Monitoring Report

Daegu Bangcheon-Ri Landfill Gas CDM Project

Monitoring Period: 19th August, 2007 ~ 31st March, 2008

Initial Verification (Ver.1)

ECOEYE Co., Ltd.

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Feb., 2008

1. General Project Activity and Monitoring Information

1.1. Title and Registration Number of the Project Activity

Daegu Bangcheon-Ri Landfill gas CDM Project (PROJECT-0851)

1.2. Short Description of the Project Activity :

Daegu Bangcheon-Ri Landfill gas CDM Project is located in 421, Bangcheon-Ri, Dasa-Eup, Dalsung-Gun, Daegu, Korea. Total area is 596,760m^2 and possible landfill capacity is 15,670,000 ton. Municipal Solid Wastes (MSW) from Daegu City has been filled up since 1990 and 14,700,000 tons of MSW is completed to fill up. This landfill site is designed to be expanded and 9,144,710 tons of MSW is expected to be filled up from 2005 until 2026. The treatment of landfill gas from Daegu Bangcheon-Ri Landfill site has been managed as reducing to Green House Ga s(GHG) and the 'simple on-site treatment' to prevent odour, air pollution and fire before operation of this project.

In addition, to reduce methane otherwise which may be released to atmosphere, vertical collection gas pipes and refinery facility are going to be installed. Daegu Bangcheon-Ri Landfill gas CDM Project is the project which captures and refines LFG and refined LFG is supplied to Korea District Heating Corp. to produce thermal energy. Produced thermal energy utilizing LFG is supplied to users.

1.3. Real Project Implementation

Daegu Bangcheon-Ri Landfill

1.4. Changes against the PDD

This monitoring report is changed against the PDD about The location of 10 simple burning systems and AF(Adjustment Factor) 14.79% to 5.02%.(see Chapter 2.2.3 in detail)

1.5. Monitoring Period

The Monitoring Period is from 19th Aug. 2007 to 31th Mar. 2008.

1.6. Methodology applied to the Project Activity(incl. version No.)

1.6.1. Baseline Methodology

The baseline applied to this project activity is ACM0001 – version 05 ; "Consolidated baseline methodology for landfill gas project activities".

1.6.2. Monitoring Methodology

The Monitoring Methodology applied to this project activity is ACM0001 – version 05 ; "Consolidated baseline methodology for landfill gas project activities".

1.7. Changes since last Verification

Not applicable, since it's the 1st Verification.

1.8. Person responsible for the preparation and submission of the Monitoring Report

This Monitoring Report was developed and revised by ;

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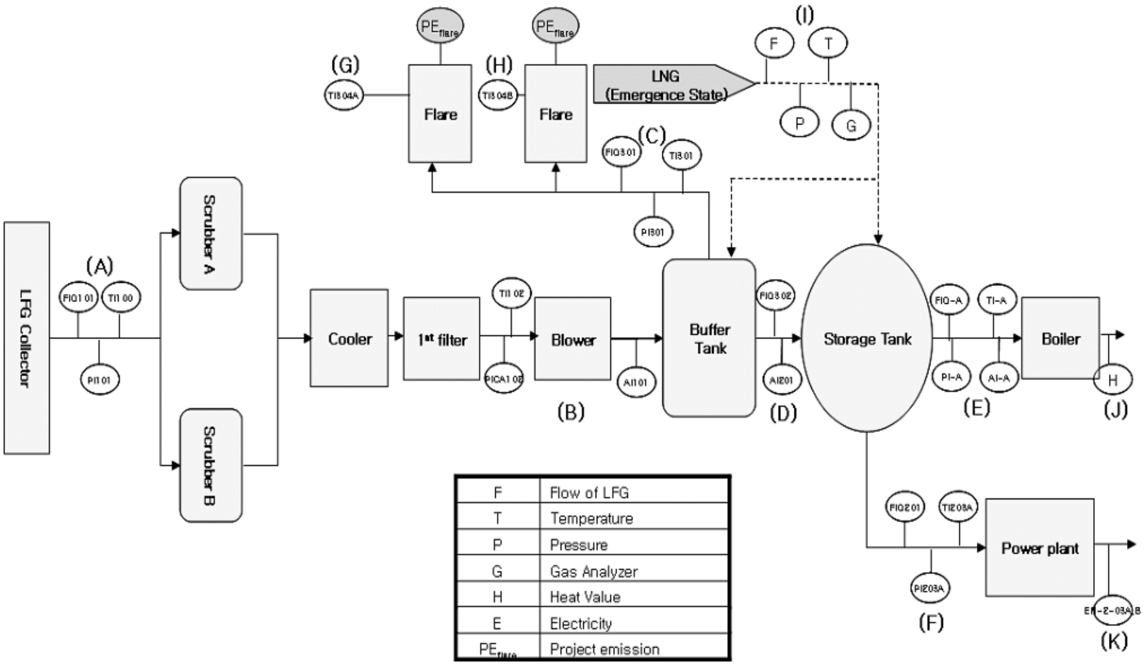
2. Key Monitoring Activities according to the plan for the monitoring period stated in 1.5.

