC)	0.033	0.033	0.034	0.035	0.035	0.036	0.037	0.037	0.038	0.039

The following table estimates the global project emission $PE_{BC,Y}$ (tCO_2/tonne BC) for PLC at Puttalam cement plant over the crediting period.

Plant PA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
$P_{Blend,y}$ (tCO2/tonne BC)	0.729	0.698	0.676	0.671	0.655	0.655	0.639	0.639	0.622	0.623

Leakage

Leakage is calculated as detailed in the methodology.

The following table outlines the transport-related emissions per tonne of additives (tCO_2/tonne of additive)

Plant PA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Limestone	0.00161	0.00161	0.00161	0.00161	0.00161	0.00161	0.00161	0.00161	0.00161	0.00161
Dolomite	0.01813	0.01813	0.01813	0.01813	0.01813	0.01813	0.01813	0.01813	0.01813	0.01813
Slag	0.04141	0.04141	0.04141	0.04141	0.04141	0.04141	0.04141	0.04141	0.04141	0.04141
Fly ash	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

The following table outlines the leakage emissions for transportation of additives L_y for the project activity (tCO_2) regarding the PLC production outlined in the baseline.

Plant PA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
L_y (tCO_2)	-145	-521	-778	-832	-1,169	-1,138	-1,496	-1,460	-1,833	-1,782

Project emission reductions

The following table estimates the project emission reductions (tCO_2/year) regarding the PLC production outlined in the baseline.

Plant PA	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
PE (tCO_2)	445,009	464,415	429,400	470,322	458,538	459,032	447,268	447,781	436,037	436,571

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

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Years	**Estimation of project emission (tonnes of CO_2e)**	**Estimation of baseline emissions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of overall emission reduction (tonnes of CO_2e)**
Year A (2007)	445,009	470,820	-145	25,665
Year B	464,415	508,101	-521	43,165
Year C	429,400	480,077	-778	49,900
Year D	470,322	523,575	-832	52,422
Year E	458,538	521,866	-1,169	62,159
Year F	459,032	520,123	-1,138	59,953
Year G	447,268	518,345	-1,496	69,581
Year H	447,781	516,531	-1,460	67,291
Year I	436,037	514,681	-1,833	76,810
Year J	436,571	512,794	1,792	74,431
Total (tonnes of CO_2e)	4,494,373	5,086,913	-10,983	581,377

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 emission reductions will be available at verification. The value of data applied for the purpose of calculating expected emission reductions (2007) is reported in this section. The value of data applied for each year of the crediting period is reported in the calculation data base. The data variables which derive from a computation of the data below are not mentioned in the following tables but are reported in the calculation data base.

The values that stem from external sources (for example value that comes from IPCC) are the same than the ones used in the baseline calculation (see section B.6.2) and will be updated regarding to the source's publication. The data stemming from HLL transport data and from geographical parameters are also the same than the ones used in the baseline calculation (see section B.6.2) and will be updated if needed throughout the duration of the project activity.

Puttalam cement plant is accredited according to ISO 9002 and 14000 systems, therefore the uncertainty level of data is relatively low. The quality control (QC) and quality assurance (QA) also include cross checking data with other internal group company reports.

Data / Parameter:	**$InCaO_y$**
Data unit:	Percentage (%)
Description:	CaO content of the raw material
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Laboratory analysis.
QA/QC procedures to be applied:	ISO 9002. Laboratory equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$OutCaO_y$**
Data unit:	Percentage (%)
Description:	CaO content of the clinker
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	67.06
Description of measurement methods and procedures to be applied:	Laboratory analysis.
QA/QC procedures to be applied:	ISO 9002. Laboratory equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$InMgO_y$**
Data unit:	Percentage (%)
Description:	MgO content in the raw material
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in	0

section B.5	
Description of measurement methods and procedures to be applied:	Laboratory analysis.
QA/QC procedures to be applied:	ISO 9002. Laboratory equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$OutMgO_y$**
Data unit:	Percentage (%)
Description:	MgO content of the clinker
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.81
Description of measurement methods and procedures to be applied:	Laboratory analysis.
QA/QC procedures to be applied:	ISO 9002. Laboratory equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**Raw material quantity**
Data unit:	Tonne
Description:	Quantity of raw material used to produce the clinker
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	823,282. As first estimation we assume that emissions per tonne of clinker (tCO2/tonne clinker) remain like the baseline, therefore we use the same value of raw material than the baseline value.
Description of measurement methods and procedures to be applied:	Weight and cross-check with the clinker content and the quantity of clinker used.
QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$CLNK_y$**
Data unit:	Tonne
Description:	Annual production of clinker
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	494,330
Description of measurement methods and procedures to be applied:	Weight and cross-check with the clinker content and merchandise sold.
QA/QC procedures to be applied:	ISO 9002. Weighing equipments are subject to regular calibration.
Any comment:	As first estimation we assume that emissions per tonne of clinker (tCO2/tonne clinker) remain like the baseline so the value applied for the project emission calculation is the one from the baseline.

