

Enclosure 1

Benchmark for baseline emission calculation-Average mass percentage of clinker for the 5 highest blend cement brands in the Northern region - Year 1999-2000

Sl.No	Name of the Plant	Clinker production (Tonnes)	Clinker Grounded (Tonnes)	OPC (Tonnes)	PPC (Tonnes)	Clinker used for OPC (Tonnes)	Clinker used for PPC(Tonnes)	Mass percent of clinker in PPC (ton of clinker/ton of PPC)
Rajasthan								
1	ACC Lakheri	432190	430630	133170	410520	124312.88	306317.12	0.74617
2	Birla Cement	606880	548630	450670	176910	420695.98	127934.02	0.72316
3	Lakshmi cement	1825000	1692030	1672290	154410	1561066.15	130963.85	0.84816
4	Shree cement	2135180	2068405	1980451	331957	1831913.00	236492.00	0.71242
Himachal Pradesh								
5	Gagal I	806800	743070	109650	830240	102357.19	640712.81	0.77172
6	Rajban	142730	147830	116110	45740	108387.53	39442.47	0.86232
7	Guj,Ambuja HP	2016260	807340	113600	853880	106044.47	701295.53	0.82130

The weighted average mass percent of clinker in OPC of only OPC manufacturing cement plants in northern region = 0.9335 OPC ton of clinker / ton of OPC Please refer- Only OPC plants excel sheet

The green highlighted ones are top five blenders in Northern region

The average (wt by production) mass percentage of clinker for the 5 highest blend cement brands for the relevant cement type in the region = 0.77309 ton of clinker / ton of PPC

Enclosure-2

Only OPC manufacturing plants in Northern Region in the year 1999-2000

Sl.No	Name of Cement Plant	Clinker production(Tonnes)	Clinker Ground (Tonnes)	OPC(Tonnes)	Mass percent of clinker in OPC (ton of clinker/ton of OPC)
Rajasthan					
1	Binnani cement	1527930	1552500	1650190	0.9408
2	Neer Shree cement	919950	886560	927360	0.9560
3	Chittor Cement	911200	999940	1078820	0.9269
4	JK udaipur	566330	522900	589550	0.8869
J& K					
5	J& K Ltd	91780	91370	96140	0.9504

Weighted Average

0.9335

ton of clinker /
ton of OPC

Enclosure-3

Benchmark for baseline emission calculation- Production weighted average mass percentage of clinker in Top 20 %(in terms of share of additive) of total production of the blended cement type in the Northern region - Year 1999-2000

Sl.No	Name of the Plant	Clinker production (Tonnes)	Clinker Grounded (Tonnes)	OPC (Tonnes)	PPC (Tonnes)	Clinker used for OPC (Tonnes)	Clinker used for PPC(Tonnes)	Mass percent of clinker in PPC(ton of clinker/ton of PPC)
	Rajasthan							
1	ACC Lakheri	432190	430630	133170	410520	124141.62	306488.38	0.74659
2	Birla Cement	606880	548630	450670	176910	420116.4217	128513.5783	0.72643
3	Lakshmi cement	1825000	1692030	1672290	154410	1558915.594	133114.4056	0.86208
4	Shree cement	2135180	2068405	1980451	331957	1831913	236492	0.71242
	Himachal Pradesh					0	0	
5	Gagal I	806800	743070	109650	830240	102216.1796	640853.8204	0.77189
6	Rajban	142730	147830	116110	45740	108238.2181	39591.78195	0.86558
7	Guj.Ambuja HP	2016260	807340	113600	853880	105875.2	701464.8	0.82150
	Total				2803657			

The 20 % of total PPC produced in the region = 560731.4 Tonnes

The cement plants which are producing PPC more than 20% of total PPC produced in the region are highlighted in yellow colour

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 = **0.79704** ton of clinker / ton of PPC

Enclosure-4

Benchmark for baseline emission calculation-Mass percentage of clinker in PPC before implementation of project activity in Shree cement - Year 1999-2000

