SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

Approved consolidated monitoring methodology ACM 0005 "Consolidated Monitoring Methodology for increasing the Blend in Cement Production."

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

This methodology is applicable to project because:

A. Project aims at producing blended cement by increasing the share of additives (i.e. reduce the share of clinker) beyond current practices in the country. The additives include fly ash, trass and limestone, etc.

B. There is no shortage of additive related to the lack of blending materials. Reserves of additive materials are abundant:
   a. Most of limestone quarry in Indonesia has reserve of 50 to 200 years for normal OPC cement production. Most cement plants are located close to these limestone quarries. When limestone is used as additive material in blended cement, the limestone consumption for producing raw meal is reduced. Thus, producing blended cement to replace OPC cement will result in net reduction of limestone consumption which would increase the lifetime of the limestone reserves.
   b. Trass is available in abundance due to the geological properties in Indonesia where volcanic areas cover the larger part of Sumatra and Java. Separate studies on trass have been carried out by Indocement and are available for validation purpose.
   c. Fly-Ash and Trass have similar properties and are interchangeable when used as cement additives. Thus, in the shortage of fly-ash, trass would be used instead of fly-ash. The availability of fly-ash quantity will not be the issue for lack of blending materials.

C. This methodology is applicable to domestically sold output of the project

D. Adequate data are available on cement types in the market (From Indonesian Cement Association – ASI)

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario (revised according to accepted request of deviation, December 2007)

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data Type	Data Variable	Source of data	Symbol	Data Unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of Data to be Monitored	How Will the Data be Archived (electronic/paper)	For How Long is the Archived Data Kept?	Comment	instrument used to record
1	Fraction	CaO content of the raw material for raw meal already calcined	Plant records	In CaOy	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence
2	Fraction	CaO content of the clinker	Plant records	OutCaOy	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence
3	Fraction	MgO content of the raw material for raw meal already calcined	Plant records	InMgOy	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence
4	Fraction	MgO content of the clinker	Plant records	Out MgO	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence
5	Mass	Clinker production	Plant records	CLNKy	Kilo tonnes of clinker	m	annually	100%	Electronic	2 years after the crediting period	As per weigh feeder codes in ITP online system	P1: 01-W-2-01 P2: 02-W-2-01 P3: 03-W-2-01 03-W-2-02 P4: 04-W-2-01 04-W-2-02 P5: 05-W-2-01 P6: 06-W-2-01 06-W-2-02 P7: 07-W-2-01 P8: 08-W-2-01 P9: 09-W-2-01 P10: 10-W-2-01 P11: 11-W-2-01 11-W-2-02 P12: 12-W-2-01 12-W-2-02
6	Quantity	Fossil fuel consumed	Plant records	FFi_y	Tonnes of fuel i	m	annually	100%	Electronic	2 years after the end of the crediting period	As per weigh feeder codes in ITP online system	Automatic Weighing feeders and weight scale: P.3:03-V-0-01, 03-S-0-01 P.4:04-V-0-01 P.9:09-I-0-01, 09-K-0-01

												P.10:10-I-0-01, 10-K-0-01 P.11:11-V-0-01 P.12:12-V-0-01
7	Emission factor	Emission factor for fossil fuel	IPCC/plant records	EFFi	TCO2/tonne of fuel i	c	annually	100%	Electronic	2 years after the end of the crediting period	Default as per IPCC standard	
8	Quantity	Grid electricity for clinker production	Plant records	$PELE_{gridCLNK,y}$	MWh	m,c	annually	100%	Electronic	2 years after the end of the crediting period	Measured & calculated as per normal operation	See attachment (Kwh Meter For Clinker.XLS)
8.a	Quantity	Electricity for clinker production	Plant records	PELE_CLNK,y	Mwh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from electricity consumption from raw mill and from kiln,limestone raw meal, clay, laterite and coal	
8.a.1	Quantity	electricity consumption for raw mill	Plant records	PELE_raw mill, y	Mwh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from each kWh meter measured and installed to measure the raw mill electricity consumption. Below is the measurement point code for each plant, P1 to P12 , except P5 since this plant is excluded in the project	Citeureup: P1: KWH METER R.M P-1 LIMESTONE W.F P-1 SANDY CLAY P-1 SAND P-1 PYRITE CINDER P-1 P2 : KWHMETER RAWMILL P2 LIMESTONE WF P2 SANDY CLAY P2 SAND P2 PYRITE CINDER P2 P3 : FEEDER DRUM DRYER P3 LIMESTONE P3 SAND P3 P4 : FEEDER RAW MILL P4 TR1+2-(BB5+BC12+BD7) P6 : RAW MILL IMPACT HAMMER MILL

												P7 : RAW MILL P8 : RAW MILL LIMESTONE WF P8 SANDCLAY WF P8 SAND WF P8 P11 : LSS1 LSS2 LM BLND TR LSS3 M.GRIND RM STRG LSS3 M.GRIND-RM STRG Cirebon: P9 : RAW MILL GRINDING RAW MILL MOTOR P10 : RAW MTRL.TRANS.&GRIN RAW MILL FAN LIMESTONE WF CLAY WF. SAND WF. Tarjun: P12 : RAW MILL L'STONE RM#1 W.F. MIX MATL RM#1 W.F. S'STONE RM#1 W.F. IRON ORE RM#1 W.F.
8.a.2	Quantity	electricity consumption for clinker burning in the kiln	Plant records	PELE_kiln, y	MWh	M,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from each kWh meter measured and installed to measure the kiln electricity consumption.Next column (right) is the measurement point code for each plant, P1 to P12 , except P5 since this plant is excluded in the project	Citeuruep : P1 : KWH METER BURNING P1 KWH METER KILN P1 KWH MTR EP COLER P1 R.COAL KL#1 RAW MEAL W.F P-1 P2 : KWH METER

												BURNING P2 KWH METER KILN P2 KWH MTR EP COOLER P2 RAW MEAL W.F P2 P3 : FEEDER BURNING CARBON FLY ASH SLUDGE PAPER WASTE FUEL PALM SHELL P4 : FEEDER BURNING P4 P6 : HEAT EXCHANGER I&II KILN & COOLER P7 : K I L N P8 : K I L N P11 : LSS4 KILN FEED &KILN LSS5 CLINKERIZATION Cirebon : P9 : KILN AND AQC HOMO AND SP P10 : HOMOGNZING&KILN FEED KILN,AQC&CLINKR.TR NS BOTTOM ASH FEEDER COAL MILL Tarjun : P12 : KILN KWH- METER WASTE OIL PALM SHELL

8.a.3	Quantity	electricity consumption for limestone production	Mining records	PELE_total_LS, y	MWh	mc	Monthly	100%	Electronic	2 years after the end of the crediting period		Citeuruep : P-4 CRS-1 / BA-4 P-3 CRUSHER-2 DP-101 P-3 CRUSHING SYSTEM P-4 CRS-2 / BA-4A P4 SYS.-D8 P-5 SYSTEM P-6A CRS-1/BA-4 P-6A CRS-2/BA-4A P-6B CRS-1/BA-5 P-6B CRS-2/BA-5A P-6 SYS.-D9 P-7 CRS/B1M.106 P-8 CRS/B1M.206 SYSTEM-D10 KWH CRS.P9 KWH CRS.P10 UNIT 3 PROK CONVEYOR DP2-6 DP102 CONBLOCK (QUARRY-A) MINING CONVEYOR Cirebon : L T P 750 KVA MWB 103 MWB 109 LS CRUSHING TR FEEDE LS CRUSHER NO1 ROTOR LS CRUSHER NO2 ROTOR Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B

												(Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux Trafo 3P2-1T1) in MCC LSS-3
8.a.4	Quantity	electricity consumption for clay production	Mining records	PELE_clay, y	MWh	m,c	Monthly	100%	Electronic	2 years after the end of the crediting period		Citeuruep : PHB-1 PHB-2 PHB-3 PHB-4 PHB-5 PHB-6 PHB-7 PHB-8 PHB-9 PHB-10 PCL01 PCL02 PCL03 PCL04 PCL05 PCA01 PCA02 PCA03 PHB-12 HAMBALANG Cirebon : 500 KVA MWB 202 ADD CRUSHER TR FEEDE ADDITIVE CRUSHER Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B (Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux Trafo 3P2-1T1) in MCC LSS-3

8.a.5	Quantity	electricity consumption for laterite production	Mining records	PELE_laterite, y	MWh	m,c	Monthly	100%	Electronic	2 years after the end of the crediting period		Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B (Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux Trafo 3P2-1T1) in MCC LSS-3
8.a.6	Quantity	electricity consumption for coal production	Plant records	PELE_coal, y	MWh	m,c	Monthly	100%	Electronic	2 years after the end of the crediting period		Citeureup : Coal Mill P.1/4 - COAL DRYER 1-4 - P4 COAL MILL Coal Mill P.6/8 - COAL DRYER 6-8 - AUX COAL MILL 6-8 - KWH COAL DRYER - P6 COAL MILL - P7 COAL MILL - P8 COAL MILL Coal Mill P.11 - P11 COAL MILL Cirebon : Coal Mill P.9 - COALMILL Coal Mill P.10 - P10 COAL PWR Tarjun : - PLANT 12
9	Emission factor	Grid Emission factor	See comment	$EF_{grid\_y\_}$	T CO2/MWh	c	annually	100%	Electronic	2 years after the end of the crediting period	ACM0002 is used to determined electricity emissions: Based on JAVA-BALI grid emission factor. Source: Decision on the meeting on determination of CDM emission factor of JAVA-MADURA-BALI (JAMALI) Grid submitted by Chevron and agreed by the committee, Directorate	

											General of Electricity and Energy Utilization, Jakarta, Indonesia, Friday, 11 March 2006). This is estimated based on ACM 0002. Reference for cross checking: Directorate general electricity and energy utilization, Renewable energy division, 2006.	

