



Monitoring report form (Version 03.0)

Monitoring report

Title of the project activity	Sudokwon Landfill Gas Electricity Generation Project (50MW)
Reference number of the project activity	0941
Version number of the monitoring report	1.0
Completion date of the monitoring report	24/12/2012
Registration date of the project activity	30/04/2007
Monitoring period number and duration of this monitoring period	7 th monitoring period (01/01/2012 – 30/06/2012)
Project participant(s)	- Sudokwon Landfill Site Management Corporation (SLC) - Rhodia Energy GHG
Host Party(ies)	Republic of Korea
Sectoral scope(s) and applied methodology(ies)	- Sectoral Scopes: 1, 13 - Applied Methodologies: •ACM0001 "Consolidated baseline methodology for landfill gas project activities" (Version 04) and, •ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", (Version 06)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	627,263 tCO ₂ e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	522,794 tCO ₂ e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Sudokwon landfill is one of the largest landfill in the world, which area is 19.79 million m² with total capacity of 228 million m³, and consists of 4 landfills. The 1st landfill was reclaimed from 1992 to 2000 and 2nd landfill has been in use for waste reclamation since 2000. The 3rd and 4th landfill will be used one after another.

About 50% of landfill gas (LFG) is composed of methane (CH₄), which is one of major greenhouse gases and has 21 times higher global warming potential (GWP) compare to carbon dioxide (CO₂). Thus, Sudokwon Landfill Gas Electricity Generation Project (50MW) was designed to minimize greenhouse gas emission by enhancing capture efficiency of LFG and utilizing it as a fuel of 50MW power plant.

For enhancing capture efficiency, lots of capturing pipelines and several LFG suction blowers were installed. The blower installation works had been finalized in 11/2007. Pipeline extension works will be continued until 2015 or more, the expected reclamation lifetime of 2nd landfill.

In order to treat LFG and generate renewable energy, renewable energy generation facility (50MW power plant) was constructed. This power plant is mainly composed of 2 boilers which generate steam and 1 steam turbine. The construction of power plant was finished in 15/12/2006 and it has been under commercial run since 15/03/2007.

This is the 7th monitoring period covering 6 months from 01/01/2012 to 30/06/2012 (182 days) and monitored emission reductions are 522,794 tCO₂e.

A.2. Location of project activity

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#58 Baekseok Dong, Seo Gu, Incheon, Republic of Korea

GPS Coordinate: Latitude 37.55000° ~ 61667°, Longitude 126.55000° ~ 666667°

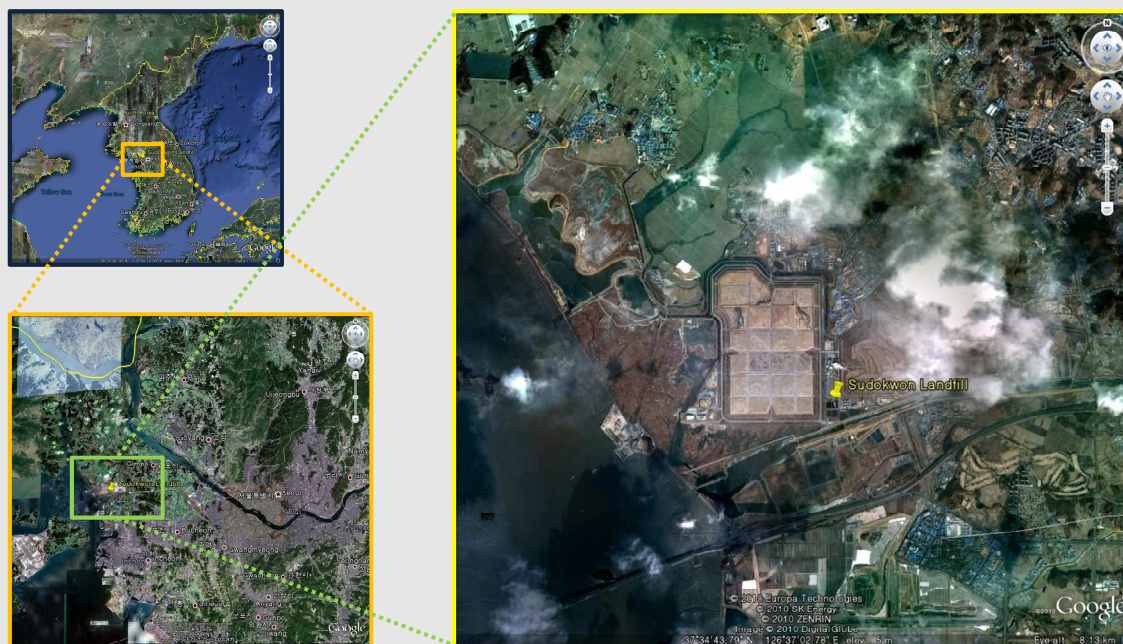


Figure 1 Location of the project activity (SLC)

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Korea (host)	Public entity Sudokwon Landfill Site Management Corporation (SLC)	No
France	Private entity Rhodia Energy GHG	No

A.4. Reference of applied methodology

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ACM0001 "Consolidated baseline methodology for landfill gas project activities" (Version 04)

http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_TX29WGSXE4781NKGQGCDPHTM2F3V3D

ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 06)

http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_BW759ID58ST5YEEV6WUCN5744MN763
A.5. Crediting period of project activity

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The start date of this project is 30/04/2007 and crediting period chosen is 10 years (fixed).

SECTION B. Implementation of project activity**B.1. Description of implemented registered project activity**

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The 50MW power plant has been under commercial run since 15/03/2007. Other facilities such as LFG blower and central flaring facility has been also under operational before the start date of crediting period (30/04/2007).



Figure 2 2nd landfill site and 50MW LFG power plant

As part of the enhancement (or expansion) of the LFG collection system, thorough inspection of LFG transferring pipes which installed in the midst of 2nd landfill were made. After the inspection, most of transferring pipes were re-installed at the top of 2nd landfill, intensively. Due to the intensive works from 2011 to 2012, amount of LFG was increased.

Detailed enhancement works are as follows;

Item	Number (ea)		Reasons for enhancement	Note
	'11.4~'11.12	'12.1~'12.6		
LFG transferring pipes re-installation	679	87	Installation of additional LFG transferring pipe for malfunctioning ones in accordance with the inspection.	
Check point installation in LFG transferring pipes	699	-	Check the operational status of LFG transferring pipes	
Flexible pipes replacement	87	288	Occurrence of pin-hole, which may cause possible influx of oxygen	

Table 1 Detailed enhancement of LFG collection system



Figure 3 Installation of check point and additional LFG transferring pipes (exposure type)

The information regarding the actual operation of the project activity in this monitoring period is as follows;

Date	Duration	Operation events	Note
01/01/2012	34 hours	Due to maintenance of #2 boiler, the output of 50MW power plant was adjusted regarding the amount of LFG(50MW ⇒ 16MW, 50MW power plant was operated at 16MW from 26/12/2011 to 02/01/2012)	
11/03/2012	264 hours	Due to maintenance of 50MW power plant, the output of 50MW power plant was adjusted regarding the amount of LFG. (50MW ⇒14MW ⇒0MW ⇒17MW ⇒15MW ⇒50MW)	
05/04/2012	364 hours	Due to problem of GCB(gas circuit breaker), 50MW power plant was stopped.	
30/04/2012	1 hour	Due to power failure of 1st & 2nd landfill blower, pressure of 50MW power plant was decreased. Other facilities were normally operated.	
07/05/2012	5.5 hours	Due to technical problem of #2 boiler, 50MW power plant was stopped.	
12/05/2012	4.5 hours	Due to power failure of LFG management centre, the output of 50MW power plant was decreased from 50MW to 17MW	
12/06/2012	158 hours	Due to periodic maintenance, 50MW power plant was stopped.	