Data / Parameter:	**FF_{i1y}**
Data unit:	Tonne
Description:	Tonne of bituminous coal used to feed the kiln
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	66,469
Description of measurement methods and procedures to be applied:	Automatically weight and cross-check with the amount bought.
QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	Emissions coming from fossil fuel consumption are assume to stay the same per tonne of clinker

Data / Parameter:	**FF_{i2y}**
Data unit:	Tonne
Description:	Tonne of heavy oil used to feed the kiln
Source of data to be used:	ATR
Value of data applied for the purpose of	521

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Automatically weight and cross-check with the amount bought.
QA/QC procedures to be applied:	ISO 9002.Weighting equipments are subject to regular calibration.
Any comment:	Emissions coming from fossil fuel consumption are assume to decrease regarding the commitment to reduce CO2 emission by increasing the use of alternative fuels.

Data / Parameter:	**FF_{i3y}**
Data unit:	Tonne
Description:	Tonne of used/waste oil used to feed the kiln
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,126
Description of measurement methods and procedures to be applied:	Automatically weight and cross-check with the amount bought.
QA/QC procedures to be applied:	ISO 9002.Weighting equipments are subject to regular calibration.
Any comment:	Emissions coming from fossil fuel consumption are assume to stay the same per tonne of clinker

Data / Parameter:	**FF_{i4y}**
Data unit:	Tonne
Description:	Tonne of used/waste oil low quality used to feed the kiln
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	101
Description of measurement methods and procedures to be applied:	Automatically weight and cross-check with the amount bought.

QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	Emissions coming from fossil fuel consumption are assume to stay the same per tonne of clinker

Data / Parameter:	**$PELE_{grid\_clnk,y}$**
Data unit:	MWh
Description:	Grid electricity consumption for the total amount of clinker manufactured for each type of cement and cement product.
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	44,297
Description of measurement methods and procedures to be applied:	Compute every 24 hours and cross-check with the electricity bill.
QA/QC procedures to be applied:	ISO 9002. Electricity consumption counters are subject to regular calibration.
Any comment:	Emissions coming from grinding clinker are assume to stay the same per tonne of clinker

Data / Parameter:	**$PELE_{grid\_BC,y}$**
Data unit:	MWh
Description:	Grid electricity consumption for grinding additives and BC type PLC
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	29,109
Description of measurement methods and procedures to be applied:	Compute ever 24 hours and cross-check with the electricity bill.
QA/QC procedures to be applied:	ISO 9002. Electricity consumption counters are subject to regular calibration.
Any comment:	**$PELE_{grid\_BC,y}$** includes the electricity consumption on site to grind additives

Data / Parameter:	**$PELE_{grid\_ADD,y}$**
Data unit:	MWh
Description:	Grid electricity consumption for grinding additives outside the plant

Source of data to be used:	suppliers' bills
Value of data applied for the purpose of calculating expected emission reductions in section B.5	79,46
Description of measurement methods and procedures to be applied:	Electricity bill.
QA/QC procedures to be applied:	Electricity consumption counters are subject to regular calibration.
Any comment:	Part of the dolomite used is purchased already grinded.

Data / Parameter:	**$BC_{, y}$**
Data unit:	Tonne
Description:	Annual production of BC
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	610,190
Description of measurement methods and procedures to be applied:	This value is used to calculate the project emission (tonne CO_2/tonne BC) Weight and cross-check with the clinker content and merchandise sold.
QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$BC_{PAclnk, y}$**
Data unit:	Tonne
Description:	Annual production of BC excluding BC produced with imported clinker
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	610,190
Description of measurement methods and procedures to be	This value is used to calculate the net emission (tonne CO2)

applied:	
QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$ADD_{,y}$_limestone**
Data unit:	Tonne
Description:	Annual consumption of additives :limestone
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	91,578
Description of measurement methods and procedures to be applied:	Automatically weight and cross-check with the clinker content and merchandise sold.
QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$ADD_{,y}$_dolomite**
Data unit:	Tonne
Description:	Annual consumption of additives: dolomite
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	21,661
Description of measurement methods and procedures to be applied:	Automatically weight and cross-check with the clinker content and merchandise sold.
QA/QC procedures to be applied:	ISO 9002.Weighting equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**ADD_{y}_slag**
Data unit:	Tonne
Description:	Annual consumption of additives: slag
Source of data to be used:	ATR

Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Automatically weight and cross-check with the clinker content and merchandise sold.
QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**$ADD_{,y}$_fly ash**
Data unit:	Tonne
Description:	Annual consumption of additives: fly ash
Source of data to be used:	ATR
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	To define when using fly ash
QA/QC procedures to be applied:	ISO 9002. Weighting equipments are subject to regular calibration.
Any comment:	None

Data / Parameter:	**Distance limestone**
Data unit:	Km
Description:	Distance between the mine and the plant
Source of data to be used:	geographical parameter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	86
Description of measurement methods and procedures to be applied:	Distance will be crossed-checked with evidence of origin and map references.
QA/QC procedures to	ISO 9002.

be applied:	
Any comment:	Round trip

Data / Parameter:	**Distance dolomite**
Data unit:	Km
Description:	Distance between the Kandy district and the plant
Source of data to be used:	geographical parameter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	240
Description of measurement methods and procedures to be applied:	Distance will be crossed-checked with evidence of origin and map references.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	Round trip

Data / Parameter:	**Distance slag (ship)**
Data unit:	Nautical miles
Description:	Distance between Visakapatanam and Galle port
Source of data to be used:	geographical parameter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	791
Description of measurement methods and procedures to be applied:	Distance will be crossed-checked with evidence of origin and map references.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	None

Data / Parameter:	**Distance slag (truck)**
Data unit:	Km
Description:	Distance between the port and the plant
Source of data to be used:	geographical parameter
Value of data applied for the purpose of	300

calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Distance will be crossed-checked with evidence of origin and map references.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	Round trip

Data / Parameter:	**Distance fly ash**
Data unit:	Km
Description:	20
Source of data to be used:	geographical parameter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	None
Description of measurement methods and procedures to be applied:	To confirm
QA/QC procedures to be applied:	ISO 9002. Distance will be crossed-checked with evidence of origin and map references.
Any comment:	Round trip. Value to confirm when using fly ash

Data / Parameter:	**Qadd dolomite**
Data unit:	tonne of additives
Description:	Quantity of additives in one trip per vehicle
Source of data to be used:	Putalam transport data base and transporters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	17
Description of measurement methods and procedures to be applied:	Truck capacity will be cross-checked with transporters.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	None

Data / Parameter:	Qadd slag (ship)
Data unit:	tonne of additives
Description:	Quantity of additives in one trip per ship
Source of data to be used:	Putalam transport data base and transporters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6,000
Description of measurement methods and procedures to be applied:	Truck capacity will be cross-checked with transporters.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	None

Data / Parameter:	Qadd slag (truck)
Data unit:	tonne of additives
Description:	Quantity of additives in one trip per vehicle
Source of data to be used:	Putalam transport data base and transporters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	33.5
Description of measurement methods and procedures to be applied:	Truck capacity will be cross-checked with transporters.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	None

Data / Parameter:	Qadd fly ash
Data unit:	tonne of additives
Description:	Quantity of additives in one trip per vehicle
Source of data to be used:	Putalam transport data base and transporters
Value of data applied for the purpose of calculating expected emission reductions in	None

section B.5	
Description of measurement methods and procedures to be applied:	Truck capacity will be cross-checked with transporters.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	Value to confirm when using fly ash.

Data / Parameter:	**Ship consumption (slag)**
Data unit:	Tonne fuel / nautical miles
Description:	Tonne fuel per nautical miles to carry 6,000t of slag
Source of data to be used:	Putalam transport data base and transporters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.07
Description of measurement methods and procedures to be applied:	Checked with transporters.
QA/QC procedures to be applied:	ISO 9002.
Any comment:	None

B.7.2 Description of the monitoring plan:

>>

Most of the data is already collected in the annual technical report (ATR). To facilitate the verification a specific report will be handled.

The technical director, responsible for monitoring, has assigned a responsible for the specific reporting of the project activity. The same team which is doing the overall monitoring is going to proceed to the collection and monitoring of the data. The data related to the transportation of the additives will be integrated into the report.