10	Quantity	Self generation of electricity for clinker production	Plant records	$PELE_{sg\_CLNK,y}$	MWh	m	monthly	100%	Electronic	2 years after the end of the crediting period		See attachment (Kwh Meter For Clinker.XLS)
11	Emission factor	Electricity self generation emission factor	Plant records /IPCC	EFsg_y	T CO_2/MWh	c	monthly	100%	Electronic	2 years after the end of the crediting period		
12	Quantity	Blended cement (BC) production in year y which is sold domestically (data is verifiable)	Plant records	BCy	Ton	m	monthly	100%	Electronic	2 years after the end of the crediting period		
13	Quantity	Grid electricity for grinding BC	Plant records	$PELE_{grid\_BC,y}$	MWh	m	monthly	100%	Electronic	2 years after the end of the crediting period		See attachment (Kwh Meter For BC.XLS)
13.a	Quantity	Electricity for grinding BC	Plant records	PELE_BC., y	Mwh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from each kWh meter measured and installed to measure the electricity consumption for grinding blended cement .Next column (right) is the measurement point code for each plant, P1 to P12 , except P5 since this plant is excluded in the project:	Citeureup : P1 : KWH METER FM P1 P2 : KWH METER FM P2 CLINKER WF P2 P3 : FINISH MILL 3-A FINISH MILL 3-B P4 : CEMENT MILL 4A-1 CEMENT MILL 4A-2 CAF. 4A DISTRIB. CE FMP4A CEMENT MILL 4B-1 CEMENT MILL 4B-2 CAF.4B DISTRIB.CE FM P4B P6 : CEMENT MILL-I CEMENT MILL-II P7 : CEMENT MILL P8 : CEMENT MILL 8A INDOSIN 8B ROLLER PRESS 8B

												P11 : LSS6A FINISH-CMT.STR LSS6B F.GRIND-CMT ST Cirebon : P9 : NO.1 CEMENT NO.2 CEMENT P10 : CEMENT GRINDING CM.MILL MOTOR Tarjun : P12 : FINISH MILL 1 CEMENT MILL 2
14	Quantity	Self generation of electricity for grinding BC	Plant records	$PELE_{sg\_BC,y}$	MWh	m	annually	100%	Electronic	2 years after the end of the crediting period		See attachment (Kwh Meter For BC.XLS)
15	Quantity	Grid electricity for grinding additives	Plant records	$PELE_{grid\_ADD}$	MWh	m	annually	100%	Electronic	2 years after the end of the crediting period		
15 a	Quantity	Overall electricity for limestone	Plant records	PELE_total ADD, y	Mwh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from each kWh meter measured and installed to measure the electricity consumption for grindinglimestone . Next column (right) is the measurement point code for each plant, P1 to P12 , except P5 since this plant is excluded in the project	Citeureup : P-4 CRS-1 / BA-4 P-3 CRUSHER-2 DP-101 P-3 CRUSHING SYSTEM P-4 CRS-2 / BA-4A P4 SYS.-D8 P-5 SYSTEM P-6A CRS-1/BA-4 P-6A CRS-2/BA-4A P-6B CRS-1/BA-5 P-6B CRS-2/BA-5A P-6 SYS.-D9 P-7 CRS/B1M.106 P-8 CRS/B1M.206 SYSTEM-D10 KWH CRS.P9 KWH CRS.P10

												UNIT 3 PROK CONVEYOR DP2-6 DP102 CONBLOCK (QUARRY-A) MINING CONVEYOR Cirebon : L T P 750 KVA MWB 103 MWB 109 LS CRUSHING TR FEEDE LS CRUSHER NO1 ROTOR LS CRUSHER NO2 ROTOR Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B (Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux Trafo 3P2-1T1) in MCC LSS-3
16	Quantity	Self generation of electricity for grinding additives	Plant records	$PELE_{sg\_\_ADD,y}$	MWh	m	annually	100%	Electronic	2 years after the end of the crediting period		
17	Quantity	Fuel consumption	Plant records	Fi,j,y	Tonnes of fuel i	m	annually	100%	Electronic	2 years after the end of the crediting period		
18	Coefficient	Carbon content of the fuel used	IPCC/Plant records	COEFi,j,y	tCO2/tonne of fuel i	c		100%	Electronic	2 years after the end of the crediting period	IPCC default	
19	Quantity	Electricity generation	Plant records	GENi,y	MWh	c	annually	100%	Electronic	2 years after the end of the crediting period		See attachment (Kwh Self Generation Meter.XLS)
20	Quantity	Emission per ton clinker due to calcinations	Plant	$PE_{calcin,y}$	t CO_2/tonne	c	annually	100%	Electronic	2 years after the end of the crediting period		

			records		clinker							
21	Quantity	Electricity generation from the grid	Plant records	GEN ele grid, y	MWh	m	annualy	100%	Electronic	2 years after the end of the crediting period	This parameter is measured at PLN power sourcing point and delivered to a single 33KV line for distribution	
22	Quantity	Electricity generation from self generation diesel	Plant records	GEN ele sg diesel, y	MWh	m	annualy	100%	Electronic	2 years after the end of the crediting period	This parameter is measured at Diesel power generation supply point and delivered to a single 33KV line for distribution	
23	Quantity	Electricity generation from self generation, natural gas	Plant records	GEN ele sg natural gas, y	MWh	m	annually	100%	Electronic	2 years after the end of the crediting period	This parameter is measured at natural gas power generation supply point and delivered to a single 33KV line for distribution	
24	Quantity	Auxiliary power, project	Plant records	Auxiliary power, y	MWh	m	anually	100%	Electronic	2 years after the end of the crediting period		
25	Quantity	Emission per ton clinker due to combustion of fossil fuels for clinker production	Plant records	$PE_{fossil\_fuel,y}$	t CO2/tonne clinker	c	annually	100%	Electronic	2 years after the end of the crediting period		
26	Quantity	Grid electricity emissions for clinker production	Plant records	$PE_{ele\_grid\_CLNK,y}$	t CO2/tonne clinker	c	annually	100%	Electronic	2 years after the end of the crediting period		
27	Quantity	Self generated electricity emission for clinker production	Plant records	$PE_{ele\_sg\_CLNK,y}$	t CO2/tonne clinker	c	annually	100%	Electronic	2 years after the end of the crediting period		
28	Quantity	Grid electricity emissions for BC grinding	Plant records	$PE_{ele\_grid\_BC,,y}$	t CO2/ tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		
29	Quantity	Self generated electricity emission for BC grinding	Plant records	$PE_{ele\_sg\_BC,y}$	t CO2/ tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		
30	Quantity	Grid electricity emissions for additives preparation	Plant records	$PE_{ele\_grid\_ADD,,y}$	t CO2/ tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		

31	Quantity	Self generated electricity emission for additives preparation	Plant records	$PE_{ele\_sg\_ADD,y}$	t CO2/tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		
32	Quantity	Share of clinker per ton of BC	Plant records	P_{blend}, y	t of clinker/t of BC	c	annually	100%	Electronic	2 years after the end of the crediting period	Calculated from no.12	

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Consistent with the approved consolidated methodology ACM 0005, the project emissions take into account the followings:

(i) Emissions from calcinations of limestone;
(ii) Emissions from combustion of fossil fuel and electricity for clinker production
(iii) Emissions from electricity used for additive preparation and grinding of cement

The following formulae is used to estimate the project emissions.

