Enclosure-2

CER calculation for preheater upgradation line 2													
		Baseline	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	
tCo2 emission per ton of Petcoke	t CO2/ton	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	3.18	
tCo2 emission per ton of Coal	t CO2/ton	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	
Quantity of fine coal consumed	tons/hr	9.18	10.01	10.68	11.10	11.10	11.10	11.10	11.10	11.10	11.10	11.10	11.10	
Percentage heat contribution by Petcoke in the kiln	%	40.24	62.87	82.84	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	
Percentage heat contribution by Coal in the kiln	%	59.76	37.13	17.16	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	
Average calorific value of fuel used	Kcal/ kg	7241.00	7504.00	7729.00	7790.00	7790.00	7790.00	7790.00	7790.00	7790.00	7790.00	7790.00	7790.00	
Total heat consumption by the kiln	million Kcal/hr	66.51	75.10	82.58	86.51	86.51	86.51	86.51	86.51	86.51	86.51	86.51	86.51	
Average emission factor of fuel used	tons CO2/ton	2.74	2.91	3.05	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	3.14	
Total clinker produced in the kiln	tons/hr	91.39	105.28	116.95	124.28	124.28	124.28	124.28	124.28	124.28	124.28	124.28	124.28	
Efficiency calculation (Ref. 0 deg C)														
Heat input														
Inlet temperature of the cooling air in system	C	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	
flow rate of cooling air in system	Nm3/hr	201061.03	227396.39	252621.19	268441.45	268441.45	268441.45	268441.45	268441.45	268441.45	268441.45	268441.45	268441.45	
Specific heat of cooling air	kcal/Nm3 C	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	
Inlet temperature of the feed in system	C	68.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	
flow rate of feed in system	Nm3/hr	145312.28	167389.01	185957.26	197602.74	197602.74	197602.74	197602.74	197602.74	197602.74	197602.74	197602.74	197602.74	
Specific heat of raw feed	kcal/Nm3 C	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	
Inlet temperature of conveying air	C	45.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
flow rate of conveying air in system	Nm3/hr	8235.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Specific heat of conveying air	kcal/Nm3 C	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	
Inlet temperature of fine coal in system	C	65.00	67.00	67.00	67.00	67.00	67.00	67.00	67.00	67.00	67.00	67.00	67.00	
flow rate of fine coal	Nm3/hr	12520.62	13475.34	14970.14	15907.64	15907.64	15907.64	15907.64	15907.64	15907.64	15907.64	15907.64	15907.64	
Specific heat of fine coal	kcal/Nm3 C	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	
Inlet temperature of coal conveying air	C	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	
Flow rate of coal conveying air	Nm3/hr	1827.83	3053.01	3391.67	3604.08	3604.08	3604.08	3604.08	3604.08	3604.08	3604.08	3604.08	3604.08	
specific heat of coal conveying air	kcal/Nm3 C	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	
Inlet temperature of primary air	C	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	
Flow rate of primary air	Nm3/hr	3747.05	4421.60	4912.08	5219.69	5219.69	5219.69	5219.69	5219.69	5219.69	5219.69	5219.69	5219.69	
specific heat of primary air	kcal/Nm3 C	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	
Temperature of seal air+excess air	C	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	
Flow rate of seal air+excess air	Nm3/hr	22847.84	10527.61	11695.43	12427.85	12427.85	12427.85	12427.85	12427.85	12427.85	12427.85	12427.85	12427.85	
specific heat of seal air+excess air	kcal/Nm3 C	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	
Temperature of water spray in cooler	C	0.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	
Flow rate of water spray in cooler	Nm3/hr	0.00	4526.87	5029.03	5343.97	5343.97	5343.97	5343.97	5343.97	5343.97	5343.97	5343.97	5343.97	
specific heat of water	kcal/Nm3 C	0.00	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	
Heat from coal burning	kcal/hr	66505011.14	75095959.60	82576152.01	86507031.99	86507031.99	86507031.99	86507031.99	86507031.99	86507031.99	86507031.99	86507031.99	86507031.99	
Total heat input		**71040628.16**	**80096302.62**	**88131216.75**	**92409937.16**	**92409937.16**	**92409937.16**	**92409937.16**	**92409937.16**	**92409937.16**	**92409937.16**	**92409937.16**	**92409937.16**	
Useful Heat output														
Heat of reaction	kcal/hr	37013508.23	42636824.00	47366472.96	50332772.73	50332772.73	50332772.73	50332772.73	50332772.73	50332772.73	50332772.73	50332772.73	50332772.73	
Efficiency of system		**52.10**	**53.23**	**53.75**	**54.47**	**54.47**	**54.47**	**54.47**	**54.47**	**54.47**	**54.47**	**54.47**	**54.47**	
% Increase in efficiency	%	0.00	1.13	1.64	2.36	2.36	2.36	2.36	2.36	2.36	2.36	2.36	2.36	
Saving in heat output due to energy efficiency of system	kCal/hr	0.00	905138.44	1448445.47	2185451.14	2185451.14	2185451.14	2185451.14	2185451.14	2185451.14	2185451.14	2185451.14	2185451.14	
Saving in input heat	kCal/hr	0.00	1700366.85	2695013.03	4012443.42	4012443.42	4012443.42	4012443.42	4012443.42	4012443.42	4012443.42	4012443.42	4012443.42	
Saving in fuel	kg/hr	0.00	226.59	348.69	515.08	515.08	515.08	515.08	515.08	515.08	515.08	515.08	515.08	
Annual saving in fuel	kg/annum	0.00	841681.59	2703786.03	4079403.32	4079403.32	4079403.32	4079403.32	4079403.32	4079403.32	4079403.32	4079403.32	2039701.66	
Emissions reduced	**tons/annum**	**0.00**	**2445.29**	**8254.70**	**12821.56**	**12821.56**	**12821.56**	**12821.56**	**12821.56**	**12821.56**	**12821.56**	**12821.56**	**6410.78**	**119683.29**