MONITORING REPORT FORM (F-CDM-MR)
Version 02.0

MONITORING REPORT

Title of the project activity	SF6 emission reductions in distribution part of Korea Electric Power Corporation
Reference number of the project activity	4166
Version number of the monitoring report	1
Completion date of the monitoring report	22/08/2012
Registration date of the project activity	25/02/2011
Monitoring period number and duration of this monitoring period	1st monitoring : 01/06/2011 ~ 16/04/2012
Project participant(s)	Korea Electric Power Corporation(KEPCO)
Host Party(ies)	Republic of Korea
Sectoral scope(s) and applied methodology(ies)	• Category 1 : Energy industries • Category 11 : Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride • AM0035(ver. 01)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	73,981 ton CO2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	47,396 ton CO2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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· **Purpose of the project activity and the measures taken for GHG emission reductions**

The purpose of this project activity is to reduce SF6 (sulphur hexafluoride) emissions from distribution system of Korea Electric Power Corporation (hereinafter referred as "KEPCO"). KEPCO directly operates electric power transmission lines, transformer substations and power plants nationwide in Korea.

This project has applied SF6 recovery, filtering and reclamation technology for SF6 gas and those technologies are utilized for collected SF6 from distribution equipment that will be removed. The SF6 gas with high purity through applied technology will be re-utilized for GIS and this would generate an effect for reduction of GHG emission.

· **Brief description of the installed technology and equipments**

The main equipments used by the project activity include three types:

Installed technology	Description
SF_6 recovery	• The recovery device can transmute SF6 gas removed out to liquid type by cryogenic & extremely high pressure and store in gas recovery tank. State of the captured gas after filtering can be confirmed by on-site purity measurement.
SF_6 Filtering	• Applicated to the Multibed Technology of AXENS.(Woosung)
SF_6 reclamation	• The impurities of used SF_6 gas removed through a series of gas purifying system which is composed of thermal decomposition, re-synthesis of SF_6, Alkaline cleaning, moisture absorption, distillation and absorption, etc. • This technology not applied to 1st monitoring period.

· **Relevant dates for the project activity**

Activity	Material centre	date
The earliest warehousing date of distribution equipment	Incheon Gyeonggi Gangwon Chungbuk Daejeon-Chungnam	01/10/2011
Starting date of SF6 gas recovery simulation	Seoul	27/02/2012 to 07/03/2012
Starting date of SF6 gas recovery	Seoul	18/03/2012
The 1st monitoring period	-	01/06/2011 to 16/04/2012

Regarding the 1st monitoring period, recovery of SF6 gas was supposed to start from 01/06/2011 but there were so many kinds of retired equipments manufactured by each manufacturer that Recovery Service Company can't be ready to recover SF6 gas until 30/09/2011. Therefore, the recovery of SF6 gas started from 01/10/2011 and the emission reduction from 01/06/2011 to 30/09/2011 will not be claimed.

As this is the first CDM project to reduce SF6 emissions from retired equipment in KEPCO's entire distribution part, reduction in emission of SF6 is not claimed by any other CDM project. Also, KEPCO is the single owner of all SF6 equipments in the project boundary, therefore no other project proponent could claim CERs.

· **Total emission reductions achieved in this monitoring period**

Emission reductions achieved in the 1st monitoring period by the project is 47,396 t CO2e.

A.2. Location of project activity

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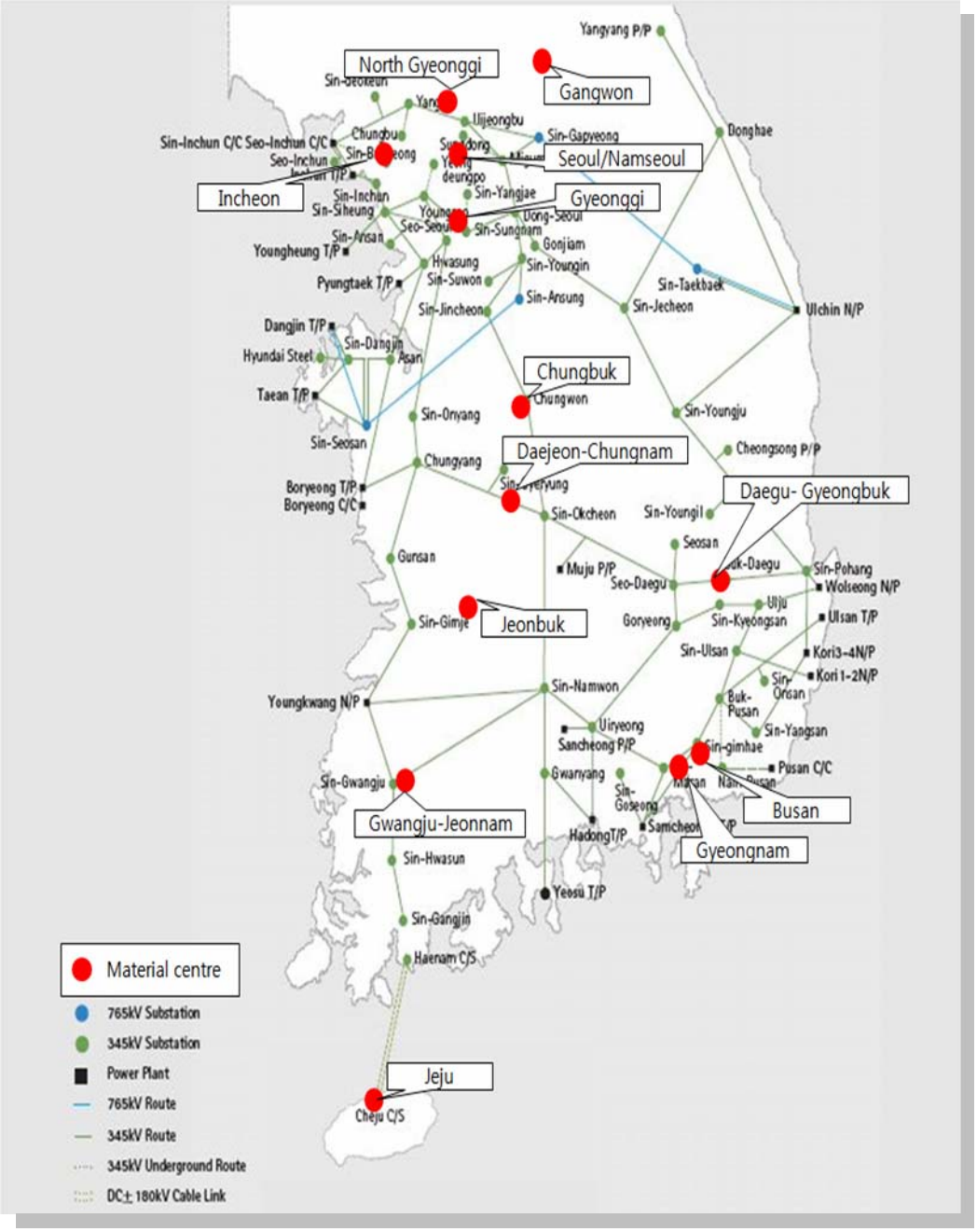