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

Where:
$PE_{BC,y}$ = CO_2 emissions per tonne of BC in the project activity plant in year y(t CO_2/tonne BC)
$PE_{clinker,y}$ = CO_2 emissions per tonne of clinker in the project activity plant in year y (t CO_2/tonne clinker) and defined below
$P_{Blend,y}$ = Share of clinker per tonne of BC in year y (tonne of clinker/tonne of BC)
$PE_{ele\_AD,D\_BC,y}$ = Electricity emissions for BC grinding and preparation of additives in year y (tCO2/tonne of BC)

CO_2 per tonne of clinker in the project activity plant in year y is calculated as below:

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

where:
$PE_{clinker,y}$ = Emissions of CO_2 per tonne of clinker in the project activity plant in year y (t CO_2/tonne clinker)
$PE_{calcin,y}$ = Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y (t CO_2/tonne clinker)
$PE_{fossil\_fuel,y}$ = Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year y (t CO_2/tonne clinker)
$PE_{ele\_grid\_CLNK,y}$ = Grid electricity emissions for clinker production per tonne of clinker in year y (t CO_2/tonne clinker)
$PE_{ele\_sg\_CLNK,y}$ = Emissions from self-generated electricity per tonne of clinker production in year y (t CO_2/tonne clinker)

$$PE_{calcin,y} = 0.785*(OutCaO_y - InCaO_y) + 1.092*(OutMgO_y - InMgO_y) / [CLNK_y * 1000]$$

where:
$PE_{calcin,y}$ = Emissions from the calcinations of limestone (tCO_2/tonne clinker)

0.785 = Stoichiometric emission factor for CaO (tCO_2/t CaO)
1.092 = Stoichiometric emission factor for MgO (tCO_2/t MgO)
$InCaO_{,y}$ = CaO content (%) of the raw material * raw material quantity (tonnes) **(for raw meal already calcined)**
$OutCaO_{,y}$ = CaO content (%) of the clinker * clinker produced (tonnes)
$InMgO_{,y}$ = MgO content (%) of the raw material * raw material quantity (tonnes) **(for raw meal already calcined)**
$OutMgO_{,y}$ = MgO content (%) of the clinker * clinker produced (tonnes)

$PE_{fossil\_fuel,\,y} = [\sum FF_{i\_,y} * EFF_i] / CLNK_{,y} * 1000$

where:

$FF_{i\_,y}$ = Fossil fuel of type i consumed for clinker production in year y (tonnes of fuel i)
EFF_i = Emission factor for fossil fuel i (tCO2/tonne of fuel)
$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

$PE_{ele\_grid\_CLNK,y} = [PELE_{grid\_CLNK,y} * EF_{grid\_y}] / [CLNK_y * 1000]$

Where:

$PELE_{grid\_CLNK,y}$ = Grid electricity for clinker production in year y (MWh)
EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)
$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

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

Where:
$PE_{ele\_grid\_BC}$ = Grid electricity emissions for BC grinding in year y (tCO2/tonne of BC)
$PE_{ele\_sg\_BC}$ = Emissions from self generated electricity for BC grinding in year y (tCO2/tonne of BC)
$PE_{ele\_grid\_ADD}$ = Grid electricity emissions for additive preparation in year y (tCO2/tonne of BC)
$PE_{ele\_sg\_ADD}$ = Emissions from self generated electricity additive preparation in year y (tCO2/tonne of BC)

$PE_{ele\_grid\_BC,y} = [PELE_{grid\_BC,y} * EF_{grid\_BSL,y}] / [BC_y * 1000]$

Where:

$PELE_{grid\_BC,y}$ = Baseline grid electricity for grinding BC (MWh)
EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)
BC_y = Annual production of BC in year y (kilotonnes of BC)

$$PE_{elec\_sg\_BC,y} = [PELE_{sg\_BC,y} * EF_{sg\_y}] / [BC_y * 1000]$$

Where:
$PELE_{sg\_BC,y}$ = Self generated electricity for grinding BC in year y (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)
BC_y = Annual production of BC in year y (kilotonnes of BC)

$$PE_{ele\_grid\_ADD} = [PELE_{grid\_ADD} * EF_{grid\_y}] /[ADD_y * 1000]$$

Where:
$PELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)
EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)
ADD_y = Annual consumption of additives in year y (kilotonnes of additives)

$$PE_{elec\_sg\_ADD,y} = [PELE_{sg\_ADD,y} * EF_{sg\_y}] / [ADD_y * 1000]$$

Where:
$PELE_{sg\_ADD,y}$ = Baseline self generation electricity for grinding additives (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)
ADD_y = Annual consumption of additives in year y (kilotonnes of additives)

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number	Data Type	Data Variable	Source of data	Symbol	Data Unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of Data to be Monitored	How Will the Data be Archived (electronic/paper)	For How Long is the Archived Data Kept?	Comment	instrument used to record
1	Fraction	CaO content of the raw material for raw meal already calcined	Plant records	$InCaO_{BSL}$	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence

2	Fraction	CaO content of the clinker	Plant records	$OutCaO_{BSL}$	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence
3	Fraction	MgO content of the raw material for raw meal already calcined	Plant records	$InMgO_{BSL}$	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence
4	Fraction	MgO content of the clinker	Plant records	$OutMgO_{BSL}$	%	m,c	daily	100%	Electronic	2 years after the end of the crediting period		X-Ray Fluorescence
5	Mass	Clinker production	Plant records	$CLNK_{BSL}$	Kilo tonnes of clinker	m	monthly	100%	Electronic	2 years after the crediting period	As per weigh feeder codes in ITP online system	P1: 01-W-2-01 P2: 02-W-2-01 P3: 03-W-2-01 03-W-2-02 P4: 04-W-2-01 04-W-2-02 P5: 05-W-2-01 P6: 06-W-2-01 06-W-2-02 P7: 07-W-2-01 P8: 08-W-2-01 P9: 09-W-2-01 P10: 10-W-2-01 P11: 11-W-2-01 11-W-2-02 P12: 12-W-2-01 12-W-2-02
6	Quantity	Fossil fuel consumed	Plant records	FF_{i_BSL}	Tonnes of fuel i	m	monthly	100%	Electronic	2 years after the end of the crediting period	As per weigh feeder codes in ITP online system	Automatic Weighing feeders and weight scale: P.3:03-V-0-01, 03-S-0-01 P.4:04-V-0-01 P.9:09-I-0-01, 09-K-0-01 P.10:10-I-0-01, 10-K-0-01 P.11:11-V-0-01 P.12:12-V-0-01
7	Emission factor	Emission factor for fossil fuel	IPCC/plant rec	EFFi	TCO2/tonne of fuel i	c	monthly	100%	Electronic	2 years after the end of the crediting period	Default as per IPCC standard	
8	Quantity	Grid electricity for clinker production	Plant records	$BELE_{grid\_CLNK,}$	MWh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Measured & calculated as per normal operation	See attachment (Kwh Meter For Clinker.XLS)
8.a	Quantity	Electricity for clinker production	Plant records	BELE_CLNK,y	Mwh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from electricity consumption from raw mill and from kiln,limestone raw meal, clay, laterite and coal	

8.a.2	Quantity	electricity consumption for clinker burning in the kiln	Plant records	BELE_kiln, y	MWh	M,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from each kWh meter measured and installed to measure the kiln electricity consumption. Next column (right) is the measurement point code for each plant, P1 to P12 , except P5 since this plant is excluded in the project	Citeuruep : P1 : KWH METER BURNING P1 KWH METER KILN P1 KWH MTR EP COLER P1 R.COAL KL#1 RAW MEAL W.F P-1 P2 : KWH METER BURNING P2 KWH METER KILN P2 KWH MTR EP COOLER P2 RAW MEAL W.F P2 P3 : FEEDER BURNING CARBON FLY ASH SLUDGE PAPER WASTE FUEL PALM SHELL P4 : FEEDER BURNING P4 P6 : HEAT EXCHANGER I&II KILN & COOLER P7 : K I L N P8 : K I L N P11 : LSS4 KILN FEED &KILN LSS5 CLINKERIZATIO N

												Cirebon : P9 : KILN AND AQC HOMO AND SP P10 : HOMOGNZING& KILN FEED KILN,AQC&CLINKR.TRNS BOTTOM ASH FEEDER COAL MILL Tarjun : P12 : KILN KWH-METER WASTE OIL PALM SHELL
8.a.3	Quantity	electricity consumption for limestone production	Mining records	BELE_total_LS, y	MWh	mc	Monthly	100%	Electronic	2 years after the end of the crediting period		Citeuruep : P-4 CRS-1 / BA-4 P-3 CRUSHER-2 DP-101 P-3 CRUSHING SYSTEM P-4 CRS-2 / BA-4A P4 SYS.-D8 P-5 SYSTEM P-6A CRS-1/BA-4 P-6A CRS-2/BA-4A P-6B CRS-1/BA-5 P-6B CRS-2/BA-5A P-6 SYS.-D9 P-7 CRS/B1M.106 P-8 CRS/B1M.206 SYSTEM-D10 KWH CRS.P9 KWH CRS.P10 UNIT 3