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)

>>

23/03/2007
Holcim Sri Lanka Ltd: Peter Spirig, George Nicole, Chalaka Fernando
Holcim Group: Bruno Vanderborght, Adrienne Williams, 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:

>>
01/01/2006

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

>>
15 years

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

A fixed ten-year crediting period was chosen.

C.2.1. Renewable crediting period

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

>>
Not applicable

C.2.1.2. Length of the first crediting period:

>>
Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/07/2007 or from the date of registration

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

>>

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

>>

The project activity contributes to sustainable development and the benefit key impact is mainly environmental as the project activity will reduce the direct emissions on site generated by calcination per tonne of blended cement, as well as the connected emissions from fuel consumption. The direct emissions off site per tonne of blended cement, mainly at the power plant, will also drop due to the decrease of electrical consumption. The drop of clinker content preserves natural resources such as coal, a non renewable resource.

Increase of additives will also result in additional transportation which may involve some environmental impact. The GHG emissions from this transportation are deducted from the amount of CERs generated by the project activity. Dust-increase from operations for additives grinding (slag and limestone) and blending (fly ash, slag, limestone) are also a potential environmental impact. However, HLL has taken measures to minimize the adverse environmental effects:

- Air pollution control system is efficiently in operation and the air quality is better than the standard norm.
- Points are covered and provided with dust collection systems.

The environment management system of the Palavi plant of HLL is ISO 14001-certified. This means that HLL have undertaken a systematic review of the key environmental impacts of their operations, have identified appropriate management and monitoring of those impacts and undertake regular management review of their environmental performance and the performance of the management system.

Additionally, HLL is subject to the Holcim Group Emissions Monitoring and Reporting Standard, which requires the installation of continuous emissions monitoring equipment for dust, SO_2, NOx and VOC and the (at least) annual monitoring of a range of other substances. These 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 and regional and plant management receive feedback on their environmental performance.

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:

>>

An environmental impact assessment is not required for the project activity.

SECTION E. Stakeholders' comments

>>

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

>>

The stakeholders' meeting has been hold on July 18th at Puttalam cement plant. The persons have been invited by official invitation and through the newspaper.

Here below find an abstract of the agenda.

a. Welcoming of the stakeholders by project proponent.

b. Briefing regarding the objective of the consultation meeting.

c. Summarizing the salient features of the project with special reference to environmental aspects, highlighting the measures proposed for environmental management.

d. Invitation of the stakeholders to express their viewpoints.

e. Clarifications by project proponent on the observations and remarks made by stakeholders.

f. Vote of thanks.

E.2. Summary of the comments received:

>>

A stakeholders' meeting report was written and sent back to the stakeholders.

The present stakeholders expressed their satisfaction that the Puttalam cement plant will be holding a project that improves environmental performance and reduces C02 emissions. The stakeholders would be pleased if HLL could - within the frame of this project – use the fly ash that will be generated around 2010 by the planned coal power plant located 10 km away from the plant.

The stakeholders mentioned that such environmental projects indirectly sustain fishermen, vegetable cultivators and coconut cultivators.

The stakeholders recalled that for better environmental performance, communications through temples, churches and schools are essential.

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

>>

Puttalam cement plant aims to use the fly ash that will be generated by the planned coal power plant. Trials and tests evaluating the potential use are foreseen to start immediately after the commissioning of the coal power plant.

A communication program will be hold throughout the duration of the project activity to inform the neighbourhood trough community structure.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Holcim Lanka Ltd
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URL:	-
Represented by:	Peter Spirig
Title:	Chief Executive Officer
Salutation:	Mr.
Last Name:	Spirig
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URL:	-
Represented by:	Bruno Vanderborght
Title:	Dr.
Salutation:	Mr.
Last Name:	Vanderborght
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding received for the project activity.

Annex 3

BASELINE INFORMATION

Data type	Source
Additives blend and type of cement in Sri Lanka	Independent benchmark
Data and parameters	HLL's annual technical reports

Annex 4

MONITORING INFORMATION

HLL have delegated a key contact, the environmental manager, who will co-ordinate the collection of plant and company level data required for monitoring. As outlined, the production manager will be responsible for collecting and archiving data. All data required is collected as part of normal operations. Records will be archived regarding the monitoring methodology and filed will be available at the time of verification.