Table 2 Operational events of 50MW power plant

Date	Duration	Operation events	Note
01/01/2012		Ordinarily operated all flares	
02/01/2012	3 hours	Due to completion of maintenance for 50MW power plant, #1, #2, #3 and #6 flare were stopped.	
26/01/2012	2 hours	Due to freeze of #4 flare pipeline, operational flare changed from	

		#4 to #3 flare.	
29/02/2012	2 hours	Due to clean of backfire arrester, operational flare changed from #3 & #5 flare to #2 & #6 flare.	
01/03/2012	1 hour	Due to clean of backfire arrester, operational flare changed from #6 flare to #5 flare.	
11/03/2012	264 hours	Due to maintenance of 50MW power plant, all flares were operated.	
22/03/2012	3 hours	Due to completion of maintenance for 50MW power plant, #1, #3, #4 and #6 flare were stopped. After this period, #2 and #5 were operated.	
05/04/2012	364 hours	Due to maintenance of 50MW power plant, all flares were operated.	
20/04/2012	2 hours	Due to operation of 50MW power plant, #2, #3, #4 and #6 was stopped. After this period, #1 and #5 were operated.	
25/05/2012	1 hour	Due to clean of backfire arrester, operational flare changed from #5 flare to #6 flare.	
25/05/2012	1 hour	Due to clean of backfire arrester, operational flare changed from #1 flare to #2 flare.	
25/05/2012	1 hours	Due to clean of backfire arrester, operational flare changed from #6 flare to #5 flare.	
12/06/2012	158 hours	Due to periodic maintenance of 50MW power plant, all flares were operated in order to treat LFG.	
12/06/2012	4 hours	Due to stop of 2 nd landfill blower, all flares were stopped.(except #5 flare).	
18/06/2012	3 hours	Due to stop of 2 nd landfill blower, all flares were stopped.(except #5 flare)	

Table 3 Operational events of central flaring facility

Date	Duration	Deviations and its reason	Corrective actions on data and its conservativeness
04/01/2012	11 hours	Due to freeze of 1 st Landfill LFG pipeline, flow meter of 1 st landfill recorded extraordinary values.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - $LFG_{1^{st}} = LFG_{50MW} + LFG_{Flare}$ - $LFG_{2^{nd}} = 0 \text{ Nm}^3$
06/01/2012	2 hours		
06/01/2012	2 hours	Due to calibration of gas analyzer, GA-01 & GA-02 did not recorded.	Most conservative value in entire 7 th monitoring period (GA-01:32.0%, GA-02:44%) applied.
09/01/2012	1 hour	Due to calibration of gas analyzer, GA-01 did not recorded.	Most conservative value in entire 7 th monitoring period (32.0%) applied. .
13/01/2012	7 hours	Due to technical problem, GA-01 recorded extraordinary values.	
14/01/2012	3 hours	Due to technical problem, GA-02 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
14/01/2012	1 hour		
15/01/2012	1 hours	Due to calibration of gas analyzer, GA-02 did not recorded.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
16/01/2012	2 hours	Due to freeze of 1st Landfill LFG pipeline, flow meter of 1 st landfill recorded extraordinary values.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - $LFG_{1^{st}} = LFG_{50MW} + LFG_{Flare}$ - $LFG_{2^{nd}} = 0 \text{ Nm}^3$
16/01/2012	1 hour	Due to calibration of gas analyzer, GA-02 did not recorded.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
17/01/2012	2 hours	Due to technical problem, GA-01 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (32.0%) applied.

19/01/2012	1 hour	Due to calibration of gas analyzer, GA-01 did not recorded.	Most conservative value in entire 7 th monitoring period (32.0%) applied.
20/01/2012	2 hours	Due to technical problem, GA-01 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (32.0%) applied.
22/01/2012	6 hours	Due to freeze of #5 flare pipeline, FT-08 recorded extraordinary values.	Theoretically conservative value(0 Nm ³ /hr) applied.
23/01/2012	3 hours	Due to freeze of #4 flare pipeline, FT-07 recorded extraordinary values.	Theoretically conservative value(0 Nm ³ /hr) applied.
23/01/2012	6 hours	Due to freeze of #5 flare pipeline, FT-08 recorded extraordinary values.	Theoretically conservative value(0 Nm ³ /hr) applied.
24/01/2012	5 hours	Due to technical problem, GA-02 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
24/01/2012	4 hours	Due to freeze of #4 flare pipeline, FT-07 recorded extraordinary values.	Theoretically conservative value(0 Nm ³ /hr) applied.
24/01/2012	6 hours	Due to freeze of #5 flare pipeline, FT-08 recorded extraordinary values	Theoretically conservative value(0 Nm ³ /hr) applied.
25/01/2012	1 hour	Due to technical problem, GA-02 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
27/01/2012	1 hour	Due to calibration of gas analyzer, GA-02 did not recorded.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
29/01/2012	1 hour	Due to freeze of 1st Landfill LFG pipeline, flow meter of 1 st landfill recorded extraordinary values.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - LFG_1 st = LFG_50MW + LFG_Flare - LFG_2 nd = 0 Nm ³
30/01/2012	1 hour	Due to maintenance of board of flow meter (FT-10), LFG flow of 50MW power plant was not recorded.	Theoretically conservative value(0 Nm ³ /hr) applied.
31/01/2012	3 hours	Due to technical problem, GA-01 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (32.0%) applied.
01/02/2012	1 hour	Due to freeze of 1st Landfill LFG pipeline, flow meter of 1st landfill recorded extraordinary values.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - LFG_1 st = LFG_50MW + LFG_Flare - LFG_2 nd = 0 Nm ³
02/02/2012	6 hours		
03/02/2012	6 hours		
06/02/2012	1 hour	Due to program error of monitoring system, FT-01, FT-02, FT-06 and FT-08 did not recorded.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - LFG_1 st = LFG_50MW + LFG_Flare - LFG_2 nd = 0 Nm ³ - LFG_flare_#3 and #6 = 0 Nm ³
07/02/2012	2 hours	Due to technical problem, GA-02 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
10/02/2012	8 hours	Due to change of gas cylinder, GA-01 recorded extraordinary values.	Most conservative value in entire 7 th monitoring period (32.0%) applied.
17/02/2012	1 hour	Due to calibration of gas analyzer, GA-01 did not recorded.	Most conservative value in entire 7 th monitoring period (32.0%) applied.
17/02/2012	1 hour	Due to calibration of gas analyzer, GA-02 did not recorded.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
09/03/2012	8 hours	Due to freeze of flow meter, FT-01 recorded extraordinary values.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep

09/03/2012	1 hour		conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - LFG_1 st = LFG_50MW + LFG_Flare - LFG_2 nd = 0 Nm ³
20/03/2012	1 hour	Due to maintenance of LFG inlet line, GA-02 recorded extraordinary value.	Most conservative value in entire 7 th monitoring period (44.0%) applied.
30/03/2012	1 hour	Due to problem of monitoring system, GA-01, GA-02, FT-01, FT-02, TC-02 and TC-05 were not recorded.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - LFG_1 st = LFG_50MW + LFG_Flare - LFG_2 nd = 0 Nm ³ - GA-01 = 32.0% - TC-02 & TC-05 = 0°C
03/04/2012	1 hour	Due to freeze of flow meter, FT-01 recorded extraordinary values.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - LFG_1 st = LFG_50MW + LFG_Flare - LFG_2 nd = 0 Nm ³
03/04/2012	2 hours		
11/04/2012	5 hours		
15/04/2012	1 hour		
15/04/2012	8 hours		
16/04/2012	2 hours		
12/05/2012	4 hours	Due to shut-down of 2nd landfill blower facility, FT-02 did not recorded	For LFG flow, following equation used to calculate; - LFG_2 nd = LFG_50MW - LFG_Flare = LFG_1 st = 0 Nm ³
13/05/2012	4 hours	Due to technical problem of flow meter, FT-01 recorded extraordinary values.	Applied conservative methane fraction, following equation used to calculate LFG flow in order to keep conservative approach(CH ₄ fraction of 1st landfill LFG was lower than that of 2nd landfill); - LFG_1 st = LFG_50MW + LFG_Flare - LFG_2 nd = 0 Nm ³
14/05/2012	6 hours		
23/05/2012	2 hours		
23/05/2012	2 hours		
21/06/2012	2 hours	Due to calibration of gas analyzer, GA-01 was decreased.	Most conservative value in entire 7 th monitoring period (32.0%) applied.

Table 4 Operational events of monitoring system and corrective actions

B.2. Post registration changes**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

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Not applicable

B.2.2. Corrections

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All facilities were already installed and fully operational as per PDD description except the 9.88MW power plant. It had not been operated since 03/2007 due to the technical problem. Therefore, the rest of LFG which is not treated in 50MW power plant was destroyed by central flaring facility only.

Regarding the stoppage of 9.88MW power plant, the request for review was made by CDM Executive Board during 1st request for issuance. In accordance with the request for review of CDM Executive Board, emissions from the electricity generated by the existing 9.88MW power plant are regarded as baseline emissions and therefore should deducted from emission reductions generated by the project activity.

For conservativeness, maximum theoretical output of 9.88MW power plant (78,760MWh/yr or 215.79MWh/day, approx. 91% of total capacity) has been chosen for additional baseline emission calculation. Since this monitoring period is 1 year (182 days), total of 22,253 tCO₂ (215.79MWh × 182 days × 0.5666tCO₂/MWh) is deducted from emission reductions.

The request was raised in 18/02/2010. Joint response from SLC & DOE (TÜV-SÜD) was made in 05/03/2010 and approved on 53th EB meeting. Related documents are available on the UNFCCC website.

Issuance Request for Review

<http://cdm.unfccc.int/Projects/DB/DNV-CUK1171534717.86/iProcess/TUEV-SUED1208270995.94/Review/PTFL27IU6U3QJIMC9WF8MZSN4F0HM7/display>

Joint response from project participant and DOE

<http://cdm.unfccc.int/UserManagement/FileStorage/CSVDHT7LAQW60Z8B5MKI4YN9RFPO2G>

Paragraph 83 (d) of CDM EB meeting report

<http://cdm.unfccc.int/EB/053/eb53rep.pdf>

B.2.3. Permanent changes from registered monitoring plan or applied methodology

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Not applicable

B.2.4. Changes to project design of registered project activity

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Not applicable

B.2.5. Changes to start date of crediting period

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According to the PDD, the crediting period started the 01/04/2007 for a period of 10 years. In accordance with the Conference of the Parties decision 17/CP.7, however, the start date of the crediting period has been changed to the date of registration, 30/04/2007.