2.1. Monitoring Equipment

The following equipment are used to monitor the operation of the project and to monitor the emission reduction.



Link	Tag No.	Description
(A)	FIQ101	Flow meter, the line that is from the LFG Collector to the Scrubber
	TI101	Temperature transmeter, the line that is from the LFG Collector to the Scrubber
	PI101	Pressure transmeter, the line that is from the LFG Collector to the Scrubber
(B)	TI102	Temperature transmeter, the line that is from the 1st filter to the Blower
	PICA102(PI102)	Pressure transmeter, the line that is from the 1st filter to the Blower
	AI101	Gas analyzer, the line that is from the Blower to the Buffer tank
(C)	FIQ301	Flow meter, the line that is from the Buffer tank to the Flare

(C)	TI301	Temperature transmeter, the line that is from the Buffer tank to the Flare
	PI301	Pressure transmeter, the line that is from the Buffer tank to the Flare
(D)	FIQ302	Flow meter, the line that is from the Buffer tank to the Storage tank
	AI201	Gas analyzer, the line that is from the Buffer tank to the Storage tank
(E)	FIQ-A	Flow meter, the line that is from the Storage tank to the Boiler
	TI-A	Temperature transmeter, the line that is from the Storage tank to the Boiler
	PI-A	Pressure transmeter, the line that is from the Storage tank to the Boiler
	AI-A	Gas analyzer, the line that is from the Storage tank to the Boiler
(F)	FIQ201	Flow meter, the line that is from the Storage tank to the Power plant
	TI203A	Temperature transmeter, the line that is from the Storage tank to the Power plant
	PI203A	Pressure transmeter, the line that is from the Storage tank to the Power plant
(G)	TI304A	Temperature transmeter, the line that is from the Flare
(H)	TI304B	Temperature transmeter, the line that is from the Flare
(I)	F	Flow meter, the line that is from the LNG supplier to the Storage tank
	T	Pressure transmeter, the line that is from the LNG supplier to the Storage tank
	P	Pressure transmeter, the line that is from the LNG supplier to the Storage tank
	G	Gas analyzer, the line that is from the LNG supplier to the Storage tank
(J)	H	Heating value
(K)	EN-2-03A, B	Electricity from the Power plant

2.1.1. Temperature Transmeter

- specification : bimetal
- structure : water proof
- accuracy : ± 0.5%
- type : any angle
- cover material : STS 304
- cover dia.(outsize) : 6.4mm O.D.
- type of process connection : KS 10K FF FLANGE(1 1/2”)

2.1.2. Pressure Transmeter

- specification : diaphragm
- pressure use : -0.5~0kg/cm^2
- material(body/element) : STS 304/STS 316)

- type of process connection : 1/2” PT
- case size : 100mm
- etc. : oil fill, blow-out hole

2.1.3. Flow Meter

- specification : vortex flowmeter
- output signal : 4~20Ma
- accuracy : ± 0.5%
- power : DC 24V
- material(body/element) : STS 304/STS 316)

2.1.4. Gas Analyzer

- specification : infrared analyzer
- ambient temperature : -5℃ to 45℃
- ambient humidity : 90% RH max., non-condensing
- repeatability : ± 0.5% of fullscale
- measurable gas components and measuring range :

	Minimum range	Maximum range
CO_2	0 ~ 500 ppm	0 ~ 100vol%
CH_4	0 ~ 1000 ppm	0 ~ 100 vol%
O_2 (built-in paramagnet)	0 ~ 5 vol%	0 ~ 100 vol%

	
Temperature transmeter	Pressure transmeter

	
Flow meter(Vortex Flow Meter)	Flow meter(Turbine Meter)
	
