Monitoring report form
(Version 03.2)

Monitoring report

Title of the project activity	Gangwon Wind Park Project
Reference number of the project activity	0222
Version number of the monitoring report	02
Completion date of the monitoring report	09/01/2014
Registration date of the project activity	20/03/2006
Monitoring period number and duration of this monitoring period	The 8th Monitoring Period 01/01/2013 - 31/12/2013 (first and last days included)
Project participant(s)	Gangwon Wind Power Co., Ltd. Ecoeye Co., Ltd. Korea Midland Power Co., Ltd. Darby Hana Korea Emerging Infrastructure Fund Military Mutual Aid Association Marubeni Corporation Eurus Energy Holdings Corporation
Host Party(ies)	The Republic of Korea Japan
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope 1, Energy Industries Applied Methodology ACM0002 (Version 04, valid from 28/11/2005 to 01/03/2006)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	149,536 tCO2e/year
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	158,719 tCO2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	0
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	158,719 tCO2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>> The Gangwon Wind Park Project (the "Project") with its nominal installed capacity of 98 MW is based on 49 units of Vestas wind turbines of type V80-2.0MW. The Project is generating electricity without GHG emissions by using wind power categorized under renewable energy and supplies electricity to the public grid using an internal 9.764 km (6.746 km overhead and 3.018 km underground), 154 kV power line to the local substation of the KEPCO (Korea Electricity Power Company) in Hoenggye. The Project started construction on 01/05/2005, commissioning on 02/12/2005 and commercial operation of all 49 units since 18/09/2006.
Total emission reductions achieved in this monitoring period are 158,719 tCO2e.

A.2. Location of project activity

>> The Project site is located in 475-2 Hoenggyei-2Ri, Daegwallyeong-Myun, Pyeongchang-Gun, Gangwon-Do, the Republic of Korea along the Daegwallyeong ridge in the eastern part of the Korean peninsula.
GPS coordinates (Tokyo datum) of the Project location are North Latitude from 37° 42' 14" to 37° 45' 29" and East Longitude from 128° 41' 49" to 128° 44' 52".

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)
The Republic of Korea (host)	Gangwon Wind Power Co., Ltd. Ecoeye Co., Ltd. Korea Midland Power Co., Ltd. Darby Hana Korea Emerging Infrastructure Fund Military Mutual Aid Association	No
Japan	Marubeni Corporation Eurus Energy Holdings Corporation	No

A.4. Reference of applied methodology

>> The title of the approved baseline methodology applied to the project activity is ACM0002 (Version 04, valid from 28/11/2005 to 01/03/2006) – "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" and the title of the approved monitoring methodology applied to the project activity is ACM0002 (Version 04, valid from 28/11/2005 to 01/03/2006) – "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources".
The determination of the additionality is done by using the "Tool for the demonstration and assessment of additionality" (Version 01, EB 16 Annex 01, 22/10/2004).

A.5. Crediting period of project activity

>> Provided type of crediting period of the project activity is 1 term of 10 years. The starting date of the fixed crediting period for the project activity is 31/12/2006 and lasts until 30/12/2016.