Sl.No	Name of the Plant	Clinker production (Tonnes)	Clinker Grounded (Tonnes)	OPC (Tonnes)	PPC (Tonnes)	Clinker used for OPC (Tonnes)	Clinker used for PPC(Tonnes)	Mass percent of clinker in PPC(ton of clinker/ton of PPC)
1	Shree cements	2135180	2068405	1980451	331957	1831913	236492	0.71242

Mass percentage of clinker in PPC before implementation of project activity in Shree cement =

ton of clinker /
0.712 ton of PPC

Enclosure-5

Baseline Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (tCO2/tonne clinker)- BE calcin		
Parameter	Unit	1999-00
Quantity of raw mix	Tonnes	3381457
Quantity of clinker produced	Tonnes	2284781
CaO content (%) of raw mix	%	0
MgO content (%) of raw mix	%	0
CaO content (%) of Clinker	%	64.59
MgO content (%) of Clinker	%	2.525
Emissions from the calcinations of limestone(tCO2/tonne clinker) BE calcin	tCO2/tclinker	0.53460
Baseline Emissions per tonne of clinker due to combustion of fossil fuels for clinker production (tCO2/tonne clinker)-BE fossil_fuel		
Quantity of coal consumed-Imported-FF1_BSL	Tonnes	263940.00
Quantity of coal consumed-Indian-FF2_BSL	Tonnes	3314.00
Quantity of Petcoke consumed-FF3_BSL	Tonnes	14632.00
Net calorific value of Imported coal Fuel(IPCC)	TJ/KiloTonnes	25.75
Carbon Emission factor of Imported coal(IPCC)	tCO2/TJ	94.60
Emission factor of Imported coal - EFF1	tCO2/Ton of fuel	2.44
Net calorific value of Indian coal Fuel(IPCC)	TJ/KiloTonnes	19.98
Carbon Emission factor of Indian coal(IPCC)	tCO2/TJ	94.60
Emission factor of Indian coal EFF2	tCO2/Ton of fuel	1.89

Net calorific value of Petcoke fuel (IPCC)	TJ/KiloTonnes	31.00
Carbon Emission factor of Petcoke fuel (IPCC)	tCO2/TJ	100.83
Emission factor of Petcoke fuel EFF ₃	tCO2/Ton of fuel	3.13
Baseline Emissions per tonne of clinker due to combustion of fossil fuels for clinker production-BE fossil_fuel	tCO2/tclinker	0.304163
Baseline grid electricity emissions for clinker production per tonne of clinker- BE ele_grid_CLNK -(tCO2/tonne clinker)		
Baseline grid electricity for clinker production - BELE _{grid_CLNK}	MWh	110377.97
Baseline grid emission Factor for northern grid - EF _{grid_BSL}	tCO2/MWh	0.75151
Baseline grid electricity emissions for clinker production per tonne of clinker BE ele_grid_CLNK	tCO2/tonne clinker	0.036306
Baseline Emissions from Self generated electricity for clinker production per tonne of clinker -BE ele_sg_CLNK-(tCO2/tonne clinker)		
Baseline generation of Electricity by DG sets for clinker production - BELE _{sg_CLNK_DG}	MWh	9487.13
DG set Emission Factor in year y (As per Appendix B of the simplified and procedures for small scale CDM project activities) - EF _{sg_DG_BSL}	tCO2/MWh	0.8
Baseline generation of Electricity by 3 MW petcoke based power plant for clinker production - BELE _{sg_CLNK_3MW power plant}	MWh	2234.42