Flow meter(Rotary Meter)	Gas analyzer

2.2. Data Collection(accumulated for the period of 7 months)

This project is registered in 19th. Aug. 2007., we collected the data in the points of measurement during 20th. Aug. 2007. ~ 31th Mar. 2008.(the period of 7 months)

2.2.1. Collected Data 1

	LFG total, y (Nm^3)	**T_1 (℃)**	**LFG flare, y (Nm^3)**	**Fv $_{CH4,R.G,h}$ (%)**	**$w_{CH4,y}$1 (m^3CH_4/m^3 LFG)**	**LFG thermal, y (Nm^3)**	**FV $_{R.G,h}$ (m^3/h)**	**$w_{CH4,y}$2 (m^3CH_4/m^3 LFG)**	**LFG electricity, y(Nm^3)**	**T_2 (℃)**	**T_3 (℃)**	**EL_{IMP} (MWh)**	**KEPCO (MWh)**
TAG No.	FIQ-101	TI-102	FIQ-301	AI-201	AI-101	FIQ-A	FIQ-301	AI-A	FIQ-201	TI-304A	TI-304B	EN-2-03A	
2007/8	708,192	21	40,265	54	54	656,552	40,265	56	7,354	243	74	3	382
2007/9	4,345,192	13	0	52	52	4,227,080	0	52	77,479	258	58	625	6,450
2007/10	4,373,858	12	988	52	52	4,277,020	988	52	65,647	64	20	66	957
2007/11	4,614,474	12	0	52	52	4,639,840	0	52	0	22	19	0	1,044
2007/12	5,119,384	12	0	51	51	5,131,560	0	51	0	22	19	0	1,095
2008/01	5,084,788	11	0	51	51	5,098,532	0	51	0	22	19	0	1,090
2008/02	4,714,592	10	0	51	50	4,756,824	0	50	0	22	19	0	1,083
2008/03	4,910,284	10	0	49	49	4,846,840	0	50	0	22	19	2,422	1,059

2.2.2. Related the Formulas

(1) $ER_y=(MD_{project,y} - MD_{reg,y}) * GWP_{CH4}+EL_y *CEF_{electricity,y} - ET_y * CEF_{thermal,y}$

→ $ER_y=(MD_{project,y} - MD_{reg,y}) * GWP_{CH4}-leakage$

ER_y	Emission Reduction, in tones of CO_2 equivalents(tCO_2e)
$MD_{project,y}$	The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH4)
$MD_{reg,y}$	The amount of methane that would have been destroyed/combusted during the year in the absence of the project, in tonnes of methane (tCH4)
GWP_{CH4}	Global Warming Portential of Methane during the first period : 21 tCO_2e/tCH_4
EL_y	net quantity of electricity exported during year y, in megawatt hours (MWh)
$CEF_{electricity,y}$	CO2 emissions intensity of the electricity displaced, in tCO2e/MWh. This can estimated using either ACM0002 or AMSI.D, if the capacity is within the small scale threshold values, when grid electricity is used or displaced, or AMS-I.A if captive electricity is used or displaced
ET_y	Incremental quantity of fossil fuel, defined as difference of fossil fuel used in the baseline and fossil use during project, for energy requirement on site under project activity during the year y, in TJ
$CEF_{themal,y}$	CO2 emissions intensity of the fuel used to generate thermal/mechanical energy, in tCO2e/TJ

(2) $MD_{project,y}=MD_{flared,y}+ MD_{electricity,y}+ MD_{thermal,y}$

$MD_{flared,y}$	the quantity of methane destroyed by flaring
$MD_{electricity,y}$	the quantity of methane destroyed by generation of electricity
$MD_{thermal,y}$	the quantity of methane destroyed for the generation of thermal energy

(3) $MD_{flared,y}=(LFG_{flared,y}*w_{CH4,y}*D_{CH4})-(PE_{flared,y}/GWP_{CH4})$

$LFG_{flared,y}$	Amount of landfill gas flared, Nm^3
$w_{CH4,y}$	Methane fraction in the landfill gas, m^3CH_4/ m^3LFG
D_{CH4}	the methane density expressed in tonnes of methane per cubic meter of methane (tCH4/m3CH4) (at standard temperature and pressure, the density of methane, 0.0007168 $tCH_4 / m^3 CH_4$
$PE_{flared,y}$	Project emissions from flaring of the residual gas stream in year y
GWP_{CH4}	Global Warming Portential of Methane during the first period : 21 tCO_2e/tCH_4