B.2.6. Types of changes specific to afforestation or reforestation project activity

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Not applicable

SECTION C. Description of monitoring system

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Data Collection Procedures

Monitoring and emission reductions calculation are made in accordance with monitoring plan in PDD, internal data handling procedure as well as approved methodologies.

All continuously measured parameters (flow and CH₄ fraction of LFG, flaring temperature, amount of exported & imported electricity, etc.) were recorded electronically via a data logger such as Citect MMI and Honeywell Hyperion DCS, which have the capacity to aggregate and print collected data at fixed frequencies.

The data are measured and collected at each control system of the 50MW power plant, central flaring facility and internal electricity monitoring system. Data aggregation and emission reductions calculation has been

made on a daily basis. The result of calculation is reported monthly and raw data are archived every two months. In order to inspect the status of capturing facility, composition, flow, pressure and temperature of each capturing facility checked on daily basis. Gas flow and other related parameters are recorded electronically on hourly basis. Every recorded electronic data are also recorded in handwritten form.



Figure 4 The control room of 50MW power plant

LFG flow

Total of 9 continuous flow meters were installed for monitoring LFG flow. Captured LFG is monitored by FT-01 & FT-02, which installed at the end of the 1st and 2nd landfill gas recovery line respectively. Combusted LFG is checked by FT-04 ~ 10, where FT-04 ~ 09 is for each flare (total of 6) and FT-10 is for 50MW power plant. Several temperature and pressure meters were also installed in order to check the system stability and (or) to convert unit from ACM (Actual Cubic Meter) to NCM (Normal Cubic Meter).

Related meters

ID	Serial Number	Manufacturer	Description	Remarks
FT-01	27051601	EPI	1 st landfill	Thermal mass type
FT-02	9C03490109D	Endress Hauser	2 nd landfill	V-cone type
FT-04	28031701	EPI	#1 flare	Thermal mass type
FT-05	28012903	EPI	#2 flare	
FT-06	28042402	EPI	#3 flare	
FT-07	28042401	EPI	#4 flare	
FT-08	28012904	EPI	#5 flare	
FT-09	28031702	EPI	#6 flare	
FT-10	465	GE Panametrics	50MW power plant	Ultrasonic type
900A (Reserve)	26050201	EPI	Reserve meter for all EPI meters	Thermal mass type
TT-02	WS1025016	WISE	Temperature of LFG captured from 2 nd landfill	For system stability check and (or) unit conversion from ACM(Actual Cubic Meter) to NCM(Normal Cubic Meter), if needed
TT-03	A6B3331T	Fuji Electronics	Temperature of LFG which fed to 50MW power plant(reserve)	
TT-10	WS1025017	WISE	Temperature of LFG which fed to 50MW power plant	
PT-02	3940244	AUTROL	Pressure of LFG captured from 2 nd landfill	
PT-05	A4J4159T	Fuji Electronics	Pressure of LFG which fed to 50MW power plant(reserve)	

PT-10	WS1025015	WISE	Pressure of LFG which fed to 50MW power plant	
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CH₄ fraction
The fraction of CH₄ in LFG was measured by using continuous NDIR type infrared gas analyzers (total of 2). Data were recorded every hour in electronic method. Only CH₄ is considered as GHG emission in the CDM monitoring procedure.

Related meters

ID	Serial Number	Manufacturer	Description	Remarks
GA-01	A2B4359T	Fuji Electronics	1 st landfill	
GA-02	A4J0063T	Fuji Electronics	2 nd landfill	

Electricity exported & imported
The amount of imported electricity which used for LFG capturing and flaring was recorded electronically by internal electricity surveillance system of SLC. Imported electricity for 50MW power plant was monitored by watt-hour meter which managed and monthly invoiced by Korea Electric Power Corporation (KEPCO).

EL_{EX,LPG}, mentioned in PDD B.7.1 as total amount of electricity exported out of the project boundary, is a typing error of EL_{EX,LFG}. The amount of exported electricity was recorded electronically by watt-hour meter which is connected to Korea Power Exchange (KPX) and cross-checked by relative documents from KPX.

Related meters

ID	Serial Number	Manufacturer	Description	Remarks
WH-01	PR-0411A055-02	Seochang Electric Communication	Exported electricity (50MW power plant)	Cross-checked with KPX document
WH-03	6063941	Seochang Electric Communication	Imported electricity (50MW power plant)	
WH-05	1104001	NEOPIS	Imported electricity (2 nd landfill blower facility)	
WH-06	10JAJ073(24)	DIK	Imported electricity (LFG mgt. centre)	

Flare efficiency
Applied methodology ACM0001 (Version 04) stipulates that efficiency of flare (FE) shall be measured in a yearly basis if enclosed flare is used and in case the yearly measurement of FE is not performed, default value of 90% should be used.
Considering the operational condition, the content analysis of each flare's exhaust gas was conducted by 3rd party (Institute of Industrial Pollution Co. Ltd) in 19/03/2012 and 18/06/2012.

	Date of analysis	Result of analysis(ppm CH ₄)	FE application over 600°C
#1 Flare	19/03/2012 (at 599°C)	1.4	99.9%
	18/06/2012 (at 603°C)	1.7	
#2 Flare	19/03/2012 (at 602°C)	3.1	99.9%
	18/06/2012 (at 601°C)	8.4	
#3 Flare	19/03/2012 (at 603°C)	1.8	99.9%
	18/06/2012 (at 600°C)	3.3	
#4 Flare	19/03/2012 (at 600°C)	7.9	99.9%
	18/06/2012 (at 603°C)	13.1	
#5 Flare	19/03/2012 (at 599°C)	2.3	99.9%
	18/06/2012 (at 599°C)	2.1	
#6 Flare	19/03/2012 (at 601°C)	0.4	99.9%
	18/06/2012 (at 602°C)	3.1	

Table 5 Summary of flare exhaust gas analysis results

In ACM0001 (Version 04), FE should be calculated by analyzing methane contents of the flare emissions at least on a yearly basis for enclosed flares. Considering the frequency stipulated in methodology, above FEs are appropriately applied. Furthermore, as explained earlier, FE of 0% applied when the temperature is below 600°C even the above results provide that there were no methane at 600°C of flaring temperature and this is conservative approach.

Related meters

ID	Serial Number	Manufacturer	Description	Remarks
TC-01	07014281	Wise	Flaring temperature of #1 flare	
TC-02	07014283	Wise	Flaring temperature of #2 flare	
TC-03	07014280	Wise	Flaring temperature of #3 flare	
TC-04	07014282	Wise	Flaring temperature of #4 flare	
TC-05	07014284	Wise	Flaring temperature of #5 flare	
TC-06	07014285	Wise	Flaring temperature of #6 flare	

Calibration of meters

All meters were calibrated by authorized 3rd party or manufacturer. In case the calibration was made after the required calibration frequency, paragraph 238 of "Clean Development Mechanism Validation and Verification Standard (Version 02.0)" was applied during the corresponding period. Detailed information is as follows;

ID	Date of Last Calibration	Calibration Due Date	Remarks
FT-01	09/12/2011	09/12/2012	
FT-02	26/09/2011	26/09/2012	
FT-04	09/12/2011	09/12/2012	
FT-05	09/12/2011	09/12/2012	
FT-06	09/12/2011	09/12/2012	
FT-07	09/12/2011	09/12/2012	
FT-08	29/09/2011	29/09/2012	
FT-09	09/12/2011	09/12/2012	
FT-10	07/10/2011	07/10/2012	
900A	29/09/2011	29/09/2012	
GA-01	14/11/2011	14/11/2012	
GA-02	14/11/2011	14/11/2012	
TT-02	20/09/2011	20/09/2012	
TT-03	24/10/2011	24/10/2012	
TT-10	24/10/2011	24/10/2012	
PT-02	26/09/2011	26/09/2012	
PT-05	27/10/2011	27/10/2012	
WH-01	28/06/2010	28/12/2013	
WH-03	17/08/2006	17/08/2013	
WH-05	07/04/2011	07/04/2018	
WH-06	05/04/2011	05/04/2018	
TC-01	20/09/2011	20/09/2012	
TC-02	20/09/2011	20/09/2012	
TC-03	21/10/2011	21/10/2012	
TC-04	21/10/2011	21/10/2012	
TC-05	20/09/2011	20/09/2012	
TC-06	21/10/2011	21/10/2012	

Fossil fuel usage

The purchased amount of LPG, which evidenced by invoices from 2010 to 2012, was regarded as LPG usage.

Data Management

The accumulated data from control station was analyzed for the verification of this project. All required guides

were stated in SLC's internal procedure. These include data handling protocol and monitoring procedure, etc.