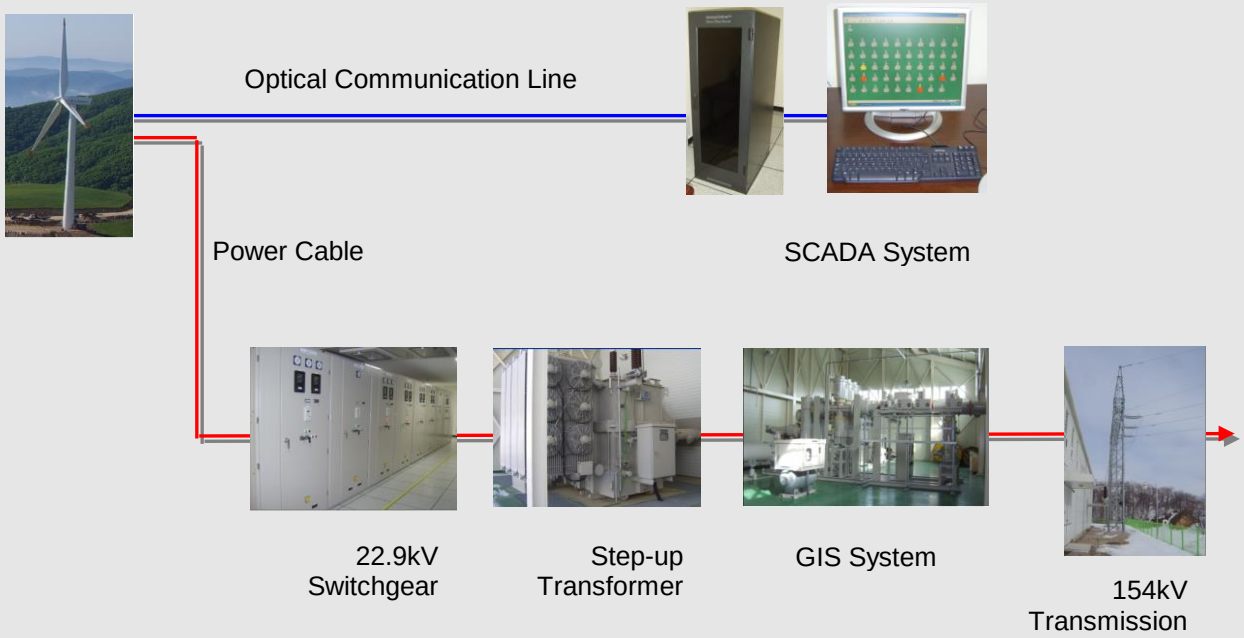
SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

>> During this monitoring period, the average wind speed is 8.1 m/s, electricity generation is 260,578 MWh, capacity factor is 30.4% and availability is 97.9%.
Major maintenance work in this monitoring period is 2 generators replacement for WTG No.3 on 18/10/2013 and WTG No.42 on 05/12/13.
The Project is the largest wind power generation project in the Republic of Korea with the total capacity of 98 MW. Specifications of Vestas V80-2.0MW wind turbines are as follows:

Rated Power:	2 MW
Cut in Speed:	4 m/s
Rated Speed:	15 m/s
Cut out Speed:	25 m/s
Blade Diameter:	80 m
Hub Height:	60 m
Gearbox:	3 Class, Ratio 1:120
Output Control:	Variable Speed Pitch Control
Noise Level:	56.4 db(A) at 107 m

The connection diagram is shown as follows:



B.2. Post registration changes

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

>> There was no temporary deviation.

B.2.2. Corrections

>> There was no correction.

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

>> Revised monitoring plan as reference title of the “Request for the revision of the monitoring plan of Gangwon Wind Park Project (0222)” due to discrepancy of calibration frequency had been submitted on 20/01/2010 and approved on 15/03/2010. There was no further revision of the monitoring plan in this monitoring period.

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

>> There was no change to project design.

B.2.5. Changes to start date of crediting period

>> There was no change to start date of crediting period.