Total Electricity generation by 3 MW Petcoke based power plant GEN 3 MW power plant	MWh	3393.00
Quantity of Petcoke consumed in 3 MW power plant -FF1	Tonnes	3035.00
Net calorific value of Petcoke fuel (IPCC) -NCV	TJ/KiloTonnes	31.00
Carbon Emission factor of Petcoke fuel (IPCC)-EFF CO ₂	tCO ₂ /TJ	100.83
Oxidation factor of the fuel - OXID ₁		0.98
CO ₂ emissions coefficient of fuel taking into account the carbon content of the fuel used by relevant power sources j and the percent oxidation of the fuel in year y COEF _{i,j}	tCO ₂ /Ton of fuel	3.06
Emission factor for self generation in year y - EF _{sg_petcoke_y}	tCO ₂ /MWh	2.74010
Self generated electricity emissions for clinker production per tonne of clinker BE _{ele_sg_CLNK,y}	tCO ₂ /tonne of clinker	0.006002
Baseline Emissions of CO₂ per tonne of clinker in the project activity (tCO₂/tonne clinker)-BE_{clinker}	tCO₂/tonne of clinker	0.881074
Annual production of BC in base year -BC _{BSL}	kilotonnes of BC	331957

Baseline grid electricity emissions for BC grinding in BE		
ele_grid_BC -(tCO2/tonne of BC)		
Baseline Grid Electricity for grinding BC -BELEgrid_BC	MWh	8777.61
Baseline Grid Emission Factor for northern grid - EFgrid_BSL	tCO2/MWh	0.75151
Baseline Grid electricity emissions for BC grinding (tCO2/tonne of BC) BE ele_grid_BC	tCO2/tonne of BC	0.019871427
Baseline self generated electricity emissions for BC grinding		
BE ele_sg_BC		
Baseline generation of Electricity by DG sets for BC grinding -BELEsg_DG_BC	MWh	754.45
Baseline generation of Electricity by 3 MW based Petcoke power plant for BC grinding BELEsg_3MW power plant_BC	MWh	177.69
Baseline Self generated electricity emissions for BC grinding (tCO2/tonne of BC) BE ele_sg_BC	tCO2/tonne of BC	0.0032849
Baseline Grid electricity emissions for additive preparation BE		
ele_grid_ADD		
Baseline grid electricity emissions for additive preparation BE ele_grid_ADD	tCO2/tonne of BC	0
Baseline emissions from Self generated electricity additive		
Emissions from Self generated electricity additive preparation BE ele_sg_ADD	tCO2 / tonne of BC	0
Baseline electricity Emissions for BC grinding and preparation of additives BE ele_ADD_BC		
Baseline electricity Emissions for BC grinding and preparation of additives BE ele_ADD_BC	tCO2 / tonne of BC	0.0231563

No grinding of additive

No grinding of additive

Enclosure-6

Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in a year y (tCO ₂ /tonne clinker)- PE calcin,y						
Parameter	Unit	2000-01	2001-02	2002-03	2003-04	2004-05
Quantity of raw mix	Tonnes	3114977	2372092	3336652	3348675	3625480
Quantity of clinker produced	Tonnes	2113279	1624686	2285091	2293627	2483247
CaO content (%) of raw mix	%	0	0	0	0	0
MgO content (%) of raw mix	%	0	0	0	0	0
CaO content (%) of Clinker	%	64.59	64.59	64.64	64.77	65.05
MgO content (%) of Clinker	%	2.525	2.53	2.50	2.405	2.36
Emissions from the calcinations of limestone(tCO ₂ /tonne clinker) PE calcin,y	tCO ₂ /tclinker	0.53460	0.53460	0.53472	0.53471	0.53641
Emissions per tonne of clinker due to combustion of fossil fuels for clinker production (tCO ₂ /tonne clinker)-PE fossil_fuel,y						
Quantity of coal consumed-Imported-FF1_y	Tonnes	39991.00	13719.00	2279.00	1788	343.00
Quantity of coal consumed-Indian-FF2_y	Tonnes	474.00	15.00	0.00	0	416
Quantity of Petcoke consumed-FF3_y	Tonnes	159653.00	137931.00	215805.00	222576	224386.00
Quantity of low CV coal consumed-FF4_y	Tonnes	0.00	2186.00	8573.00	26525	44711
Net calorific value of Imported coal Fuel(IPCC)	TJ/KiloTonnes	25.75	25.75	25.75	25.75	25.75
Carbon Emission factor of Imported coal(IPCC)	tCO ₂ /TJ	94.60	94.60	94.60	94.60	94.60
Emission factor of Imported coal - EFF1	tCO ₂ /Ton of fuel	2.44	2.44	2.44	2.44	2.44
Net calorific value of Indian coal Fuel(IPCC)	TJ/KiloTonnes	19.98	19.98	19.98	19.98	19.98
Carbon Emission factor of Indian coal(IPCC)	tCO ₂ /TJ	94.60	94.60	94.60	94.60	94.60
Emission factor of Indian coal - EFF2	tCO ₂ /Ton of fuel	1.89	1.89	1.89	1.89	1.89
Net calorific value of Petcoke fuel (IPCC)	TJ/KiloTonnes	31.00	31.00	31.00	31.00	31.00
Carbon Emission factor of Petcoke fuel (IPCC)	tCO ₂ /TJ	100.83	100.83	100.83	100.83	100.83
Emission factor of Petcoke fuel -EFF3	tCO ₂ /Ton of fuel	3.13	3.13	3.13	3.13	3.13
Emission factor of low CV fuel -EFF4	tCO ₂ /Ton of fuel	0.96	0.96	0.96	0.96	0.96
Emissions per tonne of clinker due to combustion of fossil fuels for clinker production-PE fossil_fuel,y	tCO ₂ /tclinker	0.282670	0.287253	0.301239	0.316343	0.300400