Local material centre	Location	Latitude/Longitude
Seoul	765-1 Majang-dong, Seongdong-gu, Seoul, Korea	37°33'55.00"N/126°58'58.33"E
Namseoul	765-1 Majang-dong, Seongdong-gu, Seoul, Korea	37°33'55.00"N/126°58'58.33"E
North Gyeonggi	86-1 Osan-ri, Baekseok-eup, Yangju-si, Gyeonggi-do, Korea	37°47'42.95"N/126°59'41.72"E
Incheon	90 Galsan-dong, Bupyeong-gu, incheon, Korea	37°31'4.65"N/126°44'3.11"E
Gyeonggi	665 Naeson-dong, Uiwang-si, Gyeonggi-	37°23'21.57"N/126°59'8.32"E

	do, Korea	
Gangwon	95 Hupyeong 1-dong, Chuncheon-si, Gangwon-do, Korea	37°53'5.84"N/127°44'54.70"E
Chungbuk	247-9 Naesu-ri, Naesu-eup, Cheongwon-gun, Chungcheongbuk-do, Korea	36°43'0.16"N/127°31'30.87"E
Daejeon-Chungnam	9-7 Yongjeon-dong, Dong-gu, Daejeon, Korea	36°21'30.79"N/127°26'7.18"E
Jeonbuk	935-1 Dunsan-ri, Bongdong-eup, Wanju-gun, Jeollabuk-do, Korea	35°57'21.84"N/127° 7'21.55"E
Gwangju-Jeonnam	685-5 Ilgok-dong, Buk-gu, Gwangju, Korea	35°12'4.83"N/126°53'23.43"E
Daegu- Gyeongbuk	420 Ihyeon-dong, Seo-gu, Daegu, Korea	35°52'48.83"N/128°32'9.14"E
Busan	272-3 Myeongdong-ri, Hallim-myeon, Gimhae-si, Gyeongsangnam-do, Korea	35°17'57.78"N/128°48'32.50"E
Gyeongnam	92-5 Guam-dong, Masan-si, Gyeongsangnam-do, Korea	35°15'5.43"N/128°36'3.06"E
Jeju	1191 Ara 2-dong, Jeju-si, Jeju-do, Korea	33°29'18.90"N/126°32'59.73"E

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 Party)	Korea Electric Power Corporation(KEPCO)	No

A.4. Reference of applied methodology

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· The applied methodology(ies):

AM0035. "SF_6 Emission Reductions in Electrical Grids" (Version. 01)

· Referred tools:

"Tool for the demonstration and assessment of additionality" (Version 5.2)

A.5. Crediting period of project activity

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· Type: Fixed

· Start date: 01/06/2011

As stated above, actual activity for the project was conducted on 01/10/2011 and the emission reduction from 01/06/2011 to 30/09/2011 will not be claimed.

· Length of the crediting period: 01/06/2011 ~ 31/05/2021

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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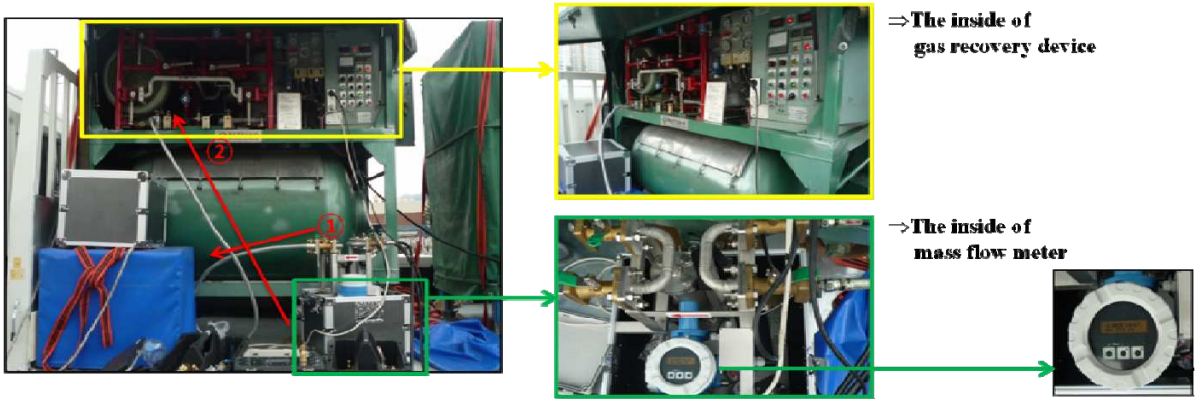
· **Technical process**

Detailed process of SF6 gas recovery is as follows.

