Monitoring report form

(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT		
Title of the project activity	Gangwon Wind Park Project	
UNFCCC reference number of the project activity	0222	
Version number of the monitoring report	01	
Completion date of the monitoring report	05/01/2016	
Monitoring period number and duration of this monitoring period	The 11th Monitoring Period 01/01/2016 - 30/12/2016 (first and last days included)	
Project participant(s)	Gangwon Wind Power Co., Ltd. Darby Hana Korea Emerging Infrastructure Fund NongHyup Bank Korea Midland Power Co., Ltd. Military Mutual Aid Association Ecoeye Co., Ltd. Eurus Energy Holdings Corporation	
Host Party	The Republic of Korea Japan	
Sectoral scope(s)	1, Energy Industries	
Selected methodology(ies)	ACM0002 (Version 04, valid from 28/11/2005 to 01/03/2006)	
Selected standardized baseline(s)	N/A	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	149,536 tCO2e/year	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	0	127,949 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 Hoengkye. 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 is 127,949tCO2e.

A.2. Location of project activity

>> The Project site is located in 688-206, Kkotbadyangji-gil, 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 whether the Party involved wishes to be considered as project participant (yes/no)
The Republic of Korea (host)	Gangwon Wind Power Co., Ltd. Darby Hana Korea Emerging Infrastructure Fund NongHyup Bank Korea Midland Power Co., Ltd. Military Mutual Aid Association Ecoeye Co., Ltd.	No
Japan	Eurus Energy Holdings Corporation	No

A.4. Reference of applied methodology and standardized baseline

>> 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.

A.6. Contact information of responsible persons/entities

>> Organization Name: Gangwon Wind Power Co., Ltd.
Address: 688-206, Kkotbadyangji-gil, Daegwallyeong-myun, Pyeongchang-gun, Gangwon-do, the Republic of Korea
Contact Person: Mr. Jong-Woo Park
Title: President
Direct fax: +82-1544-8305
Direct tel.: +82-70-4015-6300
Personal e-mail: jwpark@gawip.co.kr
The organization is one of project participants and the contact person is responsible for completing the CDM-MR-FORM.

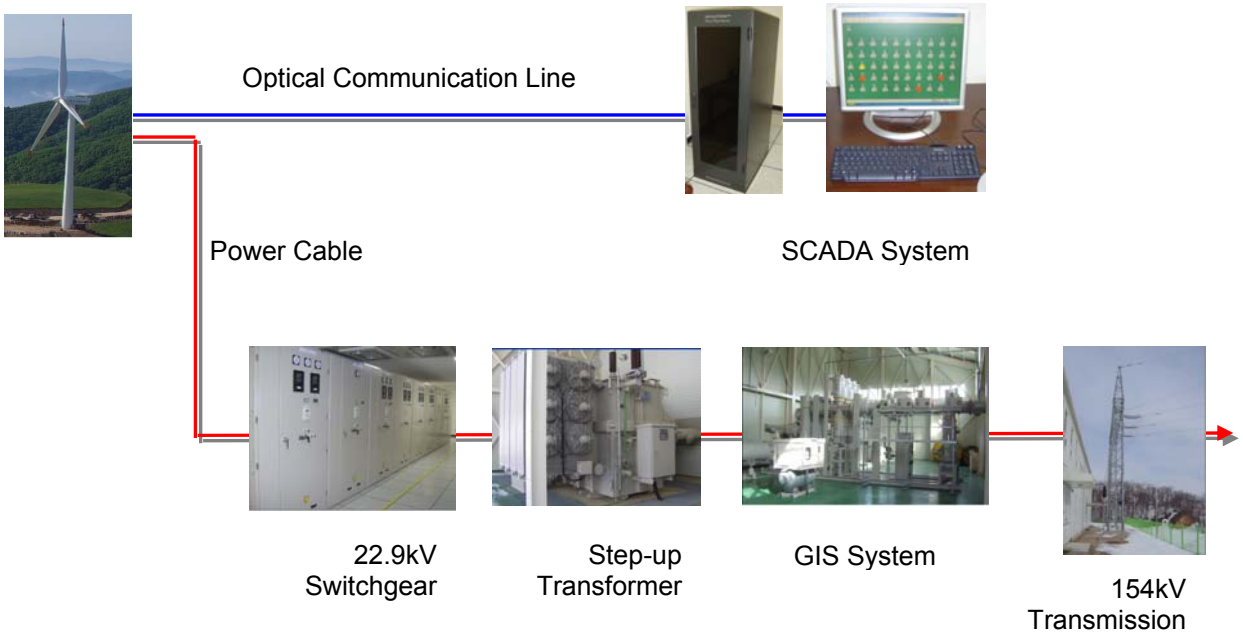
SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