(4) $MD_{electricity,y}=LFG_{electricity,y}*w_{CH4,y}*D_{CH4}$

$LFG_{electricity,y}$	Amount of landfill gas combusted in power plant, Nm^3

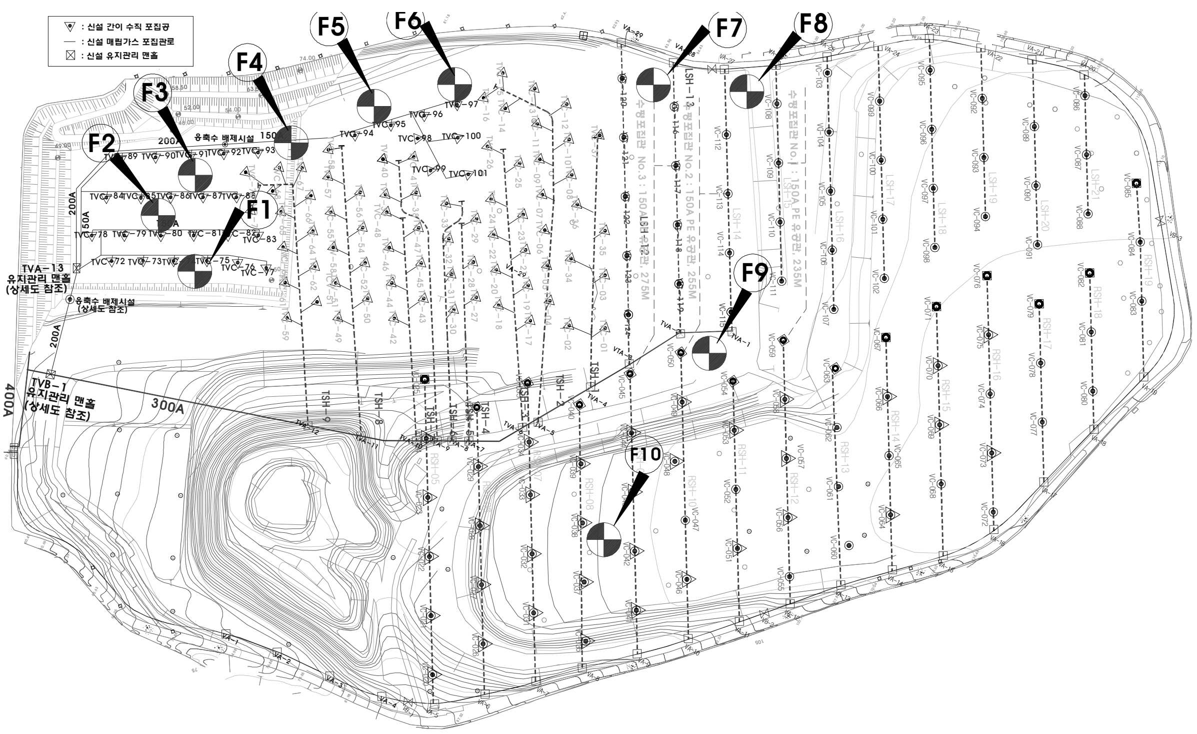
(5) $MD_{thermal,y}=LFG_{thermal,y}*w_{CH4,y}*D_{CH4}$

$LFG_{thermal,y}$	Amount of landfill gas combusted in boiler, Nm^3

2.2.3. Adjustment Factor(AF)

AF applied for estimation of emission reductions in the PDD is ex-ante value and AF will be calculated again in the monitoring process and calculated value will be applied for certifying emission reductions. Simple burning system was used before the project activity but it is not used to treat LFG anymore. However, to calculate AF, 10 simple burning facilities is established for measuring amount of methane captured by simple burning facility and total number of simple burning facilities applied to calculate AF i assumed as 41 which is number of simple burning facilities before the project activity and applied for calculating ex-ante AF. LFG captured and methane fraction of LFG of 10 simple burning facilities is measured quarterly for the first crediting period using portable measuring equipment which has similar capability with the equipment applied for measuring the value for calculation of ex-ante AF. 10 simple burning facilities locate evenly in the landfill site which is under filling-up and the landfill site in which filling-up is completed. Also, the point which is rarely influenced by capturing LFG by blower is selected as the location of 10 simple burning facilities and establishment depth of simple burning facility is averagely 2 to 2.5m under the ground. Additionally, measurement is performed 3 times during a day because the temperature is high and gas emission is quite active at that time during a day. It is measured over 3 times each a simple burning facility.