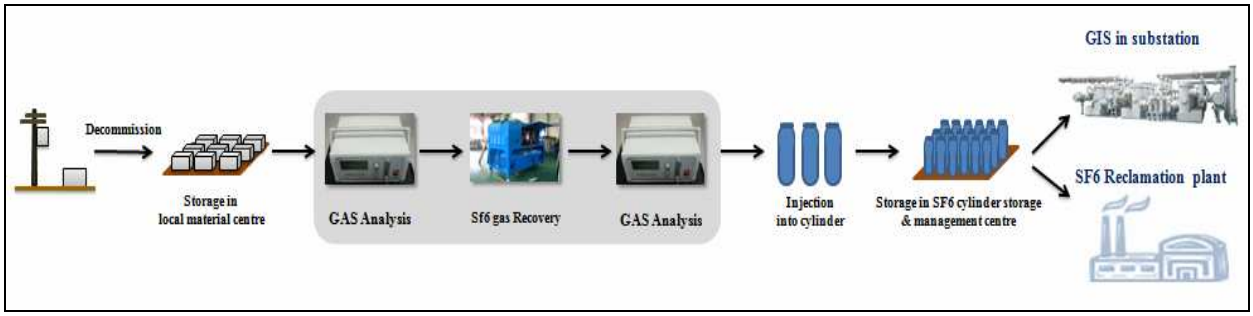
Step 1. Collecting retirement in the local material centre

Step 2. Install analogue manometer

Step 3.SF6 gas recovery



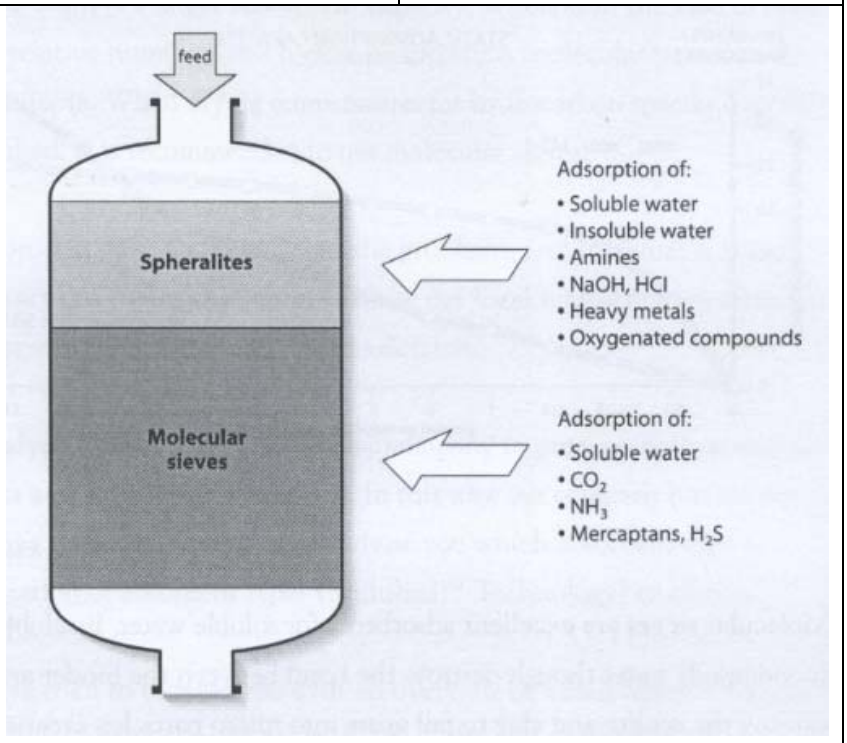
· **System diagram of the technology applied in the project activity**



· **Installed technology**

The project activity applied to SF6 recovery technology, SF6 filtering technology, SF6 reclamation technology. Detail technical description is shown as below.

Equipment	Manufacturer	Technical description	
SF6 Recovery device	Woosung Vacuum Technology	Model :	SLR-600
		Serial No. :	SLR1009
		Liquid :	600 L
		Max Pressure :	35 kgf/cm2
		Vacuum pump :	Model : LRP-120
			Serial No. : 0027
			Speed : 2,000 L/min
		Gas compressor :	Model : LRP-105
			Serial No. : 105315
			Speed : 34.7 m2/h
		Oil Rotary Vacuum Pump Only :	Ultimate pressure : 3 x 10(-3)
			Vacuum Gauge : Pirani Gauge
		Suction Port :	Ultimate pressure : 3 x 10(-5)
		Storage tank :	30 kgf/cm2
		Recovery rate :	99%
	DILO Vacuum Technology	Model :	D-87727
		Serial No. :	B057R01
		Liquid :	600L
		Storage capacity :	580kg
		Vacuum pump :	Normal suction capacity : 25m3/h
		Compressor :	Theoretical delivery rate : 5.7m3/h
		Vacuum compressor :	Theoretical delivery rate : 5.7m3/h
			Final vaccum : < 50mbar
SF6 Multigas Analyser : Analyser	Rapidox	Voltage :	90-260Vac 50/60 Hz
		Analyser dimension :	350mm x 263mm x 150mm
		Weight :	7kg
		Display :	20 x 4 character(9mm) back lit
		Warm up time :	3~4 minutes at 20℃
		Normal operating temperature :	-20℃ to 40℃