												PROK CONVEYOR DP2-6 DP102 CONBLOCK (QUARRY-A) MINING CONVEYOR Cirebon : L T P 750 KVA MWB 103 MWB 109 LS CRUSHING TR FEEDE LS CRUSHER NO1 ROTOR LS CRUSHER NO2 ROTOR Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B (Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux Trafo 3P2-1T1) in MCC LSS-3
8.a.4	Quantity	electricity consumption for clay production	Mining records	BELE_clay, y	MWh	m,c	Monthly	100%	Electronic	2 years after the end of the crediting period		Citeuruep : PHB-1 PHB-2 PHB-3 PHB-4 PHB-5 PHB-6 PHB-7 PHB-8 PHB-9 PHB-10

												PCL01 PCL02 PCL03 PCL04 PCL05 PCA01 PCA02 PCA03 PHB-12 HAMBALANG Cirebon : 500 KVA MWB 202 ADD CRUSHER TR FEEDE ADDITIVE CRUSHER Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B (Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux Trafo 3P2-1T1) in MCC LSS-3
8.a.5	Quantity	electricity consumption for laterite production	Mining records	BELE_laterite, y	MWh	m,c	Monthly	100%	Electronic	2 years after the end of the crediting period		Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B (Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux

												Trafo 3P2-1T1) in MCC LSS-3
8.a.6	Quantity	electricity consumption for coal production	Plant records	BELE_coal, y	MWh	m,c	Monthly	100%	Electronic	2 years after the end of the crediting period		Citeureup : Coal Mill P.1/4 - COAL DRYER 1-4 - P4 COAL MILL Coal Mill P.6/8 - COAL DRYER 6-8 - AUX COAL MILL 6-8 - KWH COAL DRYER - P6 COAL MILL - P7 COAL MILL - P8 COAL MILL Coal Mill P.11 - P11 COAL MILL Cirebon : Coal Mill P.9 - COALMILL Coal Mill P.10 - P10 COAL PWR Tarjun : - PLANT 12
9	Emission factor	Grid Emission factor	Plant records	EF_{grid_BSL}	T CO2/MWh	c	monthly	100%	Electronic	2 years after the end of the crediting period	ACM0002 is used to determined electricity emissions: Based on JAVA-BALI grid emission factor. Source: Decision on the meeting on determination of CDM emission factor of JAVA-MADURA-BALI (JAMALI) Grid submitted by Chevron and agreed by the committee, Directorate General of Electricity and Energy Utilization, Jakarta, Indonesia, Friday, 11 March 2006). This is estimated based on ACM 0002. Reference for cross checking: Directorate general electricity and energy utilization,	

											Renewable energy division, 2006.	
10	Quantity	Self generation of electricity for clinker production	Plant records	$BELEs_{g\_CLNK,}$	MWh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Measured & calculated as per normal operation	See attachment (Kwh Meter For Clinker.XLS)
11	Emission factor	Electricity self generation emission factor	Plant records	EF_{sg_BSL}	t CO_2/MWh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Measured & calculated as per normal operation	
12	Quantity	Blended cement (BC) production	Plant records	BC_{BSL}	Kilo tonnes of BC	m	monthly	100%	Electronic	2 years after the end of the crediting period	Composite of clinker, gypsum and additives	Clinker weighing feeders : P.1 : 01-W-3-01 P.2 : 02-W-3-01 P.10: 10-W-3-01 Gypsum weighing feeders : P.1 : 01-W-3-02 P.2 : 02-W-3-02 P.10: 10-W-3-02 Limestone weighing feeders : P.1 : 01-W-3-03/04 P.2 : 02-W-3-03 P.10: 10-W-3-03 Flyash weighing feeders : P.1 : 01-W-3-05 P.2 : 02-W-3-04 Trass weighing feeders : P.1 : 01-W-3-06 P.2 : 02-W-3-05 P.10: 10-W-3-04
13	Quantity	Grid electricity for grinding BC	Plant records	$BELE_{grid\_BC}$	MWh	c	monthly	100%	Electronic	2 years after the end of the crediting period	Reported by local electricity provider PLN	See attachment (Kwh Meter For BC.XLS)
13.a	Quantity	Electricity for grinding BC	Plant records	ELE_BC., y	Mwh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from each kWh meter measured and installed to measure the electricity consumption for grinding blended cement .next column (right) is the measurement point code for each plant, P1 to P12, except P5 since this plant is excluded in the project	Citeureup : P1 : KWH METER FM P1 P2 : KWH METER FM P2 CLINKER WF P2 P3 : FINISH MILL 3-A FINISH MILL 3-B

												P4 : CEMENT MILL 4A-1 CEMENT MILL 4A-2 CAF. 4A DISTRIB. CE FMP4A CEMENT MILL 4B-1 CEMENT MILL 4B-2 CAF.4B DISTRIB.CE FM P4B P6 : CEMENT MILL-I CEMENT MILL-II P7 : CEMENT MILL P8 : CEMENT MILL 8A INDOSIN 8B ROLLER PRESS 8B P11 : LSS6A FINISH-CMT.STR LSS6B F.GRIND-CMT ST Cirebon : P9 : NO.1 CEMENT NO.2 CEMENT P10 : CEMENT GRINDING CM.MILL MOTOR

												Tarjun : P12 : FINISH MILL 1 CEMENT MILL 2
14	Quantity	Self generation of electricity for grinding BC	Plant records	$BELE_{sg\_BC,}$	MWh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Measured and calculated as per normal operation	See attachment (Kwh Meter For BC.XLS)
15	Quantity	Grid electricity for grinding additives	Plant records	$BELE_{grid\_ADD}$	MWh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Measured and calculated as per normal operation	
15 a	Quantity	Overall electricity for limestone	Plant records	ELE_total ADD, y	Mwh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Calculated from each kWh meter measured and installed to measure the electricity consumption for grinding limestone . In the next column (right) is The measurement point code for each plant, P1 to P12, except P5 since this plant is excluded in the project	Citeureup : P-4 CRS-1 / BA-4 P-3 CRUSHER-2 DP-101 P-3 CRUSHING SYSTEM P-4 CRS-2 / BA-4A P4 SYS.-D8 P-5 SYSTEM P-6A CRS-1/BA-4 P-6A CRS-2/BA-4A P-6B CRS-1/BA-5 P-6B CRS-2/BA-5A P-6 SYS.-D9 P-7 CRS/B1M.106 P-8 CRS/B1M.206 SYSTEM-D10 KWH CRS.P9 KWH CRS.P10 UNIT 3 PROK CONVEYOR DP2-6 DP102 CONBLOCK (QUARRY-A) MINING CONVEYOR

												Cirebon : L T P 750 KVA MWB 103 MWB 109 LS CRUSHING TR FEEDE LS CRUSHER NO1 ROTOR LS CRUSHER NO2 ROTOR Tarjun : Feeder 2P1-1S1-U#1 (Incoming 11 kV) in LSS-3 Feeder 3P2-1S1-U#A (331-BC2-M#1 250 kW) in LSS-3 Feeder 3P2-1S1-U#B (Trafo 3P2-1T1) in LSS-3 Feeder 3P2-1V1/1M1 (Aux Trafo 3P2-1T1) in MCC LSS-3
16	Quantity	Self generation of electricity for grinding additives	Plant records	$BELE_{sg\_ADD,}$	MWh	m,c	monthly	100%	Electronic	2 years after the end of the crediting period	Measured and calculated as per normal operation	
17	Quantity	Fuel consumption	Plant records	$F_{i,j,BSL}$	Tonnes of fuel i	m	monthly	100%	Electronic	2 years after the end of the crediting period	Measured and calculated as per normal operation	
18	Coefficient	CO2 emission coefficient of fuel	IPCC	$COEF_{i,j,BSL}$	tCO2/tonne of fuel i	m,c		100%	Electronic	2 years after the end of the crediting period	IPCC 1996 default value, WBSCD and DVZ, to maintain the consistency with the alternative fuel project	
19	Quantity	Electricity generation	Plant records	$\Sigma GEN_{i,BSL}$	MWh	m	monthly	100%	Electronic	2 years after the end of the crediting period		See attachment (Kwh Self Generation Meter.XLS)
20	Quantity	Electricity generation from the grid in the year 2004, which is used to calculate the baseline	Plant records	Gen ele grid $_{i2004}$	MWh	m	monthly	100%	Electronic	2 years after the end of the crediting period	This parameter is measured at the PLN power sourcing point and	