2.2.4. Location of the 10 simple burning system



2.2.5. Collected Data 2

- the first measurement(29th, Nov. 2007)

Fn	CH_4(vol. %)	CO_2(vol. %)	O_2(vol. %)	Temp. (℃)	Pres. (mbar)	Normalized vol. (L/min.)	
						LFG	CH_4
F1	21.8	21.4	7.2	16.9	1010.0	10.9	2.4
F2	58.0	44.9	0.0	18.6	1011.0	97.4	54.8
F3	49.0	40.5	1.1	20.7	1010.3	89.2	43.0
F4	67.0	45.3	0.0	18.8	1009.3	93.6	55.8
F5	0.0	0.0	20.4	16.1	1008.3	43.4	0.0
F6	0.1	2.5	17.0	18.0	1008.7	14.4	0.0
F7	3.2	4.3	16.8	16.7	1008.0	47.0	0.8
F8	55.7	42.7	0.2	18.3	1007.3	100.3	56.0
F9	53.6	43.6	0.6	20.2	1006.7	328.4	174.0
F10	33.9	25.1	3.1	24.0	1005.3	189.9	64.3

- the second measurement (19th, Feb. 2008)

Fn	CH_4(vol. %)	CO_2(vol. %)	O_2(vol. %)	Temp. (℃)	Pres. (mbar)	Normalized vol. (L/min.)	
						LFG	CH_4
F1	51.1	40.3	0.1	13.0	1011.7	323.7	165.2
F2	65.0	44.7	0.0	9.6	1009.7	382.3	226.6
F3	0.0	0.03	19.7	7.6	1009.0	183.5	0.0
F4	0.0	0.0	20.0	8.4	1008.7	48.4	0.0
F5	22.6	28.1	1.4	14.2	1007.7	120.2	29.7
F6	0.5	8.4	7.3	12.1	1006.3	183.5	0.9
F7	59.6	45.1	0.0	10.8	1011.7	152.0	86.5
F8	10.6	17.8	3.8	8.9	1011.3	14.9	1.6
F9	15.2	20.6	3.0	20.6	1008.0	906.0	138.2
F10	33.3	34.3	0.0	12.0	1007.0	209.5	67.5

2.2.6. Re-accumulated AF

<AF for Daegu Bangcheon-Ri Landfill site>

Content	Value	Unit	Comment
Average amount of captured CH4 by a simple burning system	37,651.6	CH4-Liter/EA	
Number of simple burning systems	41	EA	
Amount of treated CH4 included in LFG by simple burning system in baseline scenario	1,543,715.6	CH4-m3/yr	For conservativeness applied destruction efficiency factor is 100%
Average amount of generated LFG from 2007	115,884,309.6	LFG-m3/yr	
Average amount of generated CH4 from 2007	57,942,154.8	CH4-m3/yr	CH4 content 50% of LFG
CH4 treatment efficiency before the project (baseline scenario)	2.66%		
The lowest value of expected CH4 treatment efficiency during the first crediting period	53%		
AF	5.02%		

AF was calculated as follows

First of all, we measured twice each 3 times per once in this monitoring period. After collecting data, we have to choose more conservative AF.

Second, most important thing that in this project we have discuss, that is reasonability of data, and conservativeness of data.

So we selected ***5.02%*** as AF.

3. Quality Assuarance and Quality Control Measures

3.1. Quality Assuarance

3.1.1. training

All training was supplied before the project's implementation. The training certificates will be presented to the verification team by the time of the on-site audit.
Also the monitoring manual was supplied by ECOEYE Co., Ltd. when the project was registerd.

3.2. Quality Control Measure

All equipments are follows "the national standard basic law" article 14. Also all equipments are handed out the testing certification when they are set in the first place.

3.3. Calibration

"The national calibration organization operating law of the paragraph 2 Article 42" shall apply with The period of All equipments
The testing method of all equipments are according to the international standard, "Korea Laboratory Accreditation Scheme(KOLAS)" in the ministry of knowledge economy, Republic of Korea.