Grid electricity emissions for clinker production per tonne of clinker in year y - PE ele_grid_CLNK,y -(tCO2/tonne clinker)						
Grid Electricity for clinker production in year y -PELE _{grid_CLNK,y}	MWh	114804.14	67236.99	75791.48	1405.14	1559.92
Northern Grid Emission Factor in year y- EF _{grid,y}	tCO2/MWh	0.75151	0.75151	0.75151	0.75151	0.75151
Grid electricity emissions for clinker production per tonne of clinker PE ele _{grid_CLNK,y}	tCO2/tonne clinker	0.040826	0.031101	0.024926	0.000460	0.000472
Emissions from Self generated electricity per tonne of clinker production in year y -PE ele_sg_CLNK,y-(tCO2/tonne clinker)						
Generation of Electricity by DG sets for clinker production in year y- PELE _{sg_CLNK_DG,y}	MWh	2077.35	22194.46	16835.36	979.34	2614.72
DG set Emission Factor in year y (As per Appendix B of the simplified and procedures for small scale CDM project activities) - EF _{sg_DG,y}	tCO2/MWh	0.8	0.8	0.8	0.8	0.8
Generation of Electricity by 36 MW Petcoke based power plant for clinker production in year y - PELE _{sg_CLNK_36MW power plant,y}	MWh	0.00	0.00	31121.48	138342.57	142903.12
Generation of Electricity by 3 MW Petcoke based power plant for clinker production in year y - PELE _{sg_CLNK_3MW power plant,y}	MWh	5315.57	5295.22	5654.92	1206.43	1485.63
Total Electricity generation by 36 MW Petcoke based power plant GEN 36 MW power plant,y	MWh	0.00	0.00	49646.00	213658.00	221682.00
Total Electricity generation by 3 MW Petcoke based power plant GEN 3MW power plant,y	MWh	8203.00	8364.00	9019.00	1862.00	2303.00
Quantity of Petcoke consumed in 36 MW power plant -FF1 _y	Tonnes	0.00	0.00	26189.62	102377.26	106698.89
Quantity of Petcoke consumed in 3 MW power plant -FF2 _y	Tonnes	8874.00	12388.00	10454.00	1746.00	2504.00
Net calorific value of Petcoke fuel (IPCC) - NCV	TJ/KiloTonnes	31.00	31.00	31.00	31.00	31.00
Carbon Emission factor of Petcoke fuel (IPCC)-EFF CO ₂	tCO2/TJ	100.83	100.83	100.83	100.83	100.83
Oxidation factor of the fuel - OXID ₁		0.98	0.98	0.98	0.98	0.98
CO ₂ emissions coefficient of fuel taking into account the carbon content of the fuel used by relevant power sources j and the percent oxidation of the fuel in year y COEF _{ij}	tCO2/Ton of fuel	3.06	3.06	3.06	3.06	3.06
Emission factor for self generation in year y - EF _{sg1,y}	tCO2/MWh	3.31389	4.53711	1.91342	1.47997	1.49351
Self generated electricity emissions for clinker production per tonne of clinker PE ele _{sg_CLNK,y}	tCO2/tonne of clinker	0.009122	0.025716	0.036689	0.090386	0.087682
Emissions of CO₂ per tonne of clinker in the project activity in year y (tCO2/tonne clinker)-PE clinker,y	tCO2/tonne of clinker	0.867222	0.878675	0.897577	0.941896	0.924968
Annual production of BC in year y -BC _y	kilotonnes of BC	413623	457416	731035	1078205	1217054