											delivered to a single 33KV line for distrbution	
21	Quantity	Electricity generation from the self generation Diesel in the year 2004, which is used to calculate baseline	Plant records	Gen ele sg diesel $_{i2004}$	MWh	m	monthly	100%	Electronic	2 years after the end of the crediting period	This parameter is measured at the diesel generation supply point and delivered to a single 33KV line for distrbution	
22	Quantity	Electricity generation from the self generation natural gas in the year 2004, which is used to calculate baseline	Plant records	Gen ele sg natural gas $_{i2004}$	MWh	m	monthly	100%	Electronic	2 years after the end of the crediting period		
23	Quantity	Auxiliary power, baseline in the year 2004, which is used to calculate the baseline	Plant records	BE_{calcin}	MWh	m	monthly	100%	Electronic	2 years after the end of the crediting period		
24	Quantity	Emission per ton clinker due to calcinations	Plant records	BE_{calcin}	t CO_2/tonne clinker	c	annually	100%	Electronic	2 years after the end of the crediting period		
25	Quantity	Emission per ton clinker due to combustion of fossil fuels for clinker production	Plant records	$BE_{fossil\_fuel,}$	t CO2/tonne clinker	c	annually	100%	Electronic	2 years after the end of the crediting period		
26	Quantity	Grid electricity emissions for clinker production	Plant records	$BE_{ele\_grid\_CLNK,}$	t CO2/tonne clinker	c	annually	100%	Electronic	2 years after the end of the crediting period		
27	Quantity	Self generated electricity emission for clinker production	Plant records	$BE_{ele\_sg\_CLNK}$	t CO2/tonne clinker	c	annually	100%	Electronic	2 years after the end of the crediting period		
28	Quantity	Grid electricity emissions for BC grinding	Plant records	$BE_{ele\_grid\_BC}$	t CO2/ tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		
29	Quantity	Self generated electricity emission for BC grinding	Plant records	$BE_{ele\_sg\_BC}$	t CO2/ tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		
30	Quantity	Grid electricity emissions for additives preparation	Plant records	$BE_{ele\_grid\_ADD}$	t CO2/ tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		
31	Quantity	Self generated electricity emission for additives preparation	Plant records	$BE_{ele\_sg\_ADD,}$	t CO2/tonne BC	c	annually	100%	Electronic	2 years after the end of the crediting period		
32	Quantity	Share of clinker per ton of BC	Plant records	Bblend,y	t of clinker/t of BC	c	annually	100%	Electronic	2 years after the end of the crediting period	Calculated from no.12	

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

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

where:

$BE_{BC,y}$ = Baseline CO_2 emissions per tonne of blended cement type (BC) (tCO_2/tonne BC)

$BE_{clinker}$ = CO_2 emissions per tonne of clinker in the baseline in the project activity plant (t CO_2/tonne clinker) and defined below

$B_{Blend,y}$ = Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne of BC)

$BE_{ele\_ADD\_BC}$ = Baseline electricity emissions for BC grinding and preparation of additives (tCO2/tonne of BC)

CO_2 per tonne of clinker in the project activity plant in the baseline is calculated as below:

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

where:

$BE_{clinker}$ = Baseline emissions of CO_2 per tonne of clinker in the project activity plant (t CO_2/tonne clinker)

BE_{calcin} = Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (t CO_2/tonne clinker)

BE_{fossil_fuel} = Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (t CO_2/tonne clinker)

$BE_{ele\_grid\_CLNK}$ = Baseline grid electricity emissions for clinker production per tonne of clinker (t CO_2/tonne clinker)

$BE_{ele\_sg\_CLNK}$ = Baseline emissions from self generated electricity for clinker production per tonne of clinker (t CO_2/tonne clinker)

$BE_{calcin} = [0.785*(OutCaO - InCaO) + 1.092*(OutMgO - InMgO)] / [CLNK_{BSL} * 1000]$

where:

BE_{calcin} = Emissions from the calcinations of limestone (tCO2/tonne clinker)

0.785 = Stoichiometric emission factor for CaO (tCO2/t CaO)

1.092 = Stoichiometric emission factor for MgO (tCO2/t MgO)

InCaO = CaO content (%) of the raw material * raw material quantity (tonnes) **(for raw meal already calcined)**

OutCaO = CaO content (%) of the clinker * clinker produced (tonnes)

InMgO = MgO content (%) of the raw material * raw material quantity (tonnes)

OutMgO = MgO content (%) of the clinker * clinker produced (tonnes)

$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{fossil\_fuel} = [\sum FF_{i\_BSL} * EFF_i] / [CLNK_{BSL} * 1000]$

Where:

FF_{i_BSL} = Fossil fuel of type i consumed for clinker production in the baseline (tones of fuel i)

EFF_i = Emission factor for fossil fuel i (t CO_2/tonne of fuel)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$$BE_{ele\_grid\_CLNK} = [BELE_{grid\_CLNK} * EF_{grid\_BSL}] /CLNK_{BSL} * 1000$$

Where:
$BELE_{grid\_CLNK}$ = Baseline grid electricity for clinker production (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$$BE_{elec\_sg\_CLNK} = [BELE_{sg\_CLNK} * EF_{sg\_BSL}] /[CLNK_{BSL} * 1000]$$

Where:
$BELE_{sg\_CLNK}$ = Baseline self generation of electricity for clinker production (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

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

where:
$BE_{ele\_grid\_BC}$ = Baseline grid electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele\_sg\_BC}$ = Baseline self generated electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele\_grid\_ADD}$ = Baseline grid electricity emissions for additive preparation (tCO2/tonne of BC)
$BE_{ele\_sg\_ADD}$ = Baseline self generated electricity emissions for additive preparation (tCO2/tonne of BC)

$$BE_{ele\_grid\_BC} = [BELE_{grid\_BC} * EF_{grid\_BSL}] /[BC_{BSL} * 1000]$$

Where
$BELE_{grid\_BC}$ = Baseline grid electricity for grinding BC (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$$BE_{elec\_sg\_BC} = [BELE_{sg\_BC} * EF_{sg\_BSL}] / [BC_{BSL} * 1000]$$

Where
$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding BC (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$BE_{ele\_grid\_ADD}$ = [$BELE_{grid\_ADD}$ * EF_{grid_BSL}] /[ADD_{BSL}* 1000]
Where
$BELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
ADD_{BSL} = Annual consumption of additives in the base year (kilotonnes of additives)

$BE_{elec\_sg\_ADD}$ = [$BELE_{sg\_ADD}$ * EF_{sg_BSL}] / [ADD_{BSL}* 1000]
Where:
$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding additives (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
ADD_{BSL} = Annual consumption of additives in the base year (kilotonnes of additives)

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

Not Applicable. There is no direct monitoring activities for this project

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not Applicable

D.2.3. Treatment of leakage in the monitoring plan:
D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity:

ID number	Data Type	Data Variable	Source of data	Symbol	Data Unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of Data to be Monitored	How Will the Data be Archived (electronic/paper)	For How Long is the Archived Data Kept?	Comment	instrument used to record
Truck Load												
1	Quantity	Fly-ash truck load	Plant records	Qadd	Tonne of gypsum /trip	m	daily	100%	Electronic, paper	2 years after the end of the crediting period		
2	Quantity	Trass truck load	Plant records	Qadd	Tonne of gypsum /trip	m	daily	100%	Electronic, paper	2 years after the end of the crediting period		
Ship Load												
Distance (D_{add_source}), overland												
3	Distance	Fly-ash carried	Plant records	D_{add_source}	Km/trip	m	per trip	100%	Electronic, paper	2 years after the end of the crediting period		
4	Distance	Trass carried	Plant records	D_{add_source}	Km/trip	m	Per trip	100%	Electronic, paper	2 years after the end of the crediting period		
Distance (D_{add_source}), overseas												
Emission factor for transport of fuel (kg CO_2/kg of fuel), TEF												
5	Emission factor	Emission factor for transport fuel	IPCC	TEF_{truck}	Kg CO2/kg of fuel	e	annually	100%	Electronic, paper	2 years after the end of the crediting period		
6	Emission factor	Emission factor for transport fuel	IPCC	TEF_{ship}	Kg CO2/kg of fuel	e	annually	100%	Electronic, paper	2 years after the end of the crediting period		

Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre), TF Cons											
7	Quantity	Fuel consumption for the vehicle	Plant records	TF $_{cons\ truck}$	Kg of fuel/km	c	annually	100%	Elecrronic , paper	2 years after the end of the crediting period		
8	Quantity	Fuel consumption for the vehicle	Plant records	TF $_{cons\ ship}$	Kg of fuel/km	c	annually	100%	Electronic , paper	2 years after the end of the crediting period		
CO_2 emissions/trip, by truck											
9	Emission factor	CO_2 emissions/trip for fly-ash	Plant records		Kg of CO_2/trip	c	monthly	100%	Electronic , paper	2 years after the end of the crediting period		
10	Emission factor	CO_2 emissions/trip for trass	Plant records		Kg of CO_2/trip	c	monthly	100%	Electronic , paper	2 years after the end of the crediting period		

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The leakage of project is from transportation of additives. To maintain the conservativeness of the project as suggested in ACM0005, the transport related emissions for raw materials and fuels likely to decrease are not included in the estimation of leakage.

The estimation of leakage is then limited to transportation of fly ash/trass and limestone, which is based on the fuel consumed to transport these additives to the cement facilities. The conveyor system for additive is valid only for limestone which is used as additives.