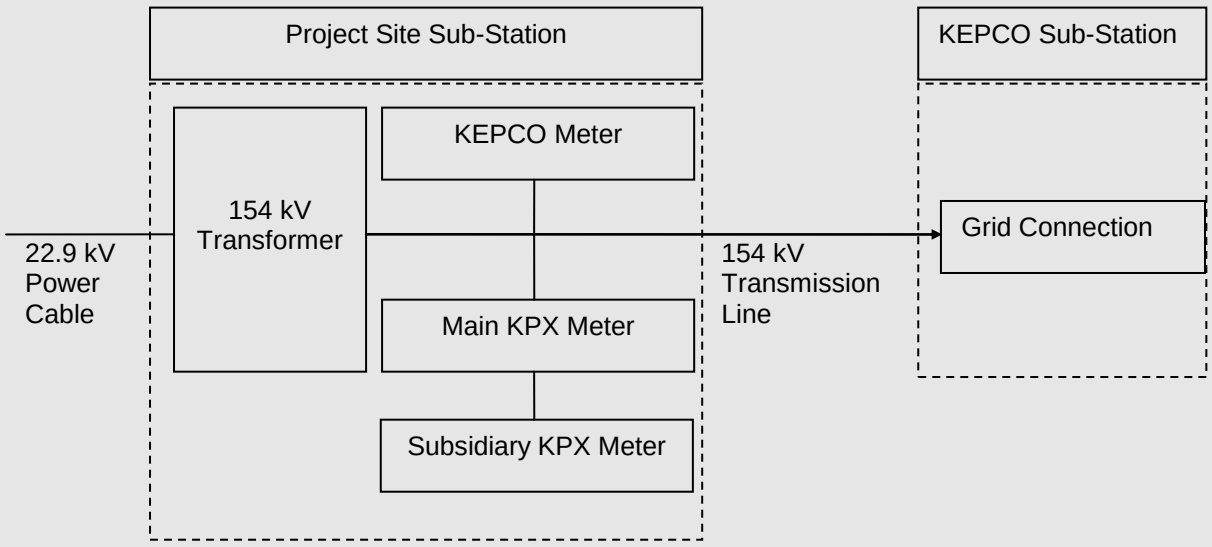
B.2.6. Types of changes specific to afforestation or reforestation project activity

>> There was no type of change specific to afforestation or reforestation project activity.

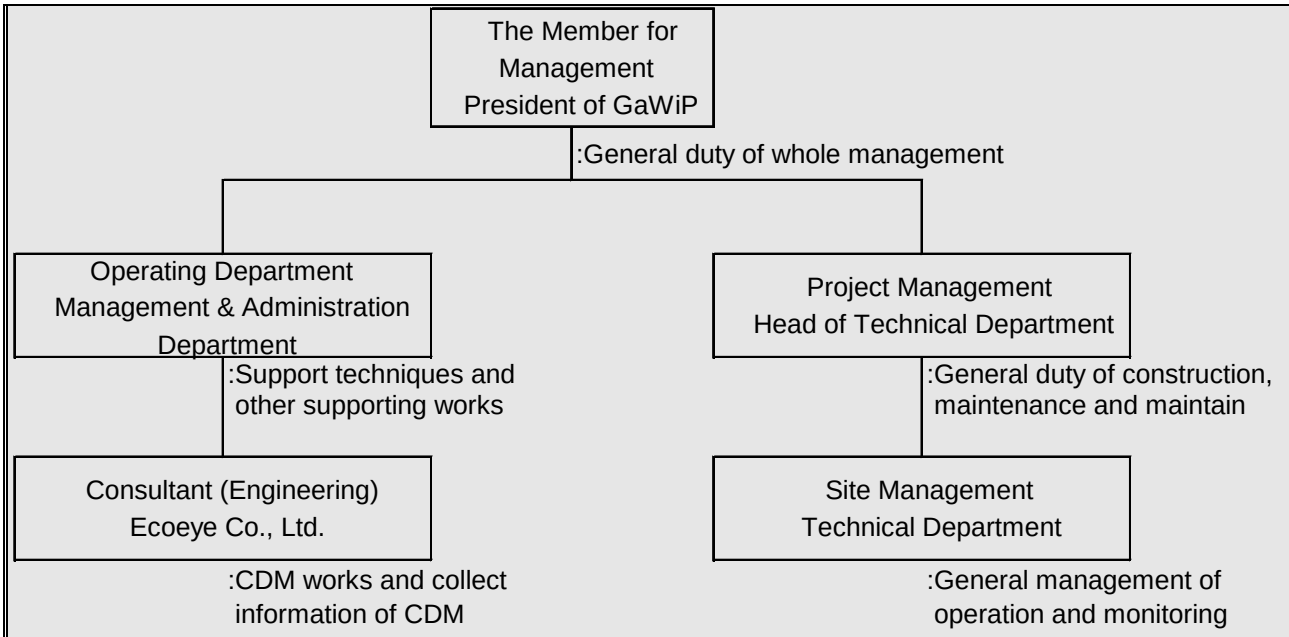
SECTION C. Description of monitoring system