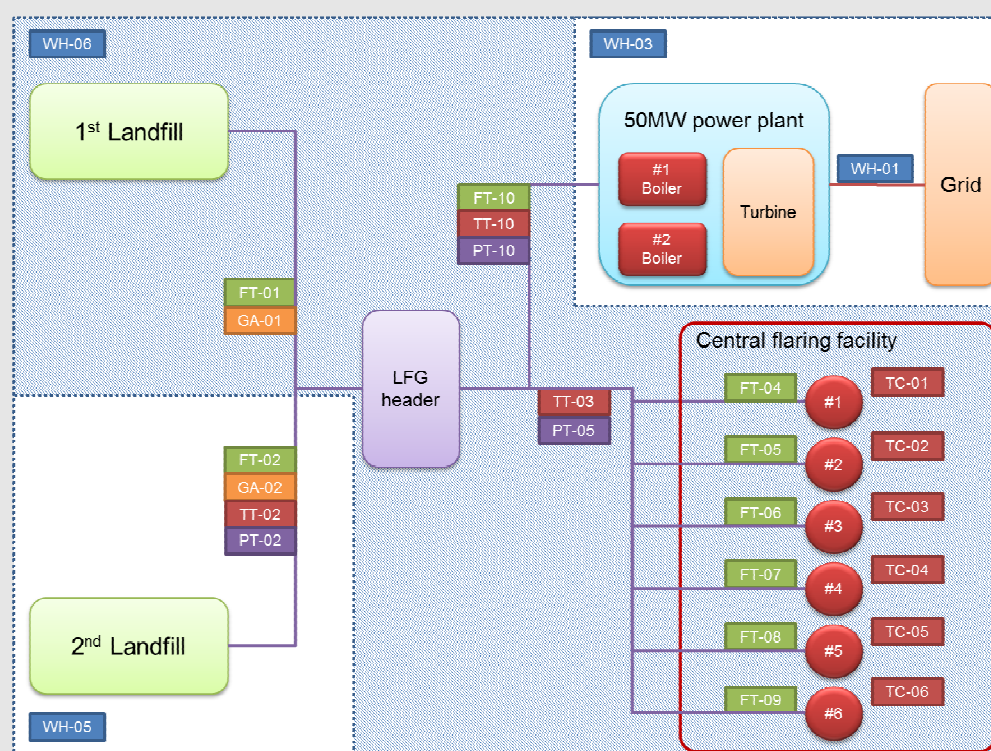


Figure 5 Line Diagram of Monitoring Points

Organizational Structure

SLC is responsible for all CDM monitoring related works. It supervises the private operator of 50MW power plant, Ecoenergy, which also commissioned to operate central flaring facility and LFG capturing system of 1st and 2nd landfill from SLC.

Ecoenergy is responsible for operation of 50MW power plant, central flaring facility and LFG capturing system of 1st and 2nd landfill.

Roles and Responsibilities of Personnel

Organization	Department	Position	Name	Roles
SLC	President		Chunkoo Cho	Approval of monthly calculation result & monitoring report
	Executive Director (Project Development)		Chongsik Shin	Approval calculation result & monitoring report (1/1/2011~04/03/2012)
			Nakbin Kim	Approval calculation result & monitoring report (05/03/2012~)
	Climate Change Business Division	General Manager	SooSung Song	Approval calculation result & monitoring report (1/1/2011~20/02/2012)
			Jongwan Kim	Approval calculation result & monitoring report(21/02/2012~)
		Manager	Laebong Han	Approval of daily calculation result & supervision of facility management
		Staff	Seongmin Park	Data analysis, calculation & arrangement of monitoring report (1/1/2011~19/08/2012)

Ecoenergy			Wongu Hwang	Data analysis, calculation & arrangement of monitoring report (20/08/2012~)
		Staff	Hyunseong Shin	Data aggregation & facility management
	CEO		DongIl Cho	Management & operation of 50MW power plant & central flaring facility
	Power Generation Div.	Team manager	Kyungyong Song	Management & operation of 50MW power plant
	Facility Management Centre	Part manager	Yongmin Kim	Management & operation of central flaring facility

Table 6 Major responsible personnel and its rules

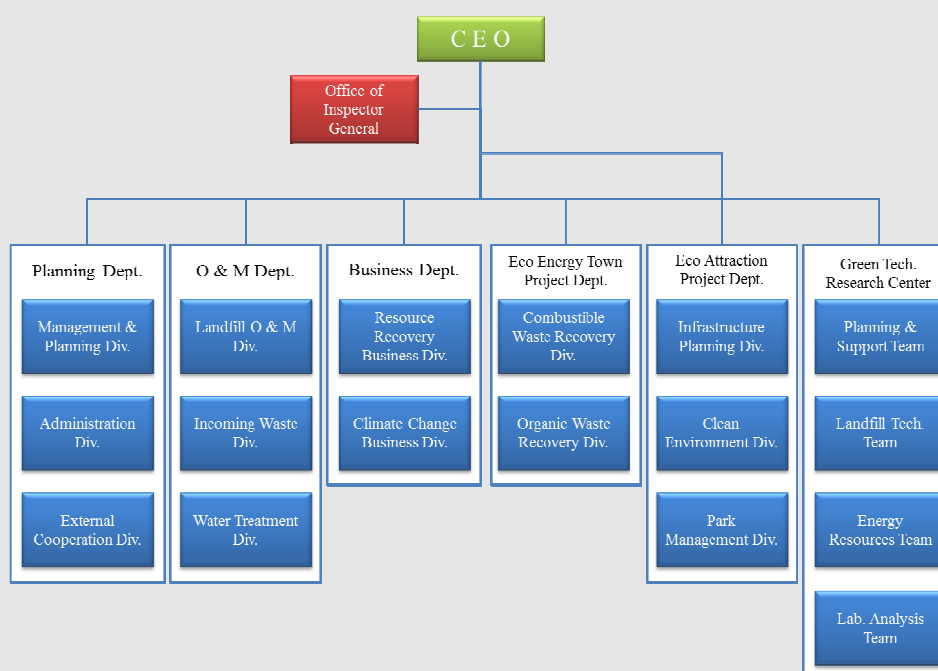


Figure 6 Organization Chart of SLC

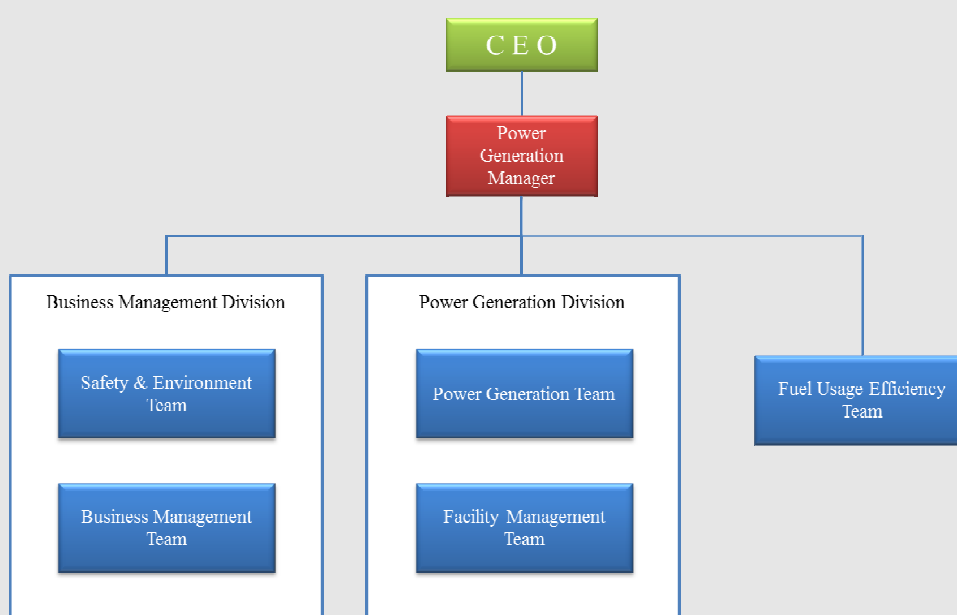


Figure 7 Organization Chart of Ecoenergy

Emergency Procedures

In order to handle emergency situations, SLC prepares internal 'Emergency Procedures', which updated every year to compensate changes of site conditions.