The collected data will be transmitted in electronic format to the HLL head office (Mr. Chalaka Fernando). Mr Fernando of HLL will then perform the data calculations and transformations as required as part of the monitoring methodology. An annual report will be produced and presented to the DOE carrying out verification.

Appendix
Grid emission factor calculation

The baseline approved for electricity supply to a grid served by a mix of generating capacity is either:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to procedures prescribed in the approved methodology ACM0002. Or,

b) The weighted average emissions of the current generation mix.

The first of these alternatives capture the recent and accelerating trend towards fossil fuel based energy production in Sri Lanka. The second would poorly represent the likely baseline because of the increasing reliance on fossil fuels indicated by the following table of planned expansion of generating capacity by the CEB.

Planned expansion of generating capacity by CEB

Plant	Year (planned)	capacitiy (MW)
Kerawalapitiya combined cycle	2008	300
Gas turbine	2008	105
Gas turbine	2009	140
Upper Kotmale Hydro	2010	150
Coal Steam West Coast 1	2010	300
Coal Steam West Coast 2	2011	300
Coal Steam West Coast 3	2012	300
Coal Steam Trincomalee 1	2013	300
Coal Steam Trincomalee 2	2014	300
Gas turbine	2015	285

source: CEB, ‘Long Term Generation Expansion Plan 2005 – 2019’, November 2004

Given the increasing reliance on fossil fuels planned by the CEB it would not be possible to justify a
baseline of the weighted average emissions of the current generation mix, as this will change towards an increasing reliance on fuels with significantly greater emission intensity.

Using the combination of the operating margin and the build margin represents better the current and likely future developments, as it balances the emissions intensity of all plants constructed since 1992 (and a few older fossil fuelled facilities) with that of the last plants added to the grid although the reality over the next years, with the commissioning of the Coal Power Plants, will be presumably much worse in terms of CO2 emission.

Key Information and data used to determine the Baseline scenario

Information	**Source**
Annual Generation of a power plant (MWh/yr), Genj,y	ENERGY CONSERVATION FUND, data for “Energy Balance 2004” DGM(EPT BRANCH), CEB

Plant Efficiency, ηj,y (%)	ENERGY CONSERVATION FUND, data for“Balance 2004” DGM(EPT BRANCH), CEB
Fuel type per plant	DGM(EPT BRANCH), CEB
Carbon Content of fuel (kgC/TJ) and oxidation factor	IPCC Guidelines 1996

Calculations

Step 1: Calculate the Operating Margin emission factor (EFom,y)

a. Selection of the method to calculate the Operating Margin emission factor (EFom,y)
The simple OM method can only be used where low-cost/must run resources constitute less than 50% of the total grid generation in: (1) average of the five most recent years, or (2) based on the long term normals for hydroelectricity production.

To demonstrate this, the following equation was used:
G = ∑Genlc,j,y/∑Geny
Where
Genlc,j,y = Generation of the low-cost/must run plant for the five most recent years (Gwh)
Geny = Total generation for the five most recent years ((Gwh)

The Dispatch Data Analysis could not be used as the hourly dispatch data were not available.
Generation over the five most recent years for which data are available

(Gwh)	**2000**	**2001**	**2002**	**2003**	**2004**	**Total**
CEB Hydro	3,153.84	3,044.87	2,588.62	3,190.04	2,754.70	14,732.07
CEB Non Conventional	3.36	3.46	3.64	3.39	2.82	16.67
SPP Hydro	43.14	64.71	103.46	120.29	205.58	537.18
Total Low-cust/must Run	3,200.34	3,113.04	2,695.72	3,313.72	2,963.10	15,285.92
CEB Thermal	2,205.34	1,895.50	1,952.62	2,247.92	2,506.86	10,808.24
IPP Thermal	822.44	1,057.78	1,243.32	1,745.68	2,086.96	6,956.18
SPP Thermal	0.15	0.05	0.39	1.16	1.42	3.17
Hired Thermal	484.61	471.09	939.25	394.40	509.24	2,798.59
Total Thermal	3,512.54	3,424.42	4,135.58	4,389.16	5,104.48	20,566.18

Total Generation	6,712.88	6,537.46	6,831.30	7,702.88	8,067.58	35,852.10
% of low-cost/must run	48%	48%	39%	43%	37%	**43%**

Source: Energy Conservation Fund, Data for the "Energy Balance 2004"

The average of the five most recent years for which data are available of low-cost/must run resources constitute less than 50% of the total grid generation (43%). Therefore the simple OM method has been selected.