		Outputs :	0-5V linear 4-20mA linear RS232 / RS485
SF6 Multigas Analyser : Sensors	Rapidox	SF6 Sensor : Moisture Sensor : SO2 Sensor : Sensor Drift :	Infra-red detector 0~100% scale le ±1% FS accuracy Ceramic Dew-Point Sensor -100℃ to +20℃ dp ± 2℃ FS accuracy Electrochemical Cell 0-100ppm ± 2℃ FS accuracy <2% of span per month
SF6 Filtering Technology	Woo-sung filtering operation instruction	 **<Application Technology>** • Separation according to molecular size : only those molecules with a diameter smaller than the zeolite pore will enter and be adsorbed. • Separation according to molecular polarity : zeolite adsorbents tend to adsorb molecules of higher polarity by affinity, e.g., removing CO from hydrogen. • The result of the application technology improve purification capability.	

* As a result of recovery, SF6 gas management standard was set as “GIS reuse”, hence reclamation technology for SF6 has not been applied during first monitoring period.

· **Relevant dates of project activity**

This project includes an activity of SF6 gas collection from distribution equipment at fourteen Local material Centres in republic of Korea. SF6 gas collected at each Local material Centre is stored in cylinders for storage at SF6 Cylinder Storage & Management Centre located in Seoul in order, and then those cylinders will be sent to GIS and reclamation plant.

1st monitoring period of this project is from 01 Jun 2011 to 16 Apr 2012. From 27 Feb 2012 to 07 Mar 2012, simulation was performed by using collected distribution equipments at Seoul and Namseoul Material Centres. After the simulation, recovery of SF6 gas was progressed from 18 Mar 2012 to 16 Apr 2012. Recovery dates of each local material centre are as follows.

The date for SF6 gas recovery was set on 18 Mar 2012; a date when first collection of distribution equipment was conducted and starting dates for each Local material Centres are as follows:
On the 1st monitoring period, Jeju site is excluded but it will be included next monitoring period.

Material centre	date	Material centre	date
Seoul	’12.03.18	Namseoul	’12.03.18
North Gyeonggi	’12.04.16	Incheon	’12.03.28~29
Gyeonggi	’12.03.22/24/26	Gangwon	’12.03.20~21
Chungbuk	’12.04.03~04	Daejeon-Chungnam	’12.04.05
Jeonbuk	’12.03.30~31	Gwangju-Jeonnam	’12.04.11
Daegu- Gyeongbuk	’12.04.07	Busan	’12.04.09
Gyeongnam	’12.04.10	Jeju	-

There are no events or situations that occurred during the monitoring period that may impact the applicability of the applied methodology.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

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N/A

B.2.2. Corrections

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N/A

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

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N/A

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

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There are no changes in implementation compared with the PDD.

B.2.5. Changes to start date of crediting period

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N/A

B.2.6. Types of changes specific to afforestation or reforestation project activity (N/A)

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N/A

SECTION C. Description of monitoring system

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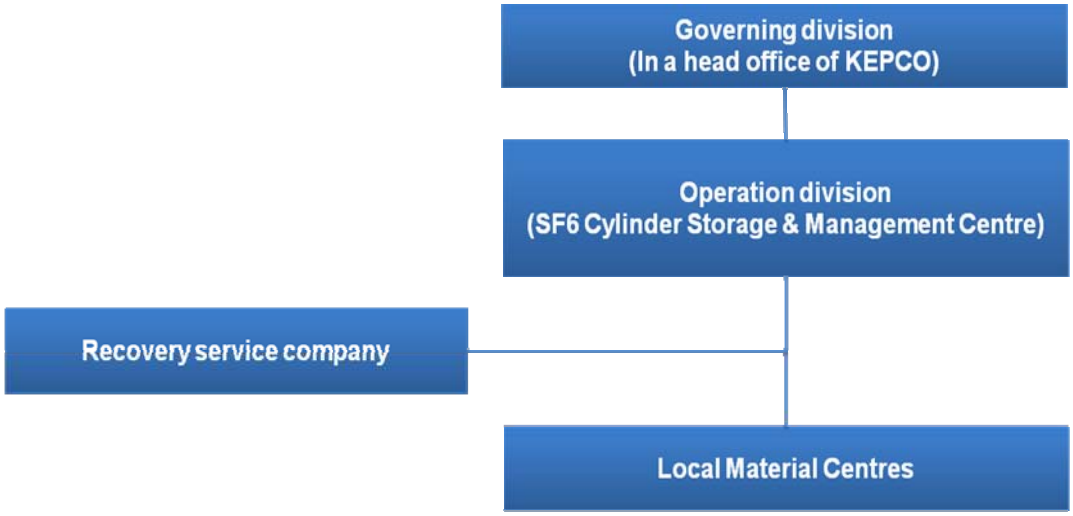
· **Operational and management structure**



Role	Responsibilities
Governing division	- Supervising the overall management of the project including monitoring data and emission reduction calculation.
Operation division (SF6 cylinder storage & management centre)	- Managing the records of SF6 inventory archived by recovery service company - Supervising measurement QA&QC including calibration of measurement instruments.
Local material centre	- Supervising field monitoring of recovery service company including raw data metering and recording.
Recovery service company	- Conducting field monitoring including raw data metering and recording. - Input raw data into computer system(excel sheet) including collecting and archiving the data - Calibration of measurement instrument.