For emergency in 50MW power plant, Ecoenergy includes emergency plan in its 'Maintenance & Operational Plan' which also updated and reported to SLC on a yearly basis

	Fire	LFG leakage
Duty	Prevent fire expansion and extinguishing	Prevent fire and (or) explosion
Report system	Discoverer -> Managing partner -> General manager -> President	Discoverer -> General manager -> Executive Director -> President
Countermeasures	<ul style="list-style-type: none"> - Use fire extinguisher located nearby road - Stop LFG capture - Use watering cart - Use soil to prevent O₂ supply - Contact neighbouring fire station (Geom am 032-568-7119, Seo bu 032-565-8119) 	<ul style="list-style-type: none"> - Stop LFG capture - Isolate leaking part from other capturing pipeline - Isolate leaking part from flammable things - Contact neighbouring fire station (Geom am 032-568-7119, Seo bu 032-565-8119) if needed
Check frequency	Per day	Per month

Table 7 Typical emergency cases and its countermeasures

SECTION D. Data and parameters**D.1. Data and parameters fixed ex ante or at renewal of crediting period**

Data / Parameter:	GWP_{CH₄}
Unit:	tCO₂/tCH₄
Description:	Global warming potential for methane (CH ₄)
Source of data:	Default value in IPCC & ACM0001 (Version 04)
Value(s) applied:	21
Purpose of data:	Calculation of baseline emissions
Additional comment:	N/A

Data / Parameter:	AF
Unit:	%
Description:	Adjustment factor for calculating baseline emission.
Source of data:	PDD
Value(s) applied:	61.15
Purpose of data:	Calculation of baseline emissions
Additional comment:	Ex-ante calculation in accordance with ACM0001 (Version 04) for entire crediting period.

Data / Parameter:	EF
Unit:	tCO₂/MWh
Description:	Grid CO ₂ emission factor
Source of data:	PDD

Value(s) applied):	0.5666
Purpose of data:	Calculation of baseline emissions
Additional comment:	Ex-ante calculation in accordance with ACM0002 (Version 06) for entire crediting period.

Data / Parameter:	D_{CH₄}
Unit:	tCH₄/Nm³
Description:	Density of methane
Source of data:	Default value in ACM0001 (Version 04)
Value(s) applied):	0.0007168
Purpose of data:	Calculation of baseline emissions
Additional comment:	N/A

D.2. Data and parameters monitored

Data / Parameter:	LFG_{total,y}																																			
Unit:	Nm³																																			
Description:	Total amount of landfill gas captured in year y																																			
Measured/ Calculated / Default:	Measured by flow meters (total of 2)																																			
Source of data:	MMI data; The two flow meters, FT-01, 900A and FT-02 are continuously measure the captured LFG from 1 st and 2 nd landfill.																																			
Value(s) of monitored parameter:	<table><tr><td></td><td>Measured Value</td><td>Applied Value</td><td>Remarks</td></tr><tr><td>Jan 2012</td><td>31,464,734</td><td>29,655,227</td><td></td></tr><tr><td>Feb</td><td>26,750,436</td><td>26,748,435</td><td></td></tr><tr><td>Mar</td><td>28,448,349</td><td>28,437,568</td><td></td></tr><tr><td>Apr</td><td>27,721,748</td><td>27,721,748</td><td></td></tr><tr><td>May</td><td>27,494,806</td><td>27,494,806</td><td></td></tr><tr><td>Jun</td><td>26,547,310</td><td>26,547,310</td><td></td></tr><tr><td>Total</td><td>168,427,383</td><td>166,605,094</td><td></td></tr></table> <p>For measured value, please refer to the worksheet of '04_LFG' of 'SLC CDM Data Workbook Phase 7 (Raw)'.</p> <p>For applied value, please refer to the worksheet of '04_LFG' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.</p>					Measured Value	Applied Value	Remarks	Jan 2012	31,464,734	29,655,227		Feb	26,750,436	26,748,435		Mar	28,448,349	28,437,568		Apr	27,721,748	27,721,748		May	27,494,806	27,494,806		Jun	26,547,310	26,547,310		Total	168,427,383	166,605,094	
	Measured Value	Applied Value	Remarks																																	
Jan 2012	31,464,734	29,655,227																																		
Feb	26,750,436	26,748,435																																		
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May	27,494,806	27,494,806																																		
Jun	26,547,310	26,547,310																																		
Total	168,427,383	166,605,094																																		

Monitoring equipment:	Item name	FT-01
	Coverage	LFG flow of 1 st landfill from 01/01/2012 to 16/04/2012 and from 07/05/2012 to 14/05/2012 and from 21/05/2012 to 23/05/2012
	Type	Thermal mass type flow meter
	Accuracy class	±[1% RDG +(0.5%FS + 0.02%/°C)]
	Serial number	27051601
	Calibration frequency	1 year
	Date of last calibration	09/12/2011
	Validity	Valid from 09/12/2011 to 08/12/2012
	Item name	900A
	Coverage	LFG flow of 1 st landfill from 16/04/2012 to 07/05/2012 and 14/05/2012 to 21/05/2012 and from 23/05/2012 to 30/06/2012
	Type	Thermal mass type flow meter
	Accuracy class	±[1% RDG +(0.5%FS + 0.02%/°C)]
	Serial number	26050201
	Calibration frequency	1 year
	Date of last calibration	29/09/2011
	Validity	Valid from 29/09/2011 to 28/09/2012
	Item name	FT-02
	Coverage	LFG flow of 2 nd landfill
	Type	V-cone type flow meter (FT-02 was normalized temperature & pressure using TT-02 & PT-02)
	Accuracy class	±0.075%
	Serial number	9C03490109D
Calibration frequency	1 year	
Date of last calibration	26/09/2011	
Validity	Valid from 26/09/2011 to 25/09/2012	
Measuring/Reading/Recording frequency:	Continuous measuring & reading, hourly recording	
Calculation method (if applicable):	(FT-01) or (900A) + (FT-02)	
QA/QC procedures:	State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority or manufacturer	
Purpose of data:	Calculation of baseline emissions	
Additional comment:		
Data / Parameter:	LFG _{flare,y}	
Unit:	Nm ³	
Description:	Amount of landfill gas which flared in year y	
Measured/Calculated / Default:	Measured by flow meters (total of 6)	

Source of data:	MMI data; The six flow meters, FT-04 to FT-09 are continuously measure the LFG flow of each flare			
Value(s) of monitored parameter:		Measured Value	Applied Value	Remarks
	Jan 2012	8,303,262	8,170,193	
	Feb	6,723,236	6,721,235	
	Mar	11,439,197	11,428,416	
	Apr	17,432,140	17,432,140	
	May	6,434,899	6,434,899	
	Jun	10,348,604	10,348,604	
	Total	60,681,338	60,535,487	
	For measured value, please refer to the worksheet of '04_LFG' of 'SLC CDM Data Workbook Phase 7 (Raw)'. For applied value, please refer to the worksheet of '04_LFG' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.			

Monitoring equipment:	Item name	FT-04
	Coverage	LFG flow of #1 flare
	Type	Thermal mass type flow meter
	Accuracy class	$\pm[1\% \text{ RDG} + (0.5\% \text{ FS} + 0.02\% / ^\circ\text{C})]$
	Serial number	28031701
	Calibration frequency	1 year
	Date of last calibration	09/12/2011
	Validity	Valid from 09/12/2011 to 08/12/2012
	Item name	FT-05
	Coverage	LFG flow of #2 flare
	Type	Thermal mass type flow meter
	Accuracy class	$\pm[1\% \text{ RDG} + (0.5\% \text{ FS} + 0.02\% / ^\circ\text{C})]$
	Serial number	28012903
	Calibration frequency	1 year
	Date of last calibration	09/12/2011
	Validity	Valid from 09/12/2011 to 08/12/2012
	Item name	FT-06
	Coverage	LFG flow of #3 flare
	Type	Thermal mass type flow meter
	Accuracy class	$\pm[1\% \text{ RDG} + (0.5\% \text{ FS} + 0.02\% / ^\circ\text{C})]$
	Serial number	28042402
	Calibration frequency	1 year
	Date of last calibration	09/12/2011
	Validity	Valid from 09/12/2011 to 08/12/2012
	Item name	FT-07
	Coverage	LFG flow of #4 flare
	Type	Thermal mass type flow meter
	Accuracy class	$\pm[1\% \text{ RDG} + (0.5\% \text{ FS} + 0.02\% / ^\circ\text{C})]$
	Serial number	28042401
	Calibration frequency	1 year
	Date of last calibration	09/12/2011
	Validity	Valid from 09/12/2011 to 08/12/2012
	Item name	FT-08
	Coverage	LFG flow of #5 flare
	Type	Thermal mass type flow meter
	Accuracy class	$\pm[1\% \text{ RDG} + (0.5\% \text{ FS} + 0.02\% / ^\circ\text{C})]$
	Serial number	28012904
	Calibration frequency	1 year
	Date of last calibration	29/09/2011
	Validity	Valid from 29/09/2011 to 28/09/2012
	Item name	FT-09
	Coverage	LFG flow of #6 flare
	Type	Thermal mass type flow meter
	Accuracy class	$\pm[1\% \text{ RDG} + (0.5\% \text{ FS} + 0.02\% / ^\circ\text{C})]$
	Serial number	28031702
	Calibration frequency	1 year
	Date of last calibration	09/12/2011
	Validity	Valid from 09/12/2011 to 08/12/2012
Measuring/ Reading/ Recording frequency:	Continuous measuring & reading, hourly recording	
Calculation method (if applicable):	(FT-04) + (FT-05) + (FT-06) + (FT-07) + (FT-08) + (FT-09)	

QA/QC procedures:	State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority or manufacturer		
Purpose of data:	Calculation of baseline emissions		
Additional comment:			

Data / Parameter:	LFG_{electricity,y}		
Unit:	Nm³		
Description:	Amount of landfill gas which fed to 50MW power plant in year y		
Measured/ Calculated / Default:	Measured by flow meter		
Source of data:	DCS data: The flow meter, FT-10 is continuously measure the LFG flow of the 50MW power plant		
Value(s) of monitored parameter:		Measured Value	Applied Value
	Jan 2012	23,161,472	21,485,034
	Feb	20,027,200	20,027,200
	Mar	17,009,152	17,009,152
	Apr	10,289,608	10,289,608
	May	21,059,907	21,059,907
	Jun	16,198,706	16,198,706
	Total	107,746,045	106,069,607

Monitoring equipment:	Item name	FT-10
	Coverage	LFG flow of 50MW power plant
	Type	Ultrasonic type flow meter (FT-10 was normalized temperature & pressure using TT-10 & PT-10)
	Accuracy class	±1%
	Serial number	465
	Calibration frequency	1 year
	Date of last calibration	07/10/2011
	Validity	Valid from 07/10/2011 to 06/10/2012
	For measured value, please refer to the worksheet of '04_LFG' of 'SLC CDM Data Workbook Phase 7 (Raw)'. For applied value, please refer to the worksheet of '04_LFG' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.	