b. Calculation of the operating margin of thermal power plant connected to the grid in 2002

As per ACM0002 for the simple OM, the following equations were used:

EFom,y = (ΣFi,j,y(kg)*COEFi,j,y(tCO2/kg))/(ΣGENj,y(mwh))
COEFi,j= NCVi(Tj/kg)*EFco2,i(tCO2/TJ)*OXIDi

Where
EFom,y is the Operating Margin emission factor for year y (tCO2/mwh)
Fi,j,y(kg) is the amount of fuel i (in kg) consumed by relevant power sources j in year y
COEFi,j,y is the CO2 emission coefficient of fuel i (tCO2/kg), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel
NCVi is the net calorific value (energy content) per kg of a fuel i
EFco2,i is the Emission Factor of CO2 for the fuel i used by the plant (tCO2/TJ)
OXIDi is the percent oxidation of the fuel
Genj,y(Mwh) is the Generation of the plant j for year y in Mwh (Mwh)
j refers to the power sources delivering electricity to the grid, not including low operating cost and must-run power plants

To calculate EFom,y, based on the data available, the following equation were also used :

Fi,j,y (kg)= Fi,j,y(TJ)/NCVi (Tj/kg)
Fi,j,y(TJ)= GENj,y(TJ)/ηj,y
GENj,y(TJ)= 3.6*10^-3*GENj,y(Mwh)

Where,
Fi,j,y(TJ) is the amount of energy consumed by the relevant plant j in TJ (TJ)
Genj,y(TJ) is the Generation of the plant j for year y in TJ (TJ)
ηj,y is the average efficiency of the plant j for year y
GENj,y(Mwh) as defined above
NCVi as defined above

The equation can be written as :
EFom,y= (Σ(GENj,y(TJ)/ηj,y)*EFco2,i(tCO2/TJ)*OXIDi)/ (ΣGENj,y(Mwh))

In this step, the calculation was made for the year 2002 with the thermal plant connected to the grid in this particular year.

Calculation of the operating margin of thermal power plant connected to the grid in 2002

Power plants	**Date commissioned**	**Fuel Type**	**Generation**	**Generation**	**Efficiency**	**Carbon Emission Factor**	**Emission Factor**	**Oxidation**	**Emission**	**Emission Factor**
Symbol	yc	Ft	Gen j,y (MWh)	Gen j,y (TJ)	ηj,y	EFc,i	EFco2,i		Fi,j,y*COEFi,	j EFom,y
Unit	Year	-	MWh	TJ		TC/TJ	TCO2/TJ		tCO2	tCO2/MWh
Facilities as of December 2002	-	-	(a)	(b)=(a)*3.6*10-3	(c)	(d)	(e) = 44/12* (d)	(f)	(g)=((b)/(c)) *(e)*(f)	(i)=(g)/(h)
source	(1)	(1)	(1)	Calc	(1)	(2)	Calc	(2)	Calc	Calc
CEB-operated Kelanitissa Power station										
1. Gas turbine (old)	1981-82	L.A.D.	179,020	644	20.90%	20.2	74.07	0.99	226,108	0.073
2. Gas turbine (new)	1997	L.A.D.	226,745	816	26.80%	20.2	74.07	0.99	223,338	0.072
3. Combined Cycle Power Plant 1	2002	L.A.D.	251,370	905	29.00%	20.2	74.07	0.99	228,810	0.073
		Naptha	219,035	789	30.70%	20.0	73.33	0.99	186,472	0.060
CEB-operated sapugaskanda power station										
4. Diesel plant	1984	H.F.O.	524,278	1,887	40.90%	21.1	77.37	0.99	353,452	0.113
5. Diesel	1997-99	H.F.O.	473,139	1,703	43.50%	21.1	77.37	0.99	299,910	0.096

extension										
Independent Power Producers (BOOT contracts)										
6. Lakdhanavi diesel engine	Nov-97	F.O.	200,940	723	32.60%	20.2	74.07	0.99	162,708	0.052
7. Asia Power Ltd diesel engine	Jun-98	H.F.O.	377,040	1,357	39.40%	21.1	77.37	0.99	263,866	0.085
8. Barge Mounted	Jul-00	F.O.	501,950	1,807	32.60%	20.2	74.07	0.99	406,446	0.130
9. Ace Power – Matara	Mar-02	F.O.	154,390	556	32.60%	20.2	74.07	0.99	125,015	0.040
10. Ace Powe - Horana	Dec-02	F.O.	9,000	32	32.60%	20.2	74.07	0.99	7,288	0.002
Total (h): 3,116,907										
									Total	**0.7968**

Source: (1) DGM (EPT BRANCH), CEB
(2) IPCC Guidelines 1996

c. Calculation of the operating margin of thermal power plant connected to the grid in 2003.
The same equations, as in the b., were used to calculate the operating margin in 2003 with the thermal plant connected to the grid in this particular year.