>> The KPX (Korea Power Exchange) electricity meters (one main and one subsidiary) for measuring the amount of delivered electricity to the grid of KEPCO (Korea Electricity Power Company) is sealed after confirmation on the correct set up of the meters by KPX. The main KPX electricity meter is 0.2 class watt-hour meter to measure the amount of delivered electricity, which is wireless transmitted to KPX on real time basis, as the standard for calculation of power generation and revenue. The subsidiary KPX electricity meter is 0.5 class watt-hour meter that KPX could collect measured amount by remote access when main KPX electricity meter is not available. The amount of obtained electricity consume in the Project is measured by one KEPCO watt-hour meter.

The schematic diagram of the metering system is shown as follows:

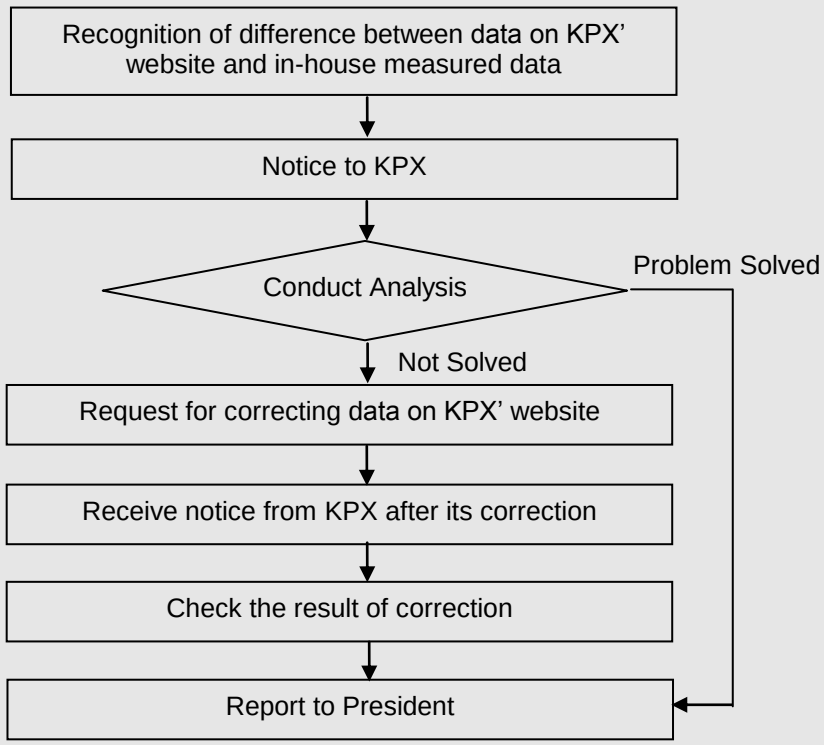


In accordance with monitoring plan, the operational and management structure to monitor emission reductions generated by the project activity is set up as follows:



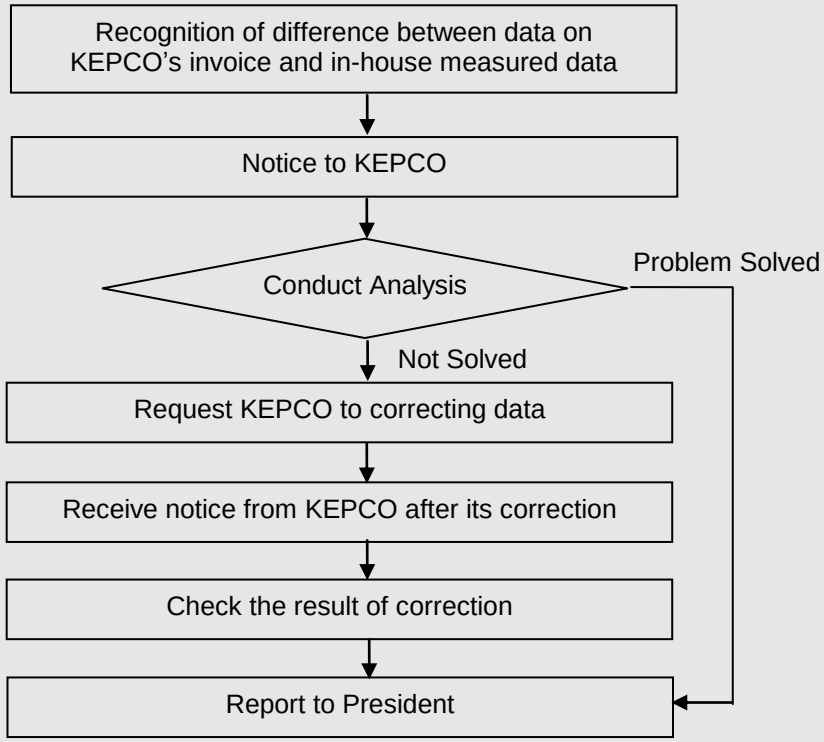
The amount of electricity delivered to the grid is measured automatically by the KPX meters and wireless transmitted to KPX on real time basis. The assigned monitoring members of the project activity collect and store the measured data electronically on hourly, daily, weekly and monthly basis. The measured data is double-checked against collected data on KPX' website and KPX' receipt of sales.

If the data on KPX' website and in-house measured data are different, following emergency procedures will be progressed.



The amount of electricity consumed by the Project site is daily checked by reading the KEPCO meter and compared with monthly KEPCO's invoice.

If the data on the KEPCO's invoice and in-house measured data are different, following emergency procedures will be progressed.



SECTION D. Data and parameters

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

(Copy this table for each piece of data and parameter.)

Data / Parameter:	**EF_y**
Unit:	tCO_2e/MWh
Description:	Baseline emission factor
Source of data:	Registered PDD
Value(s) applied):	0.6119
Purpose of data:	This data is used for baseline emission calculation.
Additional comment:	N/A

Data / Parameter:	**R_1**
Unit:	Ω
Description:	Wire resistance of one transmission line
Source of data:	Specifications of transmission cable manufacturer
Value(s) applied):	0.813
Purpose of data:	This data is used for transmission loss calculation.
Additional comment:	(0.0282 Ω/km x 3.018km) + (0.108Ω/km x 6.746km) = 0.813 Ω

D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter.)

Data / Parameter:	**Electricity delivered**
Unit:	MWh
Description:	Electricity delivered to the grid
Measured/ Calculated / Default:	Measured
Source of data:	Daily records of KPX (Korea Power Exchange) electricity meter
Value(s) of monitored parameter:	260,577.655
Monitoring equipment:	KPX Meter: Main — Type: SC8000AY1B_b; Accuracy Class: 0.2; Serial Number: AR-0111A064-02; Calibration Frequency: 3 years and 6 months ± 6 months from last calibration; Last Calibration Date: 11/09/2012; Validity: 10/09/2016 KPX Meter: Subsidiary — Type: TWR-ALM1; Accuracy Class: 0.5; Serial Number: 4349760; Calibration Frequency: 3 years and 6 months ± 6 months from last calibration; Last Calibration Date: 11/09/2012; Validity: 10/09/2016
Measuring/ Reading/ Recording frequency:	This data is continuously measured, hourly read and daily recorded.
Calculation method (if applicable):	N/A
QA/QC procedures:	Double-check against collected data on KPX' website and KPX' receipt of sales.
Purpose of data:	This data is used for baseline emission calculation.
Additional comment:	N/A

Data / Parameter:	**Electricity obtained**
Unit:	MWh
Description:	Electricity obtained from the grid
Measured/ Calculated / Default:	Measured
Source of data:	Monthly records of KEPCO (Korea Electricity Power Company) electricity meter
Value(s) of monitored parameter:	741.793