>> The Project is the largest wind power generation project in the Republic of Korea with the total capacity of 98 MW. During this monitoring period, the average wind speed is 7.2 m/s, electricity generation is 210,291.565 MWh, capacity factor is 24.5% and availability is 97.9%. Major maintenance activities for wind turbines are 3 gearboxes replacements on WTG No.19 from 31/03/2016 to 06/04/2016, WTG No.15 from 19/05/2016 to 27/05/2016 and WTG No.3 from 07/11/2016 to 14/11/2016 and 2 generators replacements on WTG No.9 from 06/03/2016 to 11/03/2016 and WTG No.2 from 03/08/2016 to 09/08/2016. Major maintenance activity for BOP is bolt torqueing and painting for 21EA of 154kV pylons from 01/06/2016 to 09/07/2016.
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, applied methodology or applied standardized baseline

>> There was no temporary deviation.

B.2.2. Corrections

>> There was no correction.

B.2.3. Changes to start date of crediting period

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

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>> There was no post inclusion of a monitoring plan to the registered PDD.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>> 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 monitoring plan after that.

B.2.6. Changes to project design of registered project activity

>> There was no change to project design.

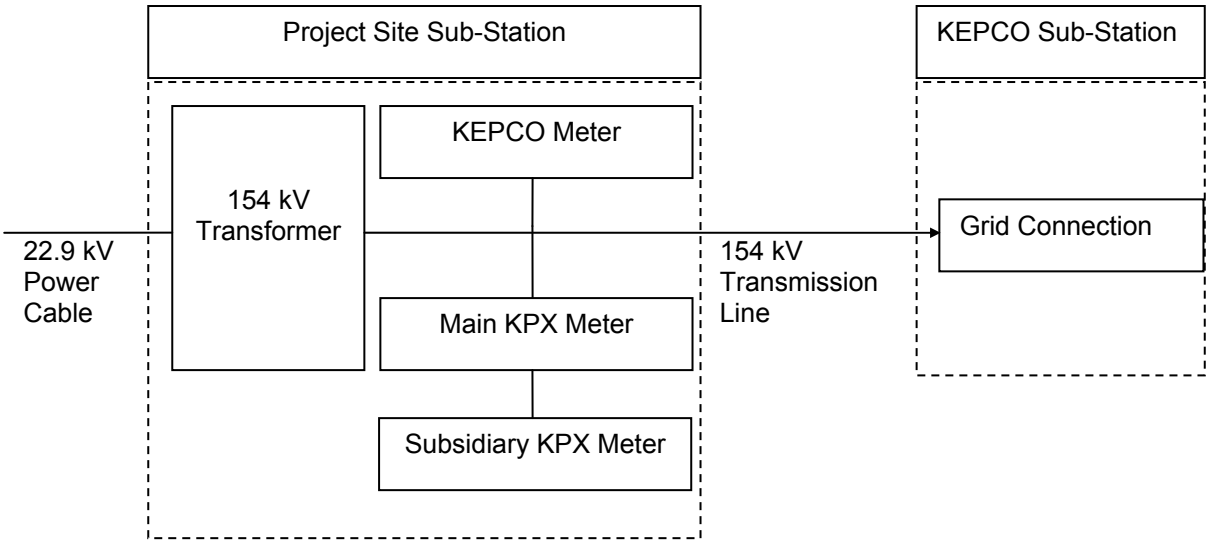
B.2.7. Types of changes specific to afforestation or reforestation project activity