· **Data collection procedure**

Data collection procedures(aggregation, recording)

According to the methodology, the monitoring parameters were collected as below:

DIy : The amount of SF6 gas was measured by counting each cylinder. However, weight of cylinder was measured before and after SF6 gas injection hence more accurate measurement was conducted.

Recovery work of retired equipments which were stored in local material centres during this monitoring period but not recovered will be performed in next monitoring period and the result will be applied DIy for next monitoring period.

AIy : Capacity of newly installed equipment for SF6 gas during monitoring period was measured based on documents received from manufacturer. The SF6 gas capacity of new equipment is same with the value of

NEC for applying conservative approach. There was no cylinder stored from reclamation plant during first monitoring period.

SIy : It means collected SF6 gas values that goes to GIS or reclamation plant. The value for the first monitoring period was "0" since there was no cylinder that transferred to GIS and reclamation plant.

RECy : SF6 nameplate values of discarded retired-equipments during monitoring period was added for calculation.

NECy : Capacity of newly installed equipment for SF6 gas during monitoring period was measured based on documents received from manufacturer.

Data archive

SF6 gas collecting local material centres removed the nameplate from equipments when collecting SF6 gas. The values were recorded by electric way (computer excel program) and hand (work sheet). Hand record (work sheet) was approved by the people in charge of each local material centre and electric data was sent to the person in charge at a head office of KEPCO.

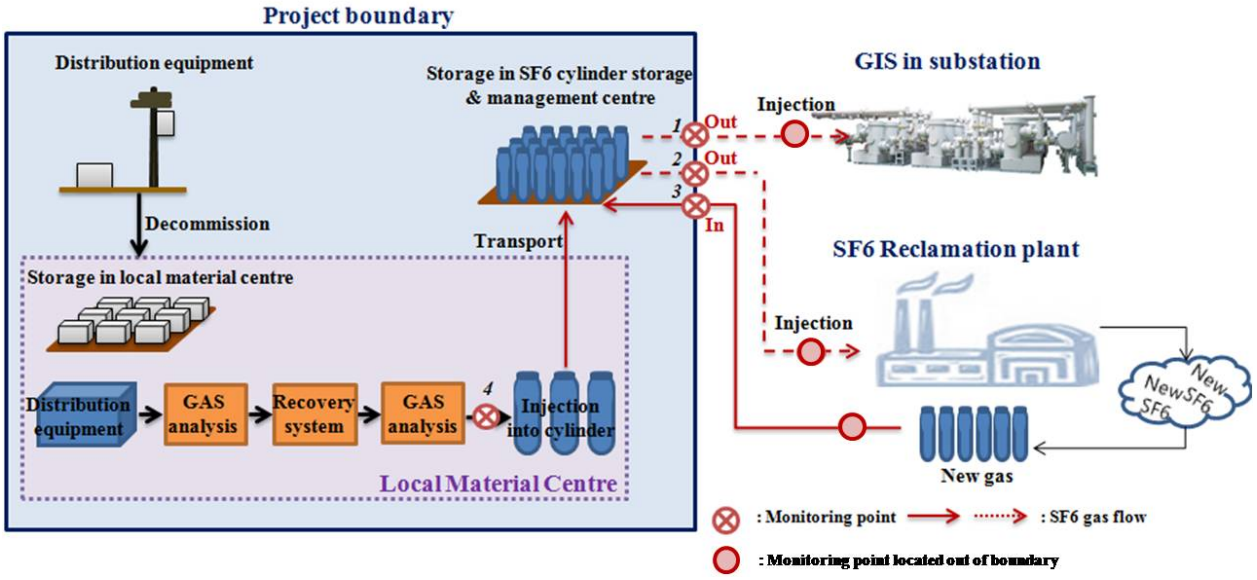
Add to that, the nameplate removed from equipments was sent to person in charge at local material centres and the person stored the rating plates in a separate space.

As the data stored in the system is going to be almost permanently preserved, all the records associated with this project will be kept at least 2 years more since the last issue date of CER.

Internal Audit

The head office of KEPCO verified monitoring data through internal audit. Subject of the audit shall be recovery service company and SF6 Cylinder Storage & Management Centre. Internal audit report shall include monitoring data, calibration records and etc.

· **Monitoring Point for the Project**



Monitoring point	Data / Parameter	Description

1	SIy	This includes cylinders sent for re-use to GIS
2	SIy	This includes cylinders sent for reclamation to SF6 reclamation plant
3	AIy	This includes cylinders returned from SF6 reclamation plant
4		SF6 gas quality has been injected into the cylinder
Cylinder storage & management centre	DIy	Counting of the cylinder at start and end of monitoring period.
Governing division	AIy	SF6 gas of new equipment.
	NECy	SF6 gas of new equipment.
Local material centre	RECy	SF6 gas of retired equipment.