Monitoring equipment:	KEPCO Meter Type: LK3410CP-005 Accuracy Class: 1.0 Serial Number: 1298472 Calibration Frequency: every year Last Calibration Date / Validity: 31/10/2013 / 31/12/2014
Measuring/ Reading/ Recording frequency:	This data is continuously measured, daily read and monthly recorded.
Calculation method (if applicable):	N/A
QA/QC procedures:	Compare with monthly KEPCO's invoice.
Purpose of data:	This data is used for baseline emission calculation.
Additional comment:	N/A

Data / Parameter:	**Delivered Transmission Loss**
Unit:	MWh
Description:	Delivered transmission loss to the grid
Measured/ Calculated / Default:	Calculated
Source of data:	N/A
Value(s) of monitored parameter:	447.287
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	$Ip = P/(1.732 \times V \times T)$ $I = Ip/PF$ $MW\ Loss = I^2R_3/1{,}000$ $MWh\ Loss = I^2R_3 \times T/1{,}000$ P : Delivered power to the grid (measured) T : Time period (hours) I : Current on the transmission line for delivered power PF : Power Factor of delivered (0.984) R_1 : Wire Resistance of one transmission line (0.813 Ω) R_3 : Wire Resistance of three transmission lines V : Voltage on the transmission line (160.084kV)
QA/QC procedures:	Delivered transmission loss is calculated by daily basis.
Purpose of data:	This data is used for baseline emission calculation.
Additional comment:	Values of delivered transmission loss are referred to the CER Calculation Spreadsheet_2013.

Data / Parameter:	Obtained Transmission Loss
Unit:	MWh
Description:	Obtained transmission loss from the grid
Measured/ Calculated / Default:	Calculated
Source of data:	N/A
Value(s) of monitored parameter:	0.0029 (Rounded to the forth position after decimal point.)
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	Ip = P/(1.732 x V x T) I = Ip/PF MW Loss = I^2R_3/1,000 MWh Loss = I^2R_3 x T/1,000 P : Obtained power from the grid (measured) T : Time period (hours) I : Current on the transmission line for obtained power PF : Power Factor of obtained (1.000) R_1 : Wire Resistance of one transmission line (0.813 Ω) R_3 : Wire Resistance of three transmission lines V : Voltage on the transmission line (160.084kV)
QA/QC procedures:	Obtained transmission loss is calculated by monthly basis.
Purpose of data:	This data is used for baseline emission calculation.
Additional comment:	Values of delivered transmission loss are referred to the CER Calculation Spreadsheet_2013.

Data / Parameter:	EGy
Unit:	MWy
Description:	Net electricity delivered to the grid by the project activity
Measured/ Calculated / Default:	Calculated
Source of data:	N/A
Value(s) of monitored parameter:	259,388.572
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A

Calculation method (if applicable):	Electricity Delivered – (Electricity Obtained + Delivered Transmission Loss + Obtained Transmission Loss)
QA/QC procedures:	N/A
Purpose of data:	This data is used for baseline emission calculation.
Additional comment:	N/A

D.3. Implementation of sampling plan

>> 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

>> The baseline emissions (BE_y in tCO_2e) are the product of the baseline emission factor (EF_y in tCO_2e/MWh) times the electricity supplied by the project activity to the grid (EG_y in MWh), as follows:

$BE_{2013} = EG_{2013} \times EF_{2013}$
$= 259{,}388.572 \text{ MWh} \times 0.6119 \text{ } tCO_2e/MWh$
$= 158{,}719.867 \text{ } tCO_2e$

The baseline emission factor EF_y was calculated in accordance with the ACM0002 baseline methodology and is based on the methodology and parameters fixed in the PDD and justified during the validation. One produced MWh of electricity replaces 0.6119 ton of CO_2e, i.e. $EF_y = 0.6119 \text{ } tCO_2e/MWh$.