4. Calculation of GHG emission Reductions

4.1. Caculation of the main factors

4.1.1. Calculation of $MD_{thermal}$

	MDthermal	LFGthermal	WCH4	DCH4
	t CH4	Nm3	(%)	ton/Nm3
Aug-08	264	656,552	0.56	0.0007168
Sep-08	1,576	4,227,080	0.52	0.0007168
Oct-08	1,594	4,277,020	0.52	0.0007168
Nov-08	1,729	4,639,840	0.52	0.0007168
Dec-08	1,876	5,131,560	0.51	0.0007168
Jan-09	1,864	5,098,532	0.51	0.0007168
Feb-09	1,705	4,756,824	0.50	0.0007168
Mar-09	1,737	4,846,840	0.50	0.0007168
Total	12,345			

4.1.2. Calculation of $MD_{electricity}$

	MDthermal	LFGthermal	WCH4	DCH4
	t CH4	Nm3	(%)	ton/Nm3
Aug-08	3	7,354	0.56	0.0007168
Sep-08	29	77,479	0.52	0.0007168
Oct-08	24	65,647	0.52	0.0007168
Nov-08	0	0	0.52	0.0007168
Dec-08	0	0	0.51	0.0007168
Jan-09	0	0	0.51	0.0007168
Feb-09	0	0	0.50	0.0007168
Mar-09	0	0	0.50	0.0007168
Total	56			

4.1.3. Calculation of MDflared

	MDflared	LFG_{flared}	W_{CH4}	D_{CH4}	PEflared	(1- W_{CH4})	D_{CH4}
	t CH4	Nm3	(%)	ton/Nm3	Nm3	(%)	ton/Nm3
Aug-08	3.46	40,265	0.56	0.0007168	40,265	0.44	0.0007168
Sep-08	0	0	0.52	0.0007168	0	0.48	0.0007168
Oct-08	0.028	988	0.52	0.0007168	988	0.48	0.0007168
Nov-08	0	0	0.52	0.0007168	0	0.48	0.0007168
Dec-08	0	0	0.51	0.0007168	0	0.49	0.0007168
Jan-09	0	0	0.51	0.0007168	0	0.49	0.0007168
Feb-09	0	0	0.50	0.0007168	0	0.50	0.0007168
Mar-09	0	0	0.50	0.0007168	0	0.50	0.0007168
Total	*3.49*						

4.1.4. Calculation of Leakage

	$EL_{leakage}$	EL_{imp}	$FE_{EL, leakage}$
	ton CO2 eq	MWh	ton CO2 eq/MWh
Aug-08	0.2	0.3820	0.5554
Sep-08	3.6	6.4500	0.5554
Oct-08	0.5	0.9570	0.5554
Nov-08	0.6	1.0440	0.5554
Dec-08	0.6	1.0950	0.5554
Jan-09	0.6	1.0900	0.5554
Feb-09	0.6	1.0830	0.5554
Mar-09	0.6	1.0590	0.5554
Total	*7.3*		

4.1.5. Conclusion of Emission Reduction

period	ER_y(tCO2e)	=($MD_{project,y}$ - $MD_{reg,y}$) * GWP_{CH4} - leakage
Aug. 2007	5,384.4	= (270-14) * 21 - 0.2
Sep. 2007	31,998.7	= (1,604-81) * 21 - 3.6
Oct. 2007	32,285.7	= (1,619-81) * 21 - 0.5
Nov. 2007	34,494.4	= (1,729-87) * 21 - 0.6
Dec. 2007	37,416.4	= (1,876-94) * 21 - 0.6
Jan. 2008	37,175.6	= (1,864-94) * 21 - 0.6
Feb. 2008	34,003.9	= (1,705-86) * 21 – 0.6
Mar. 2008	34,647.4	= (1,737-87) * 21 - 0.6
Total	*247,406.5*	

5. Summary of the emission reductions

- Total CO2e from methane destroyed in thermal ($MD_{thermal}$) :

259,235 tonnes of CO2 equivalent

- Total CO2e from methane destroyed in flared (MD_{flared}) :

73 tonnes of CO2 equivalent

- Total CO2e from methane destroyed in electricity ($MD_{electricity}$) :

1,182 tonnes of CO2 equivalent

- Total CO2e from methane destroyed in regulatory (MD_{reg}) :

13,076.6 tonnes of CO2 equivalent

- Total CO2e from methane destroyed in thermal (leakage) :

7.3tonnes of CO2 equivalent

- Total GHG Emission Reductions in project (MDproject) :

(259,235 + 73 + 1,182) = **260,490** tonnes of CO2 equivalent

- Total Emission Reduction(ERy) :

(260,490-13,076.6)-7.3 = **247,406** tonnes of CO2 equivalent