· **Quality Control (QC) / Quality Assurance (QA) and Emergency procedure**

Mass flow meter and scale for this project was calibrated once a year by complying with the standard of KTL(Korea Testing Laboratory). Calibration date for the mass flow meter and scale is as follows:

Instrument	Calibration date	Next calibration date
Electronic scale (Digital)	23/09/2011	Within 22/09/2012
Mass flow meter	27/10/2011	Within 26/10/2012
SF6 Multigas Analyser 1	13/10/2011	Within 15/04/2012
SF6 Multigas Analyser 2	22/12/2011	Within 24/06/2012

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

Data/Parameter	**GWP_{SF6}**
Unit	$tCO2e/t\ SF_6$
Description	Global Warming Potential of SF_6
Source of data	IPCC
Value(s) applied	23,900
Purpose of data	Used for baseline and project emission calculations.
Additional comment	N/A

Data/Parameter	**Dix**
Unit	kg SF6
Description	Decrease in inventory during the base year. (2009)
Source of data	Based on number of cylinders in inventory at start and end of year.
Value(s) applied	0
Purpose of data	Used for baseline emission calculation.
Additional comment	According to the methodology, the year('09) with the lowest SF_6 emissions of the three years ('07~'09) are taken for the baseline in order to be conservative.

Data/Parameter	**AIx**

Unit	kg SF6
Description	Additions to Inventory in baseline year. (2009)
Source of data	Nameplate of equipment
Value(s) applied	21,907.48kg
Purpose of data	Used for baseline emission calculation.
Additional comment	According to the methodology, the year (’09) with the lowest SF_6 emissions of the three years (‘07~’09) are taken for the baseline in order to be conservative.

Data/Parameter	**Si_x**
Unit	kg SF6
Description	Subtractions from inventory in baseline year. (2009)
Source of data	Baseline inventory or the other checkable documents about equipment purchase. Transaction note between reclamation plant and SF_6 cylinder storage & management centre.
Value(s) applied	0
Purpose of data	Used for baseline emission calculation.
Additional comment	Baseline inventory or the other checkable documents about equipment purchase.

Data/Parameter	**RECx**
Unit	kg SF_6
Description	Retired equipment capacity in baseline year. (2009)
Source of data	Nameplate of equipment
Value(s) applied	8,635.08kg
Purpose of data	Used for baseline emission calculation.
Additional comment	N/A

Data/Parameter	**NECx**
Unit	kg SF_6
Description	New equipment capacity in baseline year. (2009)
Source of data	Nameplate of equipment
Value(s) applied	22,137.64kg
Purpose of data	Used for baseline emission calculation.
Additional comment	N/A

Data/Parameter	
Unit	
Description	Distribution equipment manufacturer and model
Measured/Calculated /Default	Default
Source of data	Nameplate or purchase orders
Value(s) of monitored parameter	
Monitoring equipment	

Measuring/Reading/ Recording frequency	At the time of purchase
Calculation method (if applicable)	
QA/QC procedures	Values shall be collected by request of data to equipment manufacturer.
Purpose of data	Project emission calculations
Additional comment	

D.2. Data and parameters monitored

Data/Parameter	**DIy**
Unit	kg SF_6
Description	Decrease in inventory during the 1st monitoring period.
Measured/Calculated /Default	Calculated
Source of data	Project inventory records (in SF6 cylinder storage & management centre for the proposed project)
Value(s) of monitored parameter	-1,301.59 kg
Monitoring equipment	• Electronic scale (Digital) Type : 10g ~ 150kg Accuracy class : 99.971% Serial number : JA0070042 Calibration frequency : Once a year Date of last calibration : 23/09/2011 Validity period : 23/09/2011 ~ 22/09/2012 • Mass flow meter Type : Hauser.80F Accuracy class : 99.77% Serial number : F10A1202000 Calibration frequency : Once a year Date of last calibration : 27/01/2012 Validity period : 27/01/2012 ~ 26/01/2013 • Gas Analyser1 Accuracy class : 99% Serial number : 2101202 Calibration frequency : twice a year Date of last calibration : 13/10/2011 Validity period : 13/10/2011 ~ 15/04/2012 • Gas Analyser2 Accuracy class : 99% Serial number : 2101267 Calibration frequency : twice a year Date of last calibration : 22/12/2011 Validity period : 22/12/2011 ~ 24/06/2012

Measuring/Reading/ Recording frequency	Continuous, as SF6 is injected to cylinders.
Calculation method (if applicable)	Inventory of start minus inventory of end
QA/QC procedures	Metering rely on the simple counting of cylinders. The amount of SF6 gas in cylinders is double-checked by mass flow meter and scale. The cylinders are filled using meters with 99% accuracy, and are double checked by weighing cylinders on scales with 99% accuracy.
Purpose of data	Project emission calculations
Additional comment	

Data/Parameter	**AIy**
Unit	kg SF_6
Description	Additions to inventory during the 1st monitoring period.
Measured/Calculated /Default	Calculated
Source of data	Received data from manufacturer.
Value(s) of monitored parameter	2,464.67kg
Monitoring equipment	• Electronic scale (Digital) Type : 10g ~ 150kg Accuracy class : 99.971% Serial number : JA0070042 Calibration frequency : Once a year Date of last calibration : 23/09/2011 Validity period : 23/09/2011 ~ 22/09/2012 • Mass flow meter Type : Hauser.80F Accuracy class : 99.77% Serial number : F10A1202000 Calibration frequency : Once a year Date of last calibration : 27/01/2012 Validity period : 27/01/2012 ~ 26/01/2013 • Gas Analyser1 Accuracy class : 99% Serial number : 2101202 Calibration frequency : twice a year Date of last calibration : 13/10/2011 Validity period : 13/10/2011 ~ 15/04/2012 • Gas Analyser2 Accuracy class : 99% Serial number : 2101267 Calibration frequency : twice a year Date of last calibration : 22/12/2011 Validity period : 22/12/2011 ~ 24/06/2012

Measuring/Reading/ Recording frequency	Continuous, as equipment is purchase.
Calculation method (if applicable)	Values of SF6 gas in the Cylinders came from reclamation plant was added with SF6 gas values of newly installed equipment. (There was no cylinders sent to reclamation plant during monitoring period.)
QA/QC procedures	N/A • Confirm weight of the SF6 gas by counting the number of cylinders or double-checking by mass flow meter and scale. However, it was not applied because there was no added gas to the project boundary in this monitoring period.
Purpose of data	Project emission calculations
Additional comment	The value is calculated using inventories data of SF6 cylinder storage & management centre and reclamation plant. However, it was based on nameplate capacity, because reclamation was not conducted in this monitoring period.