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

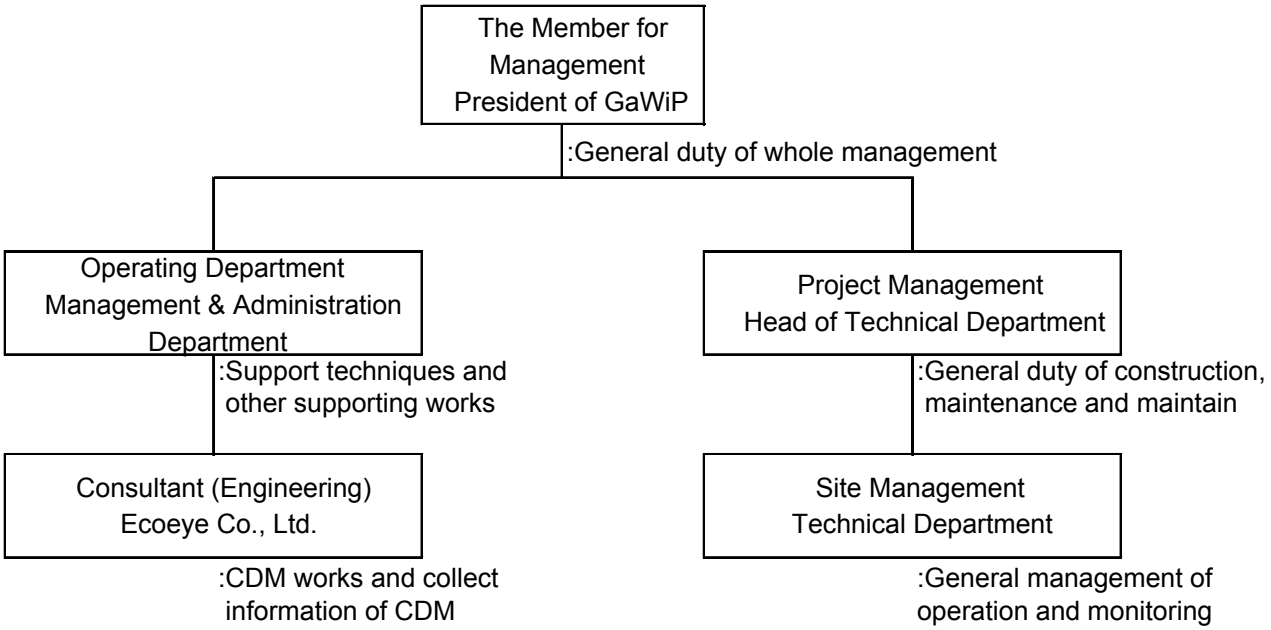
SECTION C. Description of monitoring system

>> 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:

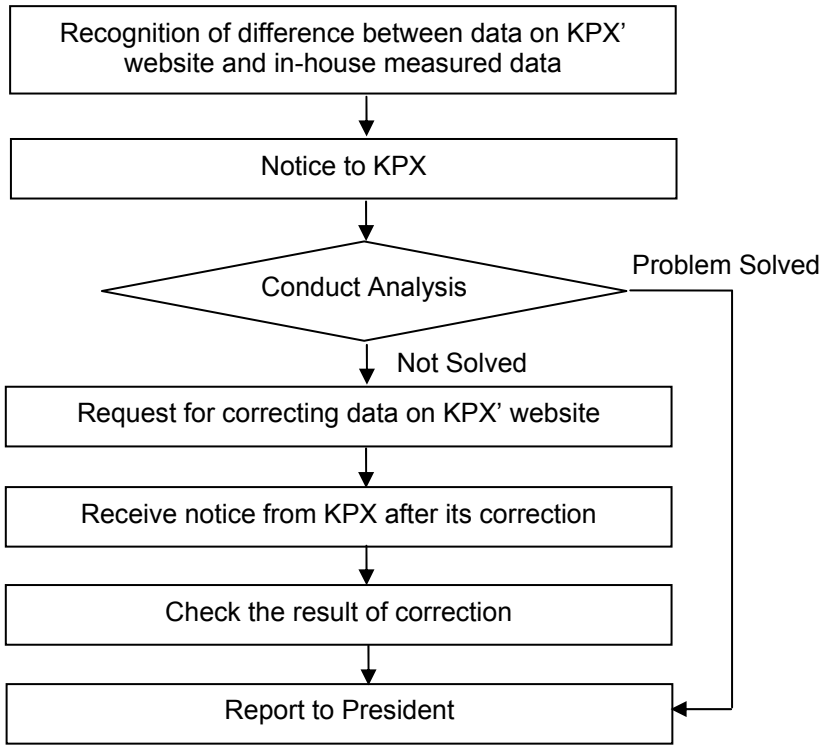


In accordance with monitoring plan, the operational and management structure to monitor emission reductions generated by the project activity is set up as follows:



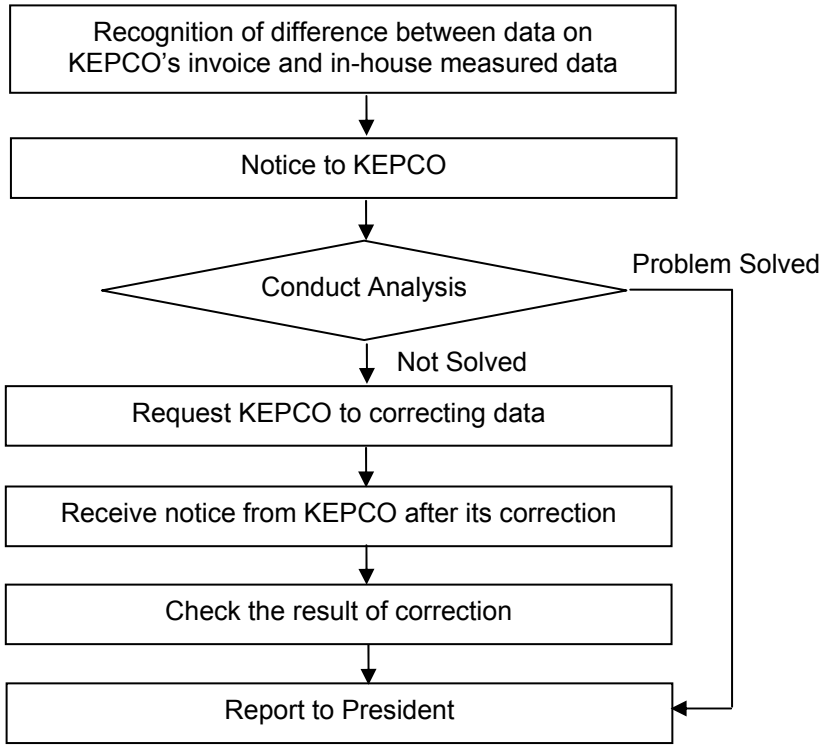
The amount of electricity delivered to the grid is measured automatically by the KPX meters and wireless transmitted to KPX on real time basis. The assigned monitoring members of the project activity collect and store the measured data electronically on hourly, daily, weekly and monthly basis. The measured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

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
Choice of data or measurement methods and procedures	Choice of data
Purpose of data	This data is used for baseline emission calculation.
Additional comments	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
Choice of data or measurement methods and procedures	(0.0282 Ω/km x 3.018km) + (0.108Ω/km x 6.746km) = 0.813 Ω