Measuring/ Reading/ Recording frequency:	Continuous measuring & reading, hourly recording
Calculation method (if applicable):	Not applicable
QA/QC procedures:	State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority
Purpose of data:	Calculation of baseline emissions
Additional comment:	

Data / Parameter:	$W_{CH_4,y}$																																
Unit:	% (Nm³ CH₄ / Nm³ LFG)																																
Description:	Methane fraction of LFG in year y																																
Measured/ Calculated / Default:	Measured by methane gas analyzers (total of 2)																																
Source of data:	MMI data: The methane gas analyzers, GA-01 and GA-02 are continuously measure the methane concentration of LFG from 1 st and 2 nd landfill																																
Value(s) of monitored parameter:	<table border="1"> <thead> <tr> <th></th><th>Measured Value</th><th>Applied Value</th><th>Remarks</th></tr> </thead> <tbody> <tr><td>Jan 2012</td><td>45.6</td><td>44.7</td><td></td></tr> <tr><td>Feb</td><td>46.3</td><td>46.2</td><td></td></tr> <tr><td>Mar</td><td>47.0</td><td>47.0</td><td></td></tr> <tr><td>Apr</td><td>47.3</td><td>47.2</td><td></td></tr> <tr><td>May</td><td>47.0</td><td>47.0</td><td></td></tr> <tr><td>Jun</td><td>46.5</td><td>46.5</td><td></td></tr> <tr><td>Average</td><td>46.6</td><td>46.4</td><td></td></tr> </tbody> </table> <p>For measured value, please refer to the worksheet of '05_wCH4' of 'SLC CDM Data Workbook Phase 7 (Raw)'.</p> <p>For applied value, please refer to the worksheet of '05_wCH4' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.</p>		Measured Value	Applied Value	Remarks	Jan 2012	45.6	44.7		Feb	46.3	46.2		Mar	47.0	47.0		Apr	47.3	47.2		May	47.0	47.0		Jun	46.5	46.5		Average	46.6	46.4	
	Measured Value	Applied Value	Remarks																														
Jan 2012	45.6	44.7																															
Feb	46.3	46.2																															
Mar	47.0	47.0																															
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May	47.0	47.0																															
Jun	46.5	46.5																															
Average	46.6	46.4																															
Monitoring equipment:	<table border="1"> <tr><td>Item name</td><td>GA-01</td></tr> <tr><td>Coverage</td><td>CH₄ fraction of LFG at 1st landfill from</td></tr> <tr><td>Type</td><td>Infrared gas analyser</td></tr> <tr><td>Accuracy class</td><td>Linearity: ±1% of FS Repeatability: ±0.5% of FS</td></tr> <tr><td>Serial number</td><td>A2B4359T</td></tr> <tr><td>Calibration frequency</td><td>1 year</td></tr> <tr><td>Date of last calibration</td><td>14/11/2011</td></tr> <tr><td>Validity</td><td>Valid from 14/11/2011 to 13/11/2012.</td></tr> </table> <table border="1"> <tr><td>Item name</td><td>GA-02</td></tr> <tr><td>Coverage</td><td>CH₄ fraction of LFG at 2nd landfill</td></tr> <tr><td>Type</td><td>Infrared gas analyser</td></tr> <tr><td>Accuracy class</td><td>Linearity: ±1% of FS Repeatability: ±0.5% of FS</td></tr> <tr><td>Serial number</td><td>A4J0063T</td></tr> <tr><td>Calibration frequency</td><td>1 year</td></tr> <tr><td>Date of last calibration</td><td>14/11/2011</td></tr> <tr><td>Validity</td><td>Valid from 14/11/2011 to 13/11/2012.</td></tr> </table>	Item name	GA-01	Coverage	CH ₄ fraction of LFG at 1 st landfill from	Type	Infrared gas analyser	Accuracy class	Linearity: ±1% of FS Repeatability: ±0.5% of FS	Serial number	A2B4359T	Calibration frequency	1 year	Date of last calibration	14/11/2011	Validity	Valid from 14/11/2011 to 13/11/2012.	Item name	GA-02	Coverage	CH ₄ fraction of LFG at 2 nd landfill	Type	Infrared gas analyser	Accuracy class	Linearity: ±1% of FS Repeatability: ±0.5% of FS	Serial number	A4J0063T	Calibration frequency	1 year	Date of last calibration	14/11/2011	Validity	Valid from 14/11/2011 to 13/11/2012.
Item name	GA-01																																
Coverage	CH ₄ fraction of LFG at 1 st landfill from																																
Type	Infrared gas analyser																																
Accuracy class	Linearity: ±1% of FS Repeatability: ±0.5% of FS																																
Serial number	A2B4359T																																
Calibration frequency	1 year																																
Date of last calibration	14/11/2011																																
Validity	Valid from 14/11/2011 to 13/11/2012.																																
Item name	GA-02																																
Coverage	CH ₄ fraction of LFG at 2 nd landfill																																
Type	Infrared gas analyser																																
Accuracy class	Linearity: ±1% of FS Repeatability: ±0.5% of FS																																
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Calibration frequency	1 year																																
Date of last calibration	14/11/2011																																
Validity	Valid from 14/11/2011 to 13/11/2012.																																
Measuring/ Reading/ Recording frequency:	Continuous measuring & reading, hourly recording																																
Calculation method (if applicable):	$\frac{(FT - 01) \times (GA - 01) + (FT - 02) \times (GA - 02)}{LFG_{total}}$																																

Measuring/ Reading/ Recording frequency:	Periodic analysis was made for flare exhaust gas Continuous measuring & reading, hourly recording for TC-01 to TC-06
Calculation method (if applicable):	Not applicable
QA/QC procedures:	State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority
Purpose of data:	Calculation of baseline emissions
Additional comment:	
Data / Parameter:	T
Unit:	°C
Description:	Temperature of LFG
Measured/ Calculated / Default:	Measured
Source of data:	MMI / DCS data The temperature transmitters, TT-02, 03 and TT-10 are continuously measure the temperature of LFG for the flow normalization.
Value(s) of monitored parameter:	0 ~ 67.0 For measured value, please refer to the worksheet of '08-1_T_50MW' and '08-2_T_2 nd _LF' of 'SLC CDM Data Workbook Phase 7 (Raw)'. For applied value, please refer to the worksheet of '08-1_T_50MW' and '08-2_T_2 nd _LF' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.

Monitoring equipment:	Item name	TT-02
	Coverage	Temperature of LFG captured from 2 nd landfill
	Type	PT 100Ω
	Accuracy class	±0.2%
	Serial number	WS1025016
	Calibration frequency	1 year
	Date of last calibration	20/09/2011
	Validity	Valid from 20/09/2011 to 19/09/2012
	Item name	TT-03
	Coverage	Temperature of LFG which fed to 50MW power plant(reserve)
	Type	PT 100Ω
	Accuracy class	Transmitter : ±0.1% RTD: ±0.1%
	Serial number	A6B3331T
	Calibration frequency	1 year
	Date of last calibration	24/10/2011
	Validity	Valid from 24/10/2011 to 23/10/2012
	Item name	TT-10
	Coverage	Temperature of LFG which fed to 50MW power plant
	Type	PT 100Ω
	Accuracy class	±0.2%
	Serial number	WS1025017
	Calibration frequency	1 year
	Date of last calibration	24/10/2011
	Validity	Valid from 24/10/2011 to 23/10/2012
Measuring/ Reading/ Recording frequency:	Continuous measuring & reading, hourly recording	
Calculation method (if applicable):	Not applicable	
QA/QC procedures:	State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority	
Purpose of data:	Calculation of baseline emissions	
Additional comment:		
Data / Parameter:	P	
Unit:	mmAq	
Description:	Pressure of LFG	
Measured/ Calculated / Default:	Measured	
Source of data:	MMI / DCS data The pressure transmitters, PT-02, PT-05 and PT-10 are continuously measure the pressure of LFG for the flow normalization.	