Data/Parameter	**SIy**
Unit	kg SF_6
Description	Subtractions from inventory during the 1st monitoring period.
Measured/Calculated /Default	N/A
Source of data	N/A • This value is calculated using transaction data between cylinder storage & management centre and GIS, cylinder storage & management centre and reclamation plant. However, it was not applied because there was no subtracted gas from the project boundary in this monitoring period.
Value(s) of monitored parameter	There is no SI value for the first monitoring period since no cylinders went to reclamation plants and GIS.

Monitoring equipment	• Electronic scale (Digital) Type : 10g ~ 150kg Accuracy class : 99.971% Serial number : JA0070042 Calibration frequency : Once a year Date of last calibration : 23/09/2011 Validity period : 23/09/2011 ~ 22/09/2012 • Mass flow meter Type : Hauser.80F Accuracy class : 99.77% Serial number : F10A1202000 Calibration frequency : Once a year Date of last calibration : 27/01/2012 Validity period : 27/01/2012 ~ 26/01/2013 • Gas Analyser1 Accuracy class : 99% Serial number : 2101202 Calibration frequency : twice a year Date of last calibration : 13/10/2011 Validity period : 13/10/2011 ~ 15/04/2012 • Gas Analyser2 Accuracy class : 99% Serial number : 2101267 Calibration frequency : twice a year Date of last calibration : 22/12/2011 Validity period : 22/12/2011 ~ 24/06/2012
Measuring/Reading/ Recording frequency	N/A
Calculation method (if applicable)	N/A
QA/QC procedures	N/A • Confirm weight of the SF6 gas by counting the number of cylinders or using scale. In addition to that, data about gas ingredients, conformed by reclamation plant, should be kept. However, it was not applied because there was no added gas from the reclamation plant in this monitoring period.
Purpose of data	Project emission calculations
Additional comment	

Data/Parameter	**RECy**
Unit	kg SF_6
Description	Retired equipment capacity in the 1st monitoring period.
Measured/Calculated /Default	Calculated
Source of data	Nameplate of retired equipment

Value(s) of monitored parameter	3,887.282 kg
Monitoring equipment	N/A
Measuring/Reading/ Recording frequency	Continuous, as equipment is retired.
Calculation method (if applicable)	All the SF6 gas collected from retired equipment was added.
QA/QC procedures	Nameplates was removed after collection of SF6 gas from retired equipments. Capacity and pressure data of SF6 stated in the nameplate was recorded at work sheet.
Purpose of data	Project emission calculations
Additional comment	

Data/Parameter	**NECy**
Unit	kg SF_6
Description	New equipment capacity in the 1st monitoring period.
Measured/Calculated /Default	Calculated
Source of data	Nameplate has been confirmed from manufacturer.
Value(s) of monitored parameter	2,464.67kg
Monitoring equipment	N/A
Measuring/Reading/ Recording frequency	Continuous, as equipment is purchase.
Calculation method (if applicable)	Value of SF6 gas in newly purchased equipments was added.
QA/QC procedures	SF6 gas value of nameplate attached on equipments was requested to the manufacture. Nameplates capacity of newly purchased equipments was put in an excel sheet based on data classified by manufactures. Based on the input data, SF6 gas capacity of new equipment was calculated.
Purpose of data	Project emission calculations
Additional comment	

D.3. Implementation of sampling plan

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N/A

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

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

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Follow the registered PDD in accordance with AM0035(ver.01), the Baseline emissions(BEy) is calculated as follows:

The baseline emissions are the total SF_6 emitted from both leaks and non-recycling of SF_6 during decommissioning of the equipments in the baseline. The calculations of SF_6 emitted shall be made in accordance with the 2006 IPCC SF_6 electric utility methodology guidelines, using the Tier 3 method.

The baseline emissions of SF_6 are estimated using the following equation:

$$BEy = (DIx + AIx - SIx + RECx - NECx) \times GWP_{SF6}/1000$$

Where:

BEy	Baseline emissions during the year y (tCO2e/yr)
DIx	Decrease in inventory in the baseline year (only cylinders; from beginning of baseline year until end; number can be negative. This is expressed as "cylinders at the beginning of the year less that at the end of the year in the inventory) (kg SF6)
AIx	Additions to Inventory in baseline year (cylinder purchases, recycled SF_6 returned to inventory (captured from retiring equipment) and any SF_6 included in new equipment fully charged by manufacturer) (kg SF_6)
SIx	Subtractions from inventory in baseline year (only cylinders; sold back to supplier, or sent for recycling) (kg SF6)
RECx	Retired Equipment Capacity expressed as nameplate capacity of retired equipment(kg SF6)
NECx	New Equipment Capacity expressed as nameplate capacity of new equipment (kg SF_6)
GWP_{SF6}	Global warming potential of SF_6 (tCO2e/t SF_6)

According to the methodology, the year with the lowest SF_6 emissions of the three years are taken for the baseline in order to be conservative. In the latest three years 2007-2009, the lowest SF_6 emission is 8404.92 kg in year 2009. The amount of SF_6 vented in year 2009 is the SF_6 baseline emission of the proposed project.
Therefore, baseline emission was changed and emission reduction value is as follow.