Electricity consumed by the project activity is used from the own wind power generation and is obtained from the grid at times when the own wind power generation is not sufficient. Correspondingly, all electricity consumed by the project activity is considered in the calculation of EG_y by subtracting electricity obtained from the grid from electricity delivered to the grid.

The wind park is located on a mountain ridge and supplies electricity to the public grid using an internal 9.764 km (6.746 km overhead and 3.018 km underground), 154 kV power line to the local substation of the KEPCO in Hoenggye. The same power line is used for electricity obtained from the grid. The detailed transmission losses have been calculated as described in the separate MS Excel 'CER Calculation Spreadsheet_2013' and the final results are as follows:

Transmission losses for electricity amount delivered to the grid: 447.287MWh
Transmission losses for electricity amount obtained from the grid: 0.0029MWh

The following table shows the results of the baseline emissions during the present monitoring period (01/01/2013 to 31/12/2013). Electricity delivered to the grid (KPX meter) and electricity obtained from the grid and consumed on site (KEPCO meter) is specified separately to determine the net electricity supplied to the grid by the project activity in this monitoring period.

Month	Electricity Delivered (MWh)	Electricity Obtained (MWh)	Delivered Transmission Loss (MWh)	Obtained Transmission Loss (MWh)	EG_{2013} (MWh)	EF_{2013} (tCO_2e/MWh)	BE_{2013} Baseline Emission (tCO_2e)
	A	B	C	D	E=A-(B+C+D)	F	G=E*F
January	22,921.012	31.772	35.666	0.0000430	22,853.574	0.6119	13,984.102
February	26,118.965	27.882	46.326	0.0000367	26,044.757	0.6119	15,936.787
March	27,825.756	51.226	48.277	0.0001119	27,726.253	0.6119	16,965.694
April	25,450.926	38.257	45.268	0.0000645	25,367.401	0.6119	15,522.313
May	21,856.370	57.061	38.410	0.0001388	21,760.899	0.6119	13,315.494
June	2,966.426	173.776	1.786	0.0013307	2,790.863	0.6119	1,707.729
July	34,912.356	38.258	71.319	0.0000624	34,802.779	0.6119	21,295.820
August	22,282.272	62.248	36.854	0.0001652	22,183.170	0.6119	13,573.882
September	7,079.427	125.145	6.067	0.0006901	6,948.214	0.6119	4,251.612
October	12,573.077	78.459	13.789	0.0002625	12,480.829	0.6119	7,637.019
November	28,621.282	33.069	51.428	0.0000482	28,536.785	0.6119	17,461.659
December	27,969.786	24.640	52.097	0.0000259	27,893.049	0.6119	17,067.757
Total	**260,577.655**	**741.793**	**447.287**	**0.002980**	**259,388.572**		**158,719.867**

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

>> The operation of the project activity has been monitored in accordance with the requirements of the applicable monitoring methodology as described in its PDD and in the approved monitoring methodology ACM0002 (Version 04), which is the consolidated monitoring methodology for zero-emission grid-connected electricity generation from renewable energy sources.

There are no GHG emissions from the project activity so that the project emissions are zero.

E.3. Calculation of leakage

>> The leakage of the project activity is considered zero in accordance with the applied methodology.

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 ($t CO_2e$)	Project emissions or actual net GHG removals by sinks ($t CO_2e$)	Leakage ($t CO_2e$)	Emission reductions or net anthropogenic GHG removals by sinks ($t CO_2e$)
Total	158,719.867	0	0	158,719.867

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 (t CO_2e)	149,536	158,719

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

>> The estimated emission reduction in the PDD is 149,536 tCO2e/year based on an electricity generation of 244,400MWh/year with average wind speed of 7.65m/sec. The project activity has achieved 158,719 tCO_2e of emission reductions which is 6.14% higher than the estimation in the PDD because actual electricity generation during this monitoring period is increased as 260,578MWh. The main reason for the increase of electricity generation is increase of average wind speed from 7.65m/sec to 8.1m/sec during this monitoring period.

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_2e)	0	158,719

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Document information

Version	*Date*	*Description*
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
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.

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