Power plants	**Date commissioned**	**Fuel Type**	**Generation**	**Generation**	**Efficiency**	**Carbon Emission Factor**	**Emission Factor**	**Oxidation**	**Emission**	**Emission Factor**
Symbol	yc	Ft	Gen j,y	Gen j,y	ηj,y	EFc,i	EFco2,i		Fi,j,y*C	j EFom,y

			(MWh)	(TJ)					OEFi,	
Unit	Year	-	MWh	TJ		TC/TJ	TCO2/TJ		tCO2	tCO2/MWh
Facilities as of December 2002	-	-	(a)	(b)=(a)*3.6*10-3	(c)	(d)	(e) = 44/12* (d)	(f)	(g)=((b)/(c)) *(e)*(f)	(i)=(g)/(h)
source	(1)	(1)	(1)	Calc	(1)	(2)	Calc	(2)	Calc	Calc
CEB-operated Kelanitissa Power station										
1. Gas turbine (old)	1981-82	L.A.D.	37,936	137	18.20%	20.2	74.07	0.99	55,023	0.014
2. Gas turbine (new)	1997	L.A.D.	292,791	1,054	27.50%	20.2	74.07	0.99	281,051	0.073
3. Combined Cycle Power Plant 1	2002	L.A.D.	315,427	1,136	37.60%	20.2	74.07	0.99	221,448	0.057
		Naptha	539,622	1,943	41.30%	20.0	73.33	0.99	341,491	0.088
CEB-operated sapugaskanda power station										
4. Diesel plant	1984	H.F.O.	494,690	1,781	40.60%	21.1	77.37	0.99	335,969	0.087
5. Diesel extension	1997-99	H.F.O.	512,779	1,846	43.60%	21.1	77.37	0.99	324,291	0.084
Independent Power Producers (BOOT contracts)										
6. Lakdhanavi diesel engine	Nov-97	F.O.	152,620	549	28.45%	20.2	74.07	0.99	141,609	0.037
7. Asia Power	Jun-98	H.F.O.	344,870	1,242	38.75%	21.1	77.37	0.99	245,400	0.063

Ltd diesel engine										
8. Barge Mounted	Jul-00	F.O.	415,700	1,497	28.45%	20.2	74.07	0.99	385,708	0.100
9. Ace Power – Matara	Mar-02	F.O.	151,080	544	28.45%	20.2	74.07	0.99	140,180	0.036
10. Ace Powe - Horana	Dec-02	F.O.	109,620	395	28.45%	20.2	74.07	0.99	101,711	0.026
11. AES Kelanitissa	Oct-03	L.A.D.	497,730	1,792	36.38%	20.2	74.07	0.99	361,153	0.093
Total (h): 3,864,865										
									Total	**0.7598**

Source: (1) DGM (EPT BRANCH), CEB
(2) IPCC Guidelines 1996

d. Calculation of the operating margin of thermal power plant connected to the grid in 2004.

The same equations, as in the b., were used to calculate the operating margin in 2004 with the thermal plant connected to the grid in this particular year.

Power plants	**Date commissioned**	**Fuel Type**	**Generation**	**Generation**	**Efficiency**	**Carbon Emission Factor**	**Emission Factor**	**Oxidation**	**Emission**	**Emission Factor**
Symbol	yc	Ft	Gen j,y (MWh)	Gen j,y (TJ)	ηj,y	EFc,i	EFco2,i		Fi,j,y*COEFi,	j EFom,y
Unit	Year	-	MWh	TJ		TC/TJ	TCO2/TJ		tCO2	tCO2/MWh