Grid electricity emissions for BC grinding in a year y PE ele_grid_BC,y -(tCO2/tonne of BC)						
Grid Electricity for grinding BC in year y - PELEgrid_BC,y	MWh	10534.91	9857.10	11778.88	288.74	306.57
Northern Grid Emission Factor in year y- EFgrid_y	tCO2/MWh	0.75151	0.75151	0.75151	0.75151	0.75151
Grid electricity emissions for BC grinding in year y (tCO2/tonne of BC) PE ele_grid_BC,y	tCO2/tonne of BC	0.019141	0.016195	0.012109	0.000201	0.000189
Emissions from self generated electricity for BC grinding in year y PE ele_sg_BC,y						
Generation of Electricity by DG sets for BC grinding in year y-PELEsg_BC,y	MWh	190.63	3253.76	2616.41	201.24	513.87
Generation of Electricity by 36 MW based coal power plant for BC grinding in year y-PELEsg_BC,y	MWh	0.00	0.00	4836.64	28427.56	28084.71
Generation of Electricity by 3 MW Petcoke based power plant for BC grinding - PELEsg_BC,y	MWh	487.78	776.29	878.84	247.91	291.97
Self generated electricity emissions for BC grinding in year y (tCO2/tonne of BC) PE ele_sg_BC,y	tCO2/tonne of BC	0.004277	0.013391	0.017823	0.039510	0.035160
Grid electricity emissions for additive preparation in year y PE ele_grid_ADD,y						
Grid electricity emissions for additive preparation in year y PE ele_grid_ADD,y	tCO2/tonne of BC	0	0	0	0	0
Emissions from Self generated electricity additive preparation in year y PE ele_sg_ADD,y						
Emissions from Self generated electricity additive preparation in year y PE ele_sg_ADD,y	tCO2 / tonne of BC	0	0	0	0	0
Electricity Emissions for BC grinding and preparation of additives in year y PE ele_ADD_BC,y						
Electricity Emissions for BC grinding and preparation of additives in year y PE ele_ADD_BC,y	tCO2 / tonne of BC	0.023417565	0.029585398	0.029931827	0.03971112	0.035349

No grinding of additive

No grinding of additive

Enclosure-7

Incorporation of endogenous trend in Flyash additive percentage during the crediting period

Parameter	Unit	1999-00 (baseline year)	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Additive blending percentage (%)*	%	21.26	21.69	22.12	22.56	23.01	23.47	23.94	24.42	24.91	25.41	25.92
Gypsum blending percentage (%)#	%	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Baseline benchmark of share of clinker per tonne of BC updated for year y -B blend,y	tonne of clinker /tonne of BC	0.712	0.708	0.704	0.699	0.695	0.690	0.686	0.681	0.676	0.671	0.666

* According to methodology an endogenous trend of 2 % increase in additive over the percentage of additive at the start of the project activity is incorporated
 # Gypsum % is constant