Ladd_trans = [(TFcons * Dadd_source * TEF)* 1/Qadd*1/1000 + (ELEconveyor_ADD * EFgrid)*1/ADDy]

where:
Ladd_trans = Transport related emissions per tonne of additives (t CO2/tonne of additive)
TFcons = Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre)
Dadd_source = Distance between the source of additive and the project activity plant (km)
TEF = Emission factor for transport fuel (kg CO2/kg of fuel)
ELEconveyor_ADD = Annual Electricity consumption for conveyor system for additives (MWh)
EFgrid = Grid electricity emission factor (tonnes of CO2/MWh)
Qadd = Quantity of additive carried in one trip per vehicle (tonnes of additive)
ADDy = Annual consumption of additives in year y. (t of additives)

Leakage emissions per tonne of BC due to additional additives are determined by

Ly = Ladd_trans * [Ablend,y – Pblend,y] * BCy

where:
Ly = Leakage emissions for transport of additives (kilotonnes of CO2)
BCy = Production of BC in year y (kilotonnes of BC)
Ablend,y = Baseline benchmark share of additives per tonne of BC updated for year y (tonne of additives/tonne of BC)
Pblend,y = Share of additives per tonne of BC in year y (tonne of additives/tonne of BC)

Ladd trans in this project is estimated for Ladd_trans of limestone, and Ladd trans of fly ash and trass. This is shown in detail in the separate excel spreadsheet, Annex3a-May 2006, worksheet "leak-ls".

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

$ER\ y = \{[BE_{BC,y} – PE_{BC,y}]\}*BCy+Ly$

Where:
ER y = Emission reductions in year y due to project activity (thousand tonnes of CO_2)
$BE_{BC,y}$ = Baseline emissions per tonne of BC (t of CO_2/tonnes of BC)
$BE_{BC,y}$ = Project emissions per tonne of BC (t of CO_2/tonnes of BC)
BCy = BC production in year y (thousand tonnes)
Ly = Leakage emissions (t of CO_2)

D.2.5. Deviation from the registered PDD: Measurement and Calculation of Electricity Consumption (based on the accepted request of deviation, December 2007)

In Indocement Blended Cement Project, electricity is consumed for clinker production, grinding of blended cement and grinding of additives. The electricity supply in Citeureup plant is from both Grid and Self generated electricity, in Cirebon plant is from grid only, and in Tarjun plant is from self- generated electricity only. The explanation below provides description on how electricity consumed for clinker production, grinding of blended cement and grinding of additives are estimated.

1. Electricity consumption for clinker production

The electricity consumption parameters for clinker production included in this monitoring report are as follows:

- Grid electricity for clinker production, baseline ($BELE_{grid\_CLNK)}$
- Self generation of electricity for clinker production, baseline ($BELEs_{g\_CLNK}$)
- Grid electricity for clinker production, project($PELE_{gridCLNK,y}$)
- Self generation of electricity for clinker production, project ($PELE_{sg\_CLNK,y}$)

Both electricity consumption method of calculation from grid and self-generated supply for clinker production for baseline and project are the same. The difference is that the baseline calculates electricity consumption for clinker production in the year 2004.

The electricity consumption for clinker production from grid is then calculated as follows:

$$PELE_{grid\_CLNK,y} = ELE\_CLNK.,y * GEN\_{grid\_ratio} \quad (1)$$

And The electricity consumption for clinker production from self-generated electricity source is then calculated as follows:

$$PELE_{sg\_CLNK,y} = ELE\_CLNK.,y - PELE_{gridCLNK,y} \quad (2)$$

Where:

$ELE_{\_CLNK,y}$ = electricity consumption for clinker production, Mwh

GEN_{grid_ratio} = the ratio of electricity supply between that of the grid and that of the total electricity supply

The electricity consumption for clinker production is calculated as follows:

$ELE\_CLNK., y = ELE\_raw\ mill, y + ELE\_kiln, y + ELE_{raw\ meal\ limestone,y} + ELE_{clay,y} + ELE_{laterite,y} + ELE_{coal,y}$
(3)

Where:

$ELE_{\_CLNK,y}$ = electricity consumption for clinker production, Mwh
$ELE_{\_raw\ mill,y}$ = electricity consumption for raw mill, measured separately in each plant, with kwh meter. In each plant may have more than one Kwh meter to measure electricity consumption for raw mill section, Mwh
$ELE_{\_kiln,y}$ = electricity consumption for clinker burning in the kiln, measured separately in each plant, with kwh meter. In each plant may have more than one Kwh meter to measure electricity consumption for clinker burning at the kiln section , Mwh
$ELE_{raw\ meal\ limestone,y}$ = power consumption for raw meal limestone in Mining, Mwh
$ELE_{clay,y}$ = power consumption for clay(sandy clay) in Mining, Mwh
$ELE_{laterite,y}$ = power consumption for laterite in Mining (only for Tarjun), Mwh
$ELE_{coal,y}$ = power consumption for coal mill section, Mwh
$ELE_{raw\ meal\ limestone,y}$ = $Q_{raw\ meal\ LS\ ,y}$ x $ELEspec_{\_\ total\_LS}$ /1000, Mwh

Where:

$Q_{raw\ meal\ LS\ ,y}$ =limestone consumed for raw meal in year y, ton

$ELEspec_{\_\ total\_LS}$ = specific electricity consumption for overall limestone
$ELEspec_{\_\ total\_LS}$ = $1000*ELE_{\_total\_LS}/(Q_{ADD\ LS}+Q_{RAWMEAL\ LS,y})$, kwh/t $_{LS}$

$ELE_{\_total\_LS}$ = Electricity consumption for raw meal limestone and for-additive limestone, measured by kWh meter, Mwh
$Q_{ADD\ LS,y}$ = Quantity of additive limestone consumed in year y

To calculate the electricity consumption for clinker production from grid and electricity consumption from self generated, the ratio of electricity supply between that of the grid is calculated as follows:

$$GEN\_{}_{grid\ \_\ ratio} = \frac{GEN\ ele\ grid, y}{\sum GENi, y + GEN\ ele\ grid, y} \qquad (4)$$

$GEN\_{sg\_ratio} = 1 - GEN\_{grid\_ratio}$ (5)

Where:

$GEN_{ele\,grid,y}$ = Electricity supply from the grid, measured by Kwh meter
$\Sigma GENi,y$ = Sum of Electricity self-generated from the source i, measured by Kwh meters

The additional parameters which are not provided in the registered PDD is already given in the Monitoring Table.

2. Electricity consumption for Blended cement

The electricity consumption parameters for blended cement included in this monitoring report are as follows:

- Grid electricity for grinding BC, baseline ($BE_{ele\_grid\_BC}$)
- Self generation of electricity for grinding BC. Baseline ($BELE_{sg\_BC,}$)
- Grid electricity for grinding BC, project ($PE_{ele\_grid\_BC}$)
- Self generation of electricity for grinding BC. Project ($PELE_{sg\_BC,}$)

Both electricity consumption method of calculation from grid and self-generated supply for grinding blended cement for baseline and project are the same. The difference is that the baseline calculates electricity consumption for clinker production in the year 2004.

The electricity consumption for grinding blended cement from grid is then calculated as follows:

$PE_{ele\_grid\_BC,\,y} = ELE\_BC.,y * GEN\_{grid\_ratio}$ (1)

And The electricity consumption for clinker production from self-generated electricity source is then estimated as follows:

$PELE_{sg\_BC} = ELE\_BC.,y - PE_{ele\_grid\_BC,\,y}$ (2)

Where,

ELE_BC, y = electricity consumption for blended cement, measured for each plant by Kwh meter. In each plant may have more than one Kwh meter to measure electricity consumption for blended cement.

The additional parameters which are not provided in the registered PDD is already given in the Monitoring Table.

3. Electricity consumption for grinding additives

The electricity consumption parameters for grinding additives included in this monitoring report are as follows:

- Grid electricity for grinding additives, baseline ($BELE_{\_grid\_ADD}$)
- Self generation of electricity for grinding additives, Baseline ($BELE_{sg\_ADD,}$)
- Grid electricity for grinding additives, project ($PELE_{\_grid\_ADD}$)
- Self generation of electricity for grinding additives, Project ($PELE_{sg\_ADD,}$)

Both electricity consumption method of calculation from grid and self-generated supply for grinding additives for baseline and project are the same. The difference is that the baseline calculates electricity consumption for clinker production in the year 2004.