Value(s) of monitored parameter:	-1,983 ~ 909 For measured value, please refer to the worksheet of '09-1_P_50MW(reserve)' and '09-2_P_2 nd _LF' of 'SLC CDM Data Workbook Phase 7 (Raw)'. For applied value, please refer to the worksheet of '09-1_P_50MW(reserve)' and '09-2_P_2 nd _LF' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.																																																
Monitoring equipment:	<table border="1"> <tr><td>Item name</td><td>PT-02</td></tr> <tr><td>Coverage</td><td>Pressure of LFG captured from 2nd landfill</td></tr> <tr><td>Type</td><td>Smart gauge pressure transmitter</td></tr> <tr><td>Accuracy class</td><td>±0.075% at span</td></tr> <tr><td>Serial number</td><td>3940244</td></tr> <tr><td>Calibration frequency</td><td>1 year</td></tr> <tr><td>Date of last calibration</td><td>26/09/2011</td></tr> <tr><td>Validity</td><td>Valid from 26/09/2011 to 25/09/2012</td></tr> </table> <table border="1"> <tr><td>Item name</td><td>PT-05</td></tr> <tr><td>Coverage</td><td>Pressure of LFG which fed to flares(reserve)</td></tr> <tr><td>Type</td><td>Absolute pressure transmitter</td></tr> <tr><td>Accuracy class</td><td>±0.5%</td></tr> <tr><td>Serial number</td><td>A4J4159T</td></tr> <tr><td>Calibration frequency</td><td>1 year</td></tr> <tr><td>Date of last calibration</td><td>27/10/2011</td></tr> <tr><td>Validity</td><td>Valid from 12/11/2010 to 26/10/2012</td></tr> </table> <table border="1"> <tr><td>Item name</td><td>PT-10</td></tr> <tr><td>Coverage</td><td>Pressure of LFG which fed to 50MW power plant</td></tr> <tr><td>Type</td><td>Absolute pressure transmitter</td></tr> <tr><td>Accuracy class</td><td>±0.5%</td></tr> <tr><td>Serial number</td><td>WS1025015</td></tr> <tr><td>Calibration frequency</td><td>1 year</td></tr> <tr><td>Date of last calibration</td><td>27/10/2011</td></tr> <tr><td>Validity</td><td>Valid from 27/10/2011 to 26/10/2012</td></tr> </table>	Item name	PT-02	Coverage	Pressure of LFG captured from 2 nd landfill	Type	Smart gauge pressure transmitter	Accuracy class	±0.075% at span	Serial number	3940244	Calibration frequency	1 year	Date of last calibration	26/09/2011	Validity	Valid from 26/09/2011 to 25/09/2012	Item name	PT-05	Coverage	Pressure of LFG which fed to flares(reserve)	Type	Absolute pressure transmitter	Accuracy class	±0.5%	Serial number	A4J4159T	Calibration frequency	1 year	Date of last calibration	27/10/2011	Validity	Valid from 12/11/2010 to 26/10/2012	Item name	PT-10	Coverage	Pressure of LFG which fed to 50MW power plant	Type	Absolute pressure transmitter	Accuracy class	±0.5%	Serial number	WS1025015	Calibration frequency	1 year	Date of last calibration	27/10/2011	Validity	Valid from 27/10/2011 to 26/10/2012
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QA/QC procedures:	State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority																																																
Purpose of data:	Calculation of baseline emissions																																																
Additional comment:																																																	
Data / Parameter:	EL_{EX,LFG}																																																
Unit:	MWh																																																
Description:	Total amount of electricity exported out of the project boundary																																																

Measured/ Calculated / Default:	Measured																																			
Source of data:	Log sheet & KPX data The watt-hour meter, WH-01 is continuously measure the exported electricity and written in log sheet by operators																																			
Value(s) of monitored parameter:	<table border="1"> <thead> <tr> <th></th> <th>Measured Value</th> <th>Applied Value</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>Jan 2012</td> <td>33,155.4</td> <td>33,155.4</td> <td></td> </tr> <tr> <td>Feb</td> <td>31,995.5</td> <td>31,995.5</td> <td></td> </tr> <tr> <td>Mar</td> <td>26,289.8</td> <td>26,289.8</td> <td></td> </tr> <tr> <td>Apr</td> <td>16,280.2</td> <td>16,280.2</td> <td></td> </tr> <tr> <td>May</td> <td>33,551.8</td> <td>33,551.8</td> <td></td> </tr> <tr> <td>Jun</td> <td>25,600.9</td> <td>25,600.9</td> <td></td> </tr> <tr> <td>Total</td> <td>166,873.6</td> <td>166,873.6</td> <td></td> </tr> </tbody> </table> <p>For measured value, please refer to the worksheet of '06-1_EL_exp' of 'SLC CDM Data Workbook Phase 7 (Raw)'. For applied value, please refer to the worksheet of '06-1_EL_exp' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.</p>					Measured Value	Applied Value	Remarks	Jan 2012	33,155.4	33,155.4		Feb	31,995.5	31,995.5		Mar	26,289.8	26,289.8		Apr	16,280.2	16,280.2		May	33,551.8	33,551.8		Jun	25,600.9	25,600.9		Total	166,873.6	166,873.6	
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Monitoring equipment:	<table border="1"> <tr> <td>Item name</td> <td>WH-01</td> </tr> <tr> <td>Coverage</td> <td>Electricity exported from 50MW power plant</td> </tr> <tr> <td>Type</td> <td>Electronic watt-hour meter</td> </tr> <tr> <td>Accuracy class</td> <td>0.2 class</td> </tr> <tr> <td>Serial number</td> <td>PR-0411A055-02</td> </tr> <tr> <td>Calibration frequency</td> <td>3.5 ± 0.5 years (according to the Operational Directive of Korean Electricity Market controlled by KPX)</td> </tr> <tr> <td>Date of last calibration</td> <td>28/06/2010</td> </tr> <tr> <td>Validity</td> <td>Valid from 28/06/2010 to 27/12/2013</td> </tr> </table>				Item name	WH-01	Coverage	Electricity exported from 50MW power plant	Type	Electronic watt-hour meter	Accuracy class	0.2 class	Serial number	PR-0411A055-02	Calibration frequency	3.5 ± 0.5 years (according to the Operational Directive of Korean Electricity Market controlled by KPX)	Date of last calibration	28/06/2010	Validity	Valid from 28/06/2010 to 27/12/2013																
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Calculation method (if applicable):	Not applicable																																			
QA/QC procedures:	State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority																																			
Purpose of data:	Calculation of baseline emissions																																			
Additional comment:																																				
Data / Parameter:	EL_{IMP}																																			
Unit:	MWh																																			
Description:	Total amount of electricity imported to the project boundary																																			
Measured/ Calculated / Default:	Measured																																			

Source of data:	SLC's internal electricity surveillance system & KEPCO data Total of 3 watt-hour meters are installed to monitor electricity imported. WH-03 is for imported electricity in 50MW power plant. WH-05 is for LFG blower of 2 nd landfill and WH-06 is for central flaring facility.																																																			
Value(s) of monitored parameter:	<table><thead><tr><th></th><th>Measured Value</th><th>Applied Value</th><th>Remarks</th></tr></thead><tbody><tr><td>Jan 2012</td><td>461.0</td><td>461.0</td><td></td></tr><tr><td>Feb</td><td>441.4</td><td>441.4</td><td></td></tr><tr><td>Mar</td><td>494.6</td><td>494.6</td><td></td></tr><tr><td>Apr</td><td>535.7</td><td>535.7</td><td></td></tr><tr><td>May</td><td>423.8</td><td>423.8</td><td></td></tr><tr><td>Jun</td><td>433.4</td><td>433.4</td><td></td></tr><tr><td>Total</td><td>2,790.0</td><td>2,790.0</td><td></td></tr></tbody></table> <p>For measured value, please refer to the worksheet of '06-2_EL_imp_50MW', '06-3_EL_imp_LFG_mgt_centre' and '06-4_EL_imp_2nd_LF' of 'SLC CDM Data Workbook Phase 7 (Raw)'. For applied value, please refer to the worksheet of '06-2_EL_imp_50MW', '06-3_EL_imp_LFG_mgt_centre' and '06-4_EL_imp_2nd_LF' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.</p>					Measured Value	Applied Value	Remarks	Jan 2012	461.0	461.0		Feb	441.4	441.4		Mar	494.6	494.6		Apr	535.7	535.7		May	423.8	423.8		Jun	433.4	433.4		Total	2,790.0	2,790.0																	
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Measuring/ Reading/ Recording frequency:	Continuous measuring & reading, hourly recording
Calculation method (if applicable):	(WH-03) + (WH-05) + (WH-06)
QA/QC procedures:	WH-03: Under control of KEPCO WH-05 and WH-06; State-check is made by responsible staff of SLC on a daily basis Regular maintenance is made by staff of Ecoenergy Periodically calibrated by approved 3 rd party authority
Purpose of data:	Calculation of baseline emissions
Additional comment:	