Facilities as of December 2002	-	-	(a)	(b)=(a)*3.6*1 0-3	(c)	(d)	(e) = 44/12* (d)	(f)	(g)=((b)/(c)) *(e)*(f)	(i)=(g)/(h)
source	(1)	(1)	(1)	Calc	(1)	(2)	Calc	(2)	Calc	Calc
CEB-operated Kelanitissa Power station										
1. Gas turbine (old)	1981-82	L.A.D.	141,418	509	19.05%	20.2	74.07	0.99	195,961	0.043
2. Gas turbine (new)	1997	L.A.D.	438,532	1,579	28.50%	20.2	74.07	0.99	406,178	0.090
3. Combined Cycle Power Plant 1	2002	L.A.D.	582,089	2,096	42.50%	20.2	74.07	0.99	361,544	0.080
		Naptha	525,352	1,891	46.70%	20.0	73.33	0.99	294,017	0.065
CEB-operated sapugaskanda power station										
4. Diesel plant	1984	H.F.O.	303,196	1,092	40.50%	21.1	77.37	0.99	206,424	0.046
5. Diesel extension	1997-99	H.F.O.	512,558	1,845	43.60%	21.1	77.37	0.99	324,152	0.072
Independent Power Producers (BOOT contracts)										
6. Lakdhanavi diesel engine	Nov-97	F.O.	176,070	634	26.73%	20.2	74.07	0.99	173,879	0.038
7. Asia Power Ltd diesel engine	Jun-98	H.F.O.	368,260	1,326	39.36%	21.1	77.37	0.99	257,983	0.057
8. Barge Mounted	Jul-00	F.O.	507,000	1,825	26.73%	20.2	74.07	0.99	500,691	0.111
9. Ace Power	Mar-02	F.O.	198,380	714	26.73%	20.2	74.07	0.99	195,911	0.043

– Matara										
10. Ace Powe - Horana	Dec-02	F.O.	167,780	604	26.73%	20.2	74.07	0.99	165,692	0.037
AES Kelanitissa	Oct-03	L.A.D.	407,060	1,465	36.38%	20.2	74.07	0.99	295,363	0.065
Heladhanavi	Dec-04	F.O.	202,730	730	26.73%	20.2	74.07	0.99	200,207	0.044
Total (h): 4,530,425										
									Total	**0.7898**

Source: (1) DGM (EPT BRANCH), CEB
(2) IPCC Guidelines 1996

e. Calculation of the 3 year average of the Operating Margin Emission Factor
The Operating margin emission factor is calculated as the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

EFom=ΣGenj,2002*EFom,2002+ΣGenj,2003*EFom,2003+ΣGenj,2004*EFom,2004)/(ΣGenj, 2002+ΣGenj,2003+ΣGenj,2004)

Where
EFom is the Operating Margin
EFom,2002 is the Operating Margin emission factor for 2002
EFom,2003 is the Operating Margin emission factor for 2003
EFom,2004 is the Operating Margin emission factor for 2004
ΣGenj,2002 is the total generation of the plant j in 2002
ΣGenj,2003 is the total generation of the plant j in 2003
ΣGenj,2004 is the total generation of the plant j in 2004

	2002	**2003**	**2004**	**Avg.**
Operating Margin emission factor	0.7968	0.7594	0.7898	**0.7815**
Total Generation	**3,116,907**	**3,864,865**	**4,530,425**	

Step 2: Calculate the Build Margin emission factor (EFbm,y)
The build margin is the weighted average emissions of recent capacity additions to the system. It is based on a sample group comprises of either the five power plants that have been built most recently or the power plant capacity additions to the electricity system that comprise 20% of the system generation and that have been build most recently. The selection of the sample group should be based on the group that comprises the larger annual generation. Power plant capacity additions registered as CDM project activities should be excluded from the sample group.

The annual total generation for 2004 has been obtained from the ECF, data for "Energy Balance 2004". The capacity addition of the most recent five plants as defined has been calculated and compared to 20% of the annual total generation for 2004. As, the capacity addition of the most recent five plants is lower than 20% of the annual total generation for 2004, the sample group was selected as the most recent power plants contributing to the annual total generation up to 20% of the annual total generation.

	Energy (GWh)
Total Generation to CEB grid in 2004	8067.58
20% of the system generation in 2004	1613.51
Generation of the five most recent plants	203.74

Step 3: Calculate the baseline emission factor EFy
The baseline emission factor EF is the weighted average of the Operating Margin emission factor

(EFom) and the Build Margin emission factor (EFbm):

EF= Wom*EFom+Wbm*EFbm

Operating Margin Emission Factor EFom = 0.7815 tCO_2/MWh
Build Margin Emission Factor EFbm = 0.5817 tCO_2/MWh
Baseline Emission Factor EF = 0.6816 tCO_2/MWh