In the mining, raw mill limestone and additive limestone is ground and the electricity supply goes into one kWh meter for both raw mill limestone and additive limestone. Therefore, the specific electricity consumption for overall limestone, both for raw mill and additives must be calculated:

$$ELEspec\_{}_{total\_LS} = 1000 * ELE_{\_total\_LS} / (Q_{ADD\ LS} + Q_{RAWMEAL\ LS}),\ kwh/t_{LS}$$

Where:

$ELEspec\_{}_{total\_LS}$ = specific electricity consumption for overall limestone

$ELE_{\_total\_LS}$ = Electricity consumption for raw mill limestone and for ~~mining~~ additive limestone, measured by kWh meter, Mwh

$Q_{ADD\ LS}$ = Quantity of additive limestone,t

$Q_{RAWMEAL\ LS}$ =Quantity of raw meal limestone,t

The electricity consumptions for grinding additives limestone are then calculated as follows:

$PELE_{\_grid\_ADD,\ y} = Q_{ADD\ LS}\ /1000* ELEspec_{\_\ total\_LS} * GEN\_{}_{grid}\ \_{}_{ratio}$, Mwh, and
$PELE_{\_sg\_ADD,\ ,y} = Q_{ADD\ LS}\ /1000* ELEspec_{\_\ total\_LS} * (1-GEN\_{}_{grid}\ \_{}_{ratio})$, Mwh

The additional parameters which are not provided in the registered PDD is already given in the Monitoring Table.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored			
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table 2.1.1, ID 1-29	Low-Medium	Yes	These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross-checking these with other internal company reports. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.
Table 2.1.1 ID 9, 11	Medium	Yes	The source of uncertainties in the grid emission factor is the fuel composition mix of the grid. This will be updated every year to incorporate the changes in fuel composition mix. Data will be requested to DGEEU (directorate general of energy and electricity utilization). The uncertainty of the grid emission factor is about ± 10%. This will be verified regularly during the verification process. In the absence of actual fuel emission factor for the fuel composition mix of the self generated electricity, IPCC default value will be used.
Table 2.1.3, ID 1-29	Low-Medium	Yes	These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross-checking these with other internal company reports. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.

Table 2.1.3, ID 9.11	Medium	Yes	The source of uncertainties in the grid emission factor is the fuel composition mix of the grid. This will be updated every year to incorporate the changes in fuel composition mix. Data will be requested to DGEEU (directorate general of energy and electricity utilization). The uncertainty of the grid emission factor is about ± 10%. This will be verified regularly during the verification process. In the absence of actual fuel emission factor for the fuel composition mix of the self generated electricity, IPCC default value will be used.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

CDM project operation is integrated in the normal plant management structure. All monitoring equipment will be installed by experts and regularly calibrated to the highest standards by project staff. An executive responsible for all data monitoring / acquisition and recording for CDM purposes is appointed by the Plant General Managers of Citeureup, Cirebon and Tarjun.

D.5 Name of person/entity determining the monitoring methodology:

1) Indocement (also project participant): tc_yang@indocement.co.id
2) Architrandi Priambodo, consultant: chitra_dpsolusi@cbn.net.id
3) Prototype Carbon Fund, World Bank, 1818 H Street, Washington Dc 20433. (contact Mr. Lasse Ringius, lringius@ worldbank.org, and V. Atur, vatur@worldbank.org). PCF is a project participant.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The emissions of the project activity determined per unit of clinker or per unit of BC consist of:

- Emissions from calcinations of limestone (PEcalcin,y)
- Emissions from combustion of fossil fuel and electricity for clinker production and processing of raw material $PE_{fossil\_fuel,y}$, $PE_{ele\_grid\_CLINK}$, $PE_{ele\_sg\ CLINK}$,
- Emissions from electricity used for additives preparation and grinding of cement ($PE_{ele\_AD\_BC,y}$).

The estimation is based on cement projection with the increasing growth from about 35% to about 60% over 10 years.

The estimated emissions generated by sources and by facilities are given in Table 2.a, 2.b and 2.c. The emissions due to electricity consumption in Citeureup is from grid and self generated power while in Cirebon is from grid only and in Tarjun is from self-generated power only.

Table. 2 a Estimated project activity emissions by sources, Citeureup

Citeureup	t of CO_2/ton clinker					t of CO2/ton of cement	clinker to cement ratio	t of CO2/ton of cement
Year	PE_{calcin}	PE_{fossil_fuel}	$PE_{ele\_grid\_CLINK}$	$PE_{ele\_sg\_CLINK}$	$PE_{clinker}$	$PE_{ele\_ADD\_BC}$	P_{blend}	$PE_{BC,y}$
2005	0.534	0.321	0.018	0.037	0.909	0.033	0.889	0.842
2006	0.534	0.310	0.012	0.040	0.897	0.032	0.873	0.815
2007	0.534	0.303	0.012	0.040	0.890	0.033	0.859	0.797
2008	0.534	0.298	0.012	0.040	0.884	0.033	0.845	0.780
2009	0.534	0.300	0.012	0.040	0.886	0.033	0.832	0.770
2010	0.534	0.300	0.012	0.040	0.886	0.033	0.820	0.760
2011	0.534	0.302	0.012	0.040	0.888	0.033	0.809	0.751
2012	0.534	0.306	0.012	0.040	0.893	0.033	0.809	0.755
2013	0.534	0.308	0.012	0.040	0.894	0.033	0.810	0.756
2014	0.534	0.307	0.012	0.040	0.894	0.033	0.810	0.757

Table. 2 b Estimated project activity emissions by sources, Cirebon

Cirebon	t of CO_2/ton clinker					t of CO2/ton of cement	clinker to cement ratio	t of CO2/ton of cement
Year	PE_{calcin}	PE_{fossil_fuel}	$PE_{ele\_grid\_CLINK}$	$PE_{ele\_sg\_CLINK*}$	$PE_{clinker}$	$PE_{ele\_ADD\_BC}$	P_{blend}	$PE_{BC,y}$
2005	0.530	0.319	0.055	N/A	0.904	0.030	0.870	0.816
2006	0.530	0.302	0.055	N/A	0.887	0.031	0.822	0.760
2007	0.530	0.298	0.055	N/A	0.883	0.031	0.822	0.757
2008	0.530	0.297	0.055	N/A	0.882	0.031	0.822	0.756
2009	0.530	0.296	0.055	N/A	0.881	0.031	0.822	0.755
2010	0.530	0.295	0.055	N/A	0.880	0.031	0.822	0.754
2011	0.530	0.295	0.055	N/A	0.879	0.031	0.822	0.754
2012	0.530	0.294	0.055	N/A	0.879	0.031	0.822	0.754
2013	0.530	0.295	0.055	N/A	0.880	0.031	0.822	0.754
2014	0.530	0.295	0.055	N/A	0.880	0.031	0.822	0.755

Table. 2 c Estimated project activity emissions by sources, Tarjun

Tarjun	t of CO_2/ton clinker					t of CO_2/ton of cement	clinker to cement ratio	t of CO_2/ton of cement
Year	PE_{calcin}	PE_{fossil_fuel}	$PE_{ele\_grid\_CLINK*}$	$PE_{ele\_sg\_CLINK}$	$PE_{clinker}$	$PE_{ele\_ADD\_BC}$	P_{blend}	$PE_{BC,y}$
2005	0.536	0.274	N/A	0.093	0.904	0.054	0.894	0.862
2006	0.536	0.282	N/A	0.091	0.909	0.054	0.862	0.839
2007	0.536	0.279	N/A	0.091	0.906	0.054	0.862	0.836
2008	0.536	0.278	N/A	0.091	0.905	0.054	0.862	0.835
2009	0.536	0.276	N/A	0.091	0.903	0.054	0.862	0.834
2010	0.536	0.275	N/A	0.091	0.902	0.054	0.862	0.833
2011	0.536	0.275	N/A	0.091	0.902	0.054	0.862	0.833
2012	0.536	0.275	N/A	0.091	0.902	0.054	0.862	0.833
2013	0.536	0.276	N/A	0.091	0.903	0.054	0.862	0.833
2014	0.536	0.276	N/A	0.091	0.903	0.054	0.862	0.833

E.2. Estimated leakage:

The leakage of project is mainly from transportation of additives. To maintain the conservativeness of the project as suggested in ACM0005, the transport related emissions for raw materials and fuels likely to decrease are not included in the estimation of leakage.

The estimation of leakage is then limited to:

a) Transportation of fly ash/trass, which is based on the fuel consumed to transport these additives to the cement facilities. Since there is no conveyor system for additive, the emissions from electricity consumption of conveyor system for additives do not exist in this project.
b) Transportation of increased limestone which is due additional limestone used in grinding Phase in PCC production. This transportation includes overland transportation and due to limestone conveying using electricity from grid or self generating, depending on the plant.

Table 3 illustrates the emission factors from transportation of fly-ash, trass and limestone at different location.

In the final fly-ash/trass consumption, it is decided that in Citereup, the consumption of fly-ash and trass to produce PCC is 1:1, which makes the emission factors of fly-ash/trass is the average of both emission factors for fly-ash and trass. Trass is used as additive to produce PPC in Cirebon while fly-ash is used as additive in Tarjun. These additives are used at particular place due to its abundant availability at specific location and also the considering transportation distance. Trass is available in abundant in java and it is more convenient in terms of transport for production of PCC in cement plants in Java while in kalimantan, due to abundant amount of coal, fly-ash availability is unquestionable. Fly ash is available in Java, but the transportation to Cirebon is more costly. Therefore, the estimation of leakage in the spreadsheet only estimates fly ash share in Cirebon as zero.