Data / Parameter:	Regulatory requirements relating to landfill gas projects
Unit:	Not applicable
Description:	Regulatory requirements relating to landfill gas projects
Measured/ Calculated / Default:	Not applicable
Source of data:	Investigation of legislation by CDM monitoring staff (Lae Bong HAN)
Value(s) of monitored parameter:	Not applicable
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Annually recorded
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Not applicable
Purpose of data:	Not applicable
Additional comment:	

Data / Parameter:	Hours
Unit:	Hours
Description:	Operation of the energy plant (50MW power plant)
Measured/ Calculated / Default:	On site measurement
Source of data:	Generated (exported) amount of electricity by 50MW power plant
Value(s) of monitored parameter:	3,834

Monitoring equipment:	Same as above 'EL _{EXLFG} '
Measuring/ Reading/ Recording frequency:	Continuous measuring & reading, hourly recording
Calculation method (if applicable):	Electricity exported to grid > 0 kWh
QA/QC procedures:	Not applicable
Purpose of data:	Not applicable
Additional comment:	

Data / Parameter:	LPG
Unit:	Kg
Description:	The amount of LPG used for start-up (ignition) of 50MW power plant and each flares
Measured/ Calculated / Default:	Calculated
Source of data:	Log sheets and invoices
Value(s) of monitored parameter:	130 Kg Please refer to the worksheet of '10_PE_LPG' of 'SLC CDM Data Workbook Phase 7 (Version 1.0)'.
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Monthly recorded
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Not applicable
Purpose of data:	Calculation of project emissions
Additional comment:	

D.3. Implementation of sampling plan

>>

Not applicable

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

According to applied methodology ACM0001 (Version 04), emission reductions are calculated by following equation (page 2).

Emission Reduction

The greenhouse gas emission reduction achieved by the project activity during a given year “y” (ER_y) are estimated as follows:

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH_4} + EL_y * CEF_{electricity,y} - ET_y * CEF_{thermal,y} \quad (1)$$

where:

ER_y	is emissions reduction, in tonnes of CO ₂ equivalents (tCO ₂ e).
$MD_{project,y}$	the amount of methane that would have been destroyed/combusted during the year, in, tonnes of methane (tCH ₄)
$MD_{reg,y}$	the amount of methane that would have been destroyed/combusted during the year in the absence of the project, in, tonnes of methane (tCH ₄)
GWP_{CH_4}	Global Warming Potential value for methane for the first commitment period is 21 tCO ₂ e/tCH ₄
EL_y	net quantity of electricity exported during year y, in megawatt hours (MWh).
$CEF_{electricity,y}$	CO ₂ emissions intensity of the electricity displaced, in tCO ₂ e/MWh. This can be estimated using either ACM0002 or AMSI.D, if the capacity is within the small scale threshold values, when grid 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.
$CEF_{thermal,y}$	CO ₂ emissions intensity of the fuel used to generate thermal/mechanical energy, in tCO ₂ e/TJ

Figure 8 Emission reduction equation in ACM0001 (Version 04) (page 2)

As there are no consideration about project emissions and leakage in ACM0001 (Version 04), above equation can be used to calculate baseline emissions;

$$BE = (MD_{project} - MD_{reg}) \times GWP_{CH_4} + EL \times CEF_{electricity} + ET \times CEF_{thermal}$$

Where this project does not include thermal energy displacement and MD_{reg} is calculated by AF (Adjustment factor), above equation can be simplified as below, which could be divided into two steps, baseline emissions from methane avoidance and from electricity generation;

$$BE = (MD_{project} \times AF) \times GWP_{CH_4} + (EL_{exp} - EL_{imp}) \times EF$$

Baseline emissions from methane avoidance

In accordance with applied methodology ACM0001 (Version 04), captured amount of LFG and treated amount of LFG should be compared and smaller value ($LFG_{selected}$) should be used to determine the amount of methane destruction.

Next, weighted average of methane fraction from 1st and 2nd landfill multiplied in order to calculate methane content and global warming potential and AF applied to calculate baseline emissions.

$$BE_{methane_avoidance} = (LFG_{selected} \times W_{CH_4} \times D_{CH_4} \times AF) \times GWP_{CH_4}$$

	LFG_{selected} (Nm³)	W_{CH4} (%)	CH₄_treated (Nm³)	BE from CH₄ avoidance(tCO₂e)	AF applied BE (tCO₂e)
Jan 2012	29,655,227.2	44.7	13,249,981.5	199,449.3	77,486
Feb	26,748,435.0	46.2	12,349,749.5	185,898.3	72,221
Mar	28,437,568.0	47.0	13,360,735.8	201,116.5	78,134
Apr	27,721,747.8	47.2	13,082,160.3	196,923.1	76,505
May	27,494,806.0	47.0	12,932,163.8	194,665.3	75,627
Jun	26,547,310.0	46.5	12,329,868.0	185,599.0	72,105
Total	166,605,094.0	46.4	77,304,659.0	1,163,651.6	452,079

* The above data, sum of each month, may not be equal to calculation. Calculation of emission reductions is more accurate than the above data because it was calculated on daily basis and especially, CH₄_treated on hourly basis. Please refer calculation spread sheet file for more detailed calculation.

Baseline emissions from electricity generation

In accordance with methodology, the amount of net generation and CO₂ emission factor of grid (EF) shall be used to calculate baseline emissions.

$$BE_{electricity_generation} = (EL_{exp} - EL_{imp}) \times EF$$

	Elec. exported (MWh)	Elec. imported (MWh)	Net generation (MWh)	BE from elec. generation (tCO₂e)
Jan 2012	33,155.4	461.0	32,694.3	18,525
Feb	31,995.5	441.4	31,554.1	17,879
Mar	26,289.8	494.6	25,795.2	14,616
Apr	16,280.2	535.7	15,744.5	8,921
May	33,551.8	423.8	33,128.0	18,770
Jun	25,600.9	433.4	25,167.5	14,260
Total	166,873.6	2,790.0	164,083.6	92,970

* The above data, sum of each month, may not be equal to calculation because emission reductions are calculated with several decimal places i.e. it is calculated in kWh unit instead of MWh for accuracy. Please refer calculation spread sheet file for more detailed calculation

Baseline emissions from 9.88MW power plant

As described in B. 1, however, request for review was made by CDM Executive Board during 1st request for issuance of the project regarding the stoppage of 9.88MW power plant. In accordance with the request for review of CDM Executive Board, emissions from the electricity generated by the existing 9.88MW power plant are regarded as baseline emissions and should be deducted from calculated baseline emissions. It is calculated as follows;

$$BE_{9.88MW} = \text{Maximum theoretical output of 9.88MW power plant} \times \text{monitoring period} \times EF$$

	Maximum theoretical output of 9.88MW (MWh)	Monitoring period (days)	EF (tCO₂/MWh)	BE_{9.88MW} (tCO₂)
Total	215.79	182	0.5666	22,253

E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

Project emissions calculation is included in E.1 Emission reductions calculation, e.g. electricity usage is included in EL_{imp} except project emissions from fossil fuel usage, which is not included in above emission reductions calculation equation.

Project emissions from fossil fuel (LPG) usage are calculated as following equation:

$$PE_{LPG} = Usage(Kg) \times 0.509 Nm^3 / Kg \times 57.8 MJ / Nm^3 \times 20.2 CKg / GJ \times 10^{-6} \times \frac{44}{12} CO_2 / C$$

	Usage of 50MW power plant (Kg)	Usage of central flaring facility (Kg)	PE_{LPG} (tCO₂e)
2010	50	0	0.10895
2011	0	40	0.08716
2012	0	40	0.08716
Total	50	80	0.28328

For conservativeness, 1 tCO₂e applied though calculated project emissions from LPG usage were 0.28328 tCO₂e.

E.3. Calculation of leakage

>>

There was no leakage in this monitoring period (in accordance with applied methodologies, leakage considered as zero (0) in PDD).

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	522,795	1	0	522,794

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period	Item	Values estimated in ex-ante calculation of registered PDD
Emission reductions or GHG removals by sinks (t CO₂e)	627,263	522,794	-	-

E.6. Remarks on difference from estimated value in registered PDD

>>

Claimed actual emission reductions are about 83.3% of estimated ones in PDD. This is mainly owing to the difference between estimated LFG generation by MELF model in PDD and actual amount of treated LFG which caused by model's own limitation and change of characteristics of reclaimed waste (portion of degradable organic waste decreased).

Recently, due to supplementation of calculation method for LFG monitoring, the issuance success ratio was increased compare to estimated value in registered PDD. Compared to other landfill projects listed in CDM Pipeline(dated 01/06/2012), the performance of this project is not extraordinary.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO ₂ e)	522,794	0

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Document information

Version	Date	Description
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: issuance Keywords: monitoring report, performance monitoring		