$BEy = (0+21907.48– 0 +8635.08–22137.64) \times 23,900/1000$
= 200,878 tCO2e

So the baseline emission for 1st monitoring period is:

BEy = 200,878*(199/365) = 109,515.79 tCO2e

E.2. Calculation of project emissions or actual net GHG removals by sinks
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Project emissions are estimated using the following equation:

$PEy = (DIy + AIy - SIy + RECy - NECy) \times GWP_{SF6}/1000$

Where:

PEy	Project emissions during the year y (tCO2e/yr)
DIy	Decrease in inventory in the project year (only cylinders; from beginning of baseline year until end; number can be negative. This is expressed as "cylinders at the beginning of the year less that at the end of the year in the inventory) (kg SF_6)
AIy	Additions to Inventory in project year (cylinder purchases, recycled SF_6 returned to inventory (captured from retiring equipment) and any SF_6 included in new equipment fully charged by manufacturer) (kg SF_6)
SIy	Subtractions from inventory in project year (only cylinders; sold back to supplier, or sent for recycling) (kg SF_6)
RECy	Retired Equipment Capacity expressed as nameplate capacity of retired equipment (kg SF_6)
NECy	New Equipment Capacity expressed as nameplate capacity of new equipment (kg SF_6)
GWP_{SF6}	Global warming potential of SF_6 (tCO2e/t SF_6)

The project emissions are the total non-recycled SF_6 of retired equipment of distribution utility and that vented into atmosphere during project period. DI, AI, SI, REC, NEC are applied. Recovered gas is store in cylinders at SF_6 cylinder storage & management centre.

DI is a decrease in inventory during the 1st monitoring period (inventory at the beginning of the Oct 2011 minus inventory of 16 Apr 2012).

AI is total sum of SF6 came into the boundary of the project. Values of SF6 gas amount in newly purchased distribution equipments during the monitoring period shall be "2,734.03 kg ".

SI is total SF_6 in cylinders sent outside. This value is "0" since there was no SF6 sent outside of project boundary.

REC is nameplate capacity of equipments that will be removed during monitoring periods and ***NEC*** is nameplate capacity of equipments that will be newly installed during the monitoring period. . Its value is the same with "SF6 included in new equipment fully charged by manufacturer" included in ***AI*** for a conservative approach.

The relevant data for 1st monitoring period is shown as below.

1st Monitoring period	DI(kg)	AI(kg)	SI(kg)	REC(kg)	NEC(kg)
01/06/2011~16/04/2012	-1,301.59	2,464.67	0.00	3,887.28	2,464.67

For the period that is 01/06/2011~30/09/2011, the value of emission reduction is zero.

So during the monitoring period project emission and emission reduction are listed below:

$$PEy = (DIy + AIy - SIy + RECy - NECy) \times GWP_{SF6}/1000$$
$$= (-1,301.59 + 2,464.67 - 0 + 3,887.28 - 2,464.67) \times 23,900 / 1,000$$
$$= 61,797.95 \text{ tCO2e}$$

$$ER = BEy - PEy$$
$$= 109,519.79 - 61,797.95$$
$$= 47,721.84 \text{ tCO2e}$$
$$= 47,721 \text{ tCO2e}$$

For more information, please refer to the ER sheet

E.3. Calculation of leakage

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Following the registered PDD in accordance with AMS-I.D (version 13), leakage does not need to be considered. Thus,

$LEy = 0$ tCO2e

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

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO2e)	Project emissions or actual net GHG removals by sinks (tCO2e)	Leakage (tCO2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO2e)
Total	109,519.79	61,797.95	0.00	47,721

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
Emission reductions or GHG removals by sinks (tCO2e)	73,981	47,721

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

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The actual emission reductions achieved during this monitoring period is smaller than the corresponding value in ex-ante calculation of the registered the PDD. Because the recovery of SF6 was smaller than expected and retired equipment in this monitoring period was larger than registered the PDD. Also many retired equipment were damaged in the process of decomposition from poles some of retired equipment was not able to recover the SF6 gas.

ANNEX 1

SF_6 emission of KEPCO in 1st Monitoring Period

Description		Amount(kg)	Note
DI	**Change in Inventory (SF_6 contained in cylinders, not electrical equipment)**		
	1.Beginning of the 1st Monitoring Period	0.00	
	2.End of the 1st Monitoring Period	1,301.59	
			(1 – 2)
AI	**Purchases/Acquisitions of SF_6**		
	3. SF_6 purchased from producers or distributors in cylinders	0.00	
	4. SF_6 provided by equipment manufacturers with/inside equipment	2,464.67	
	5. SF_6 returned to the site after offsite recycling	0.00	
			(3+4+5)
SI	**Sales/Disbursements of SF_6**		
	6.Sales of SF_6 to other entities, including gas left in equipment that is sold	0.00	
	7.Returns of SF_6 to supplier	0.00	
	8. SF_6 sent to other facilities	0.00	
	9. SF_6 sent off-site for recycling	0.00	
			(6+7+8+9)
NEC	10.Total nameplate capacity (proper full charge) of new equipment	2,464.67	
REC	11.Total nameplate capacity (proper full charge) of retired or sold equipment	3,887.28	
			(10-11)
Total Annual Emissions			
	Total Emissions (A+B-C-D) (kg SF_6)		
	Tonnes CO2 equiv. (kg. SF_6x23,900/1000) (tCO2e)		**47,721**