Net calorific value of Diesel Fuel(IPCC)	TJ/KiloTonnes	43.33	43.33	43.33	43.33	43.33	43.33	43.33	43.33	43.33	43.33
Carbon Emission factor of Diesel fuel (IPCC)	tCO2/TJ	74.07	74.07	74.07	74.07	74.07	74.07	74.07	74.07	74.07	74.07
Emission factor for transport fuel(Diesel)-TEF	kg CO2/ kg of fuel	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21
Electricity consumption for the conveyor system for additives- ELEconveyor_ADD	MWh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grid electricity emission factor EF _{grid}	tCO2/MWh	0.75151	0.75151	0.75151	0.75151	0.75151	0.75151	0.75151	0.75151	0.75151	0.75151
Quantity of additive carried in one trip per vehicle - Kota thermal power plant -Q _{add}	Tonnes of Additive	26	26	26	26	26	26	26	26	26	26
Quantity of additive carried in one trip per vehicle - Suratgargh thermal power plant -Q _{add}	Tonnes of Additive	30	30	30	30	30	30	30	30	30	30
Quantity of additive carried in one trip per vehicle - Panipat thermal power plant -Q _{add}	Tonnes of Additive	27	27	27	27	27	27	27	27	27	27
Transport related emissions per tonne of additives-L _{add,trans}	tCO2/tonne of additive	0.00901	0.00919	0.00933	0.01028	0.01047	0.01016	0.00992	0.00982	0.00967	0.00967
Production of BC in year y -BC _y	kilotonnes of BC	413.623	457.416	731.035	1078.205	1217.054	1602.564	2013.963	2237.059	2715.424	2721.335
Baseline benchmark of share of clinker per tonne of BC updated for year y -B _{blend,y}	tonne of clinker /tonne of BC	0.708	0.704	0.699	0.695	0.690	0.686	0.681	0.676	0.671	0.666
Share of clinker per tonne of BC in year y -P _{blend,y}	tonne of clinker /tonne of BC	0.635	0.596	0.611	0.598	0.612	0.585	0.583	0.581	0.579	0.577
Leakage emissions for transport of additives-L _y	kilotonnes of CO2	0.272	0.453	0.603	1.074	0.998	1.638	1.954	2.086	2.415	2.337

Enclosure-9

Emission Reduction Calculations												
Parameters	Unit	1999-00 Baseline year	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Production of BC in year y	Tonnes	331957	413623	457416	731035	1078205	1217054	1602564	2013963	2237059	2715424	2721335
Baseline benchmark of share of clinker per tonne of BC updated for year y -B blend,y	tonne of clinker /tonne of BC	0.712	0.708	0.704	0.699	0.695	0.690	0.686	0.681	0.676	0.671	0.666
Share of clinker per tonne of BC in year y -P blend,y	tonne of clinker /tonne of BC	-	0.635	0.596	0.611	0.598	0.612	0.585	0.583	0.581	0.579	0.577
Baseline Emissions of CO2 per tonne of clinker in the project activity -BE clinker	tCO2/tonne of clinker	0.881074	-	-	-	-	-	-	-	-	-	-
Emissions of CO2 per tonne of clinker in the project activity in year y-PE clinker,y	tCO2/tonne of clinker	-	0.8672	0.8787	0.8976	0.9419	0.9250	0.9250	0.9250	0.9250	0.9250	0.9250
Baseline electricity Emissions for BC grinding and preparation of additives BE ele_ADD_BC	tCO2 / tonne of BC	0.0231563	-	-	-	-	-	-	-	-	-	-
Electricity Emissions for BC grinding and preparation of additives in year y PE ele_ADD_BC,y	tCO2 / tonne of BC	-	0.023	0.030	0.030	0.040	0.035	0.035	0.035	0.035	0.035	0.035
Baseline CO2 emissions per tonne of BC type-BE BC,y	tCO2 / tonne of BC	-	0.647	0.643	0.639	0.635	0.631	0.627	0.623	0.619	0.614	0.610
CO2 emissions per tonne of BC in the project activity plant in year y PE BC,y	tCO2 / tonne of BC	-	0.583	0.555	0.578	0.603	0.601	0.576	0.575	0.573	0.571	0.569
Emissions reductions in year y due to project activity	tCO2		26285	40064	44015	33909	35423	79713	95510	100687	115438	108622

679665