The baseline for limestone as additive includes the limestone used as additives for relevant cement types which would be replaced by PCC.

Table 4 gives estimation of leakages in this project.

Table 3 CO2 emissions from fly-ash, trass and limestone per ton of additives

Additives	Citeureup	Cirebon	Tarjun
Limestone, (kg of CO2/t of limestone)	4.6	1.6	6.6
Average fly-ash/trass (kf of CO2/t of fly-ash/trass)	5.6	0.8	22.6

Table 4. Estimation of Leakages

Year	Leakage, t of CO_2			Total
	Citeureup	Cirebon	Tarjun	
2005	-266	-929	313	-882
2006	-936	-1494	151	-2279
2007	-1491	-1489	171	-2808
2008	-2092	-1484	193	-3383
2009	-2742	-1479	214	-4006
2010	-3444	-1473	236	-4681
2011	-4201	-1468	258	-5411
2012	-4405	-1463	281	-5586
2013	-4610	-1457	304	-5762
2014	-4816	-1452	328	-5940

E.3. The sum of E.1 and E.2 representing the project activity emissions:

The sum of E.1 and E.2 are calculated separately, referring to the approved consolidated methodology ACM 0005.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

In estimating the baseline emissions, there are several conditions and parameters that to be determined as follows:

1. Benchmark of clinker to cement ratio, B_{Blendy}

Consistent with the methodology ACM0005, and explanation on selection on benchmark baseline emissions in section B.2, The representative year taken for the baseline is 2004, because the project starts in 2005. Table 5 gives the estimation of the baseline benchmark options as follows:

i. The average (weighted by production) mass percentage of clinker for the 5 highest Total Cement brands in Indonesian cement market: Indocement, Semen Gresik, Semen Cibinong, Semen Padang and Semen Tonasa. The baseline benchmark clinker to cement ratio value is estimated to be 0.898.

ii. The production weighted average mass percentage of clinker for the Total Cement in the top 20% (in terms of share of additives) of the total production of the blended cement type Indonesian cement market. Table 5 illustrates the estimate of the production weighted average mass percentage of clinker for the Total Cement in 90% of cement market consisting of Indocement, Semen Gresik, Semen Cibinong, Semen Padang and Semen Tonasa. The scope of national cement market for relevant cement type (Total Cement) is limited to these 90% of market share since these are the brands that are really sold in national market (at least more than 2 regions of the cement market listed in Table 1). It shows that the top 20% is the ITP cement with the baseline benchmark clinker to cement ratio value of 0.898 (In red).

iii. The mass percentage of clinker for the Total Cement produced in the proposed project activity plant before the implementation of the CDM project activity. The estimated weighted average clinker to cement ratio value in 2004 prior to the implementation of project activity at Indocement is estimated as 0.898 (in red).

Based on these options, the lowest value is the option (ii) and (iii) which is the Indocement clinker to cement ratio which is 0.898. This is taken as B_{Blendy} in the calculation of baseline emissions for all facilities: Citeureup, Cirebon and Tarjun.

Table 5 Estimation of baseline benchmark clinker to cement ratio, B_{Blend}

Brands	Share of clinker in 2004 for total cement	Production Volume in 2004	Share of production (%)
ITP	**0.898**	9051742	0.335
Gresik	0.913	7331689	0.271
Cibinong	0.921	4550654	0.168
Padang	0.914	3719907	0.138
Tonasa	0.937	2379764	0.088
Total		27033756	

2. Baseline trend: increase in additives

Since the selected baseline benchmark values is the Indocement value of 0.898, the baseline trend of increase in additives is also based on the trend of Indocement's increase in additive. Table 6 illustrates the increasing rate of additive in 2000 to 2004. It shows that from 2002 to 2003 the increase rate of additive is 20% while from 2003 to 2004 the increase rate is only 5%, reaching the optimum additive share according to standard SNI 15-3500-1994 (OPC Type I). During those times, indocement has made a trial to produce new type of cement but the standard of this type of cement did not exist. In the absence of the project, the share of additive would stay and be maintained at 0.102. However, to keep the conservativeness, the baseline increase rate for this project is taken as 2%, which follows the option (ii) and option (iii) of the ACM 0005.

Table 6 The share of additive and increase rate of additive of indocement's relevant type of cement (OPC Type I + PPC).

Year	Share of additives, 2000-2004	Increase rate
2000	0.040	
2001	0.044	12%
2002	0.081	83%
2003	0.097	20%
2004	0.102	5%

3. Determination of Baseline emission clinker ($BE_{clinker, y}$) and Baseline cement grinding emission factor, BEele_ADD_BC

In certain year y, the $BE_{clinker , y}$, determination of Baseline emission clinker follow condition (i) where in case of emissions per tonne of clinker during the crediting period are less than baseline emissions per tonne of clinker ($PE_{Clinker,y} < B_{EClinker}$), the baseline value is substituted by the project activity value. That is, if emissions per tonne of clinker are lower during the crediting period, the lower value is taken as the baseline. The adjusted baseline value following this condition is reflected in row "adjusted baseline clinker emission factor" in the spreadsheet "annex 3a-blended cement". This condition applies even in the absence of the alternative fuel project which is currently conducted by Indocement in parallel with this project.

Similar approach is also applied to Baseline cement grinding emission factor, BEele_ADD_BC

Estimation of project emissions and baseline emissions are applying more or less the same formula, however, the baseline emissions are estimated based the consumption of fuel and electricity in the production of clinker and blended cement monitored one year prior to the start of the project activity, which is in the year of 2004 (refer to ACM 0005). In Annex 3.a blended cement, worksheet "Estimation of ER", the parameters related to emissons due to fuel consumption and electricity of the year 2004 becomes baseline, while starting from 2005 it becomes project emissions.

The estimated baseline emissions per ton of cement generated is given in Table 7.

Table 7.a . Estimated baseline emissions for Citeureup, CO2/ton of cement

Year	$BE_{clinker}$	$BE_{ele\_ADD\_BC}$	B_{blend}	$BE_{BC,y}$
2005	0.896	0.033	0.898	0.837
2006	0.896	0.032	0.896	0.835
2007	0.890	0.033	0.894	0.828
2008	0.884	0.033	0.891	0.821
2009	0.886	0.033	0.889	0.820
2010	0.886	0.033	0.887	0.819
2011	0.888	0.033	0.885	0.818
2012	0.893	0.033	0.883	0.820
2013	0.894	0.033	0.880	0.820
2014	0.894	0.033	0.878	0.817

Table 7.b Estimated baseline emissions for Cirebon, CO2/ton of cement

Year	$BE_{clinker}$	$BE_{ele\_ADD\_BC}$	B_{blend}	$BE_{BC,y}$
2005	0.896	0.030	0.898	0.834
2006	0.887	0.031	0.896	0.825
2007	0.883	0.031	0.894	0.820
2008	0.882	0.031	0.891	0.817
2009	0.881	0.031	0.889	0.814
2010	0.880	0.031	0.887	0.811
2011	0.879	0.031	0.885	0.809
2012	0.879	0.031	0.883	0.807
2013	0.880	0.031	0.880	0.805
2014	0.880	0.031	0.878	0.803

Table 7.c Estimated baseline emissions for Tarjun

Year	$BE_{clinker}$	$BE_{ele\_ADD\_BC}$	B_{blend}	$BE_{BC,y}$
2005	0.896	0.033	0.898	0.837
2006	0.896	0.033	0.896	0.835
2007	0.896	0.033	0.894	0.833
2008	0.896	0.033	0.891	0.831
2009	0.896	0.033	0.889	0.829
2010	0.896	0.033	0.887	0.827
2011	0.896	0.033	0.885	0.825
2012	0.896	0.033	0.883	0.823
2013	0.896	0.033	0.880	0.821
2014	0.896	0.033	0.878	0.819

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The estimated emission reductions during the 10-year crediting period are about 5 million tonnes of CO2 emissions.

E.6. Table providing values obtained when applying formulae above:

Estimated emissions reductions during the 10-year crediting period are given in Table 8. It should be noted hat the estimation of the project emissions and baseline emissions for the project are derived and summed up from calculation for each separate cement facility: Citeureup, Cirebon and Tarjun.

Table 8. Estimated emissions reduction during the 10-year crediting period

Years	Estimation of project emissions (t CO2 e)	Estimation of baseline emissions (t of CO2 e)	Estimation of leakage (t of CO2 e)	Estimation of emissions reductions (t of CO2 e)
2005	7876270	7855744	-882	-21408
2006	7741867	7994481	-2279	250335
2007	7991000	8318745	-2808	324936
2008	8262922	8663967	-3383	397661
2009	8585174	9068996	-4006	479817
2010	8911752	9482836	-4681	566403
2011	9263693	9928486	-5411	659382
2012	9741085	10418711	-5586	672040
2013	10221949	10908445	-5762	680734
2014	10713410	11406946	-5940	687596
Total estimated emissions reductions				4697497