Purpose of data	This data is used for transmission loss calculation.
Additional comments	N/A

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	210,290.565
Monitoring equipment	KPX Meter: Main — Type: SC8000AY1B_b; Accuracy Class: 0.2; Serial Number: PT-1309A086-01; Tolerance Test Frequency: 3 years and 6 months ± 6 months from last calibration; Last Tolerance Test Date: 24/01/2014; Validity: 23/01/2018 KPX Meter: Subsidiary — Type: TWR-ALM1; Accuracy Class: 0.5; Serial Number: 4349760; Tolerance Test Frequency: 3 years and 6 months ± 6 months from last calibration; Last Tolerance Test Date: 12/04/2016; Validity: 11/04/2020
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 comments:	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	857.211
Monitoring equipment	KEPCO Meter — Type: LK3410CP-005; Accuracy Class: 1.0; Serial Number: 01101298472; Tolerance Test Frequency: 1 year ± 6 months; Tolerance Test Date: 05/10/2015; Validity: 04/04/2017 – 24/10/2016; 23/04/2018
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 comments:	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	330.844
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 : Delivered power to the grid (measured) T : Time period (hours) I : Current on the transmission line for delivered power PF : Power Factor of delivered (Average 0.989) R_1 : Wire Resistance of one transmission line (0.813Ω) R_3 : Wire Resistance of three transmission lines V : Voltage on the transmission line (Average 158.417kV)
QA/QC procedures:	Delivered transmission loss is calculated by daily basis.
Purpose of data:	This data is used for baseline emission calculation.
Additional comments:	Values of delivered transmission loss are referred to 2016 CER Calculation Spreadsheet_170105.xls.

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	0.0037 (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 (0.813Ω) R_3 : Wire Resistance of three transmission lines V : Voltage on the transmission line (Average 158.417kV)
QA/QC procedures:	Obtained transmission loss is calculated by monthly basis.
Purpose of data:	This data is used for baseline emission calculation.

Additional comments:	Values of delivered transmission loss are referred to 2016 CER Calculation Spreadsheet_170105.xls.

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	209,102.507
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 comments:	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:

$BE_{2016} = EG_{2016} \times EF_{2016}$
$= 209{,}102.507 \text{ MWh} \times 0.6119 \text{ } tCO_2e/MWh$
$= 127{,}949.824 \text{ } tCO_2e$

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 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 Hoengkye. 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 '2016 CER Calculation Spreadsheet_170105.xls' and the final results are as follows:

Transmission losses for electricity amount delivered to the grid: 330.844MWh
Transmission losses for electricity amount obtained from the grid: 0.0037MWh

The following table shows the results of the baseline emissions during the present monitoring period (01/01/2016 to 30/12/2016). Electricity delivered to the grid (KPX meter) and electricity obtained from the grid to consume on the 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_{2016} (MWh)	EF_{2016} (tCO_2e/MWh)	BE_{2016} Baseline Emission (tCO_2e)
	A	B	C	D	E=A-(B+C+D)	F	G=E*F
January	29,383.934	29.827	57.003	0.0000387	29,297.104	0.6119	17,926.898
February	28,992.464	20.101	55.327	0.0000195	28,917.036	0.6119	17,694.334
March	20,457.305	44.741	30.889	0.0000872	20,381.674	0.6119	12,471.547
April	20,941.740	36.311	31.176	0.0000593	20,874.253	0.6119	12,772.956
May	20,311.948	63.545	33.168	0.0001758	20,215.235	0.6119	12,369.702
June	9,690.196	118.660	10.324	0.0006336	9,561.211	0.6119	5,850.505
July	13,065.904	106.341	18.250	0.0004924	12,941.313	0.6119	7,918.789
August	6,451.712	145.895	6.676	0.0009269	6,299.140	0.6119	3,854.444
September	5,882.101	141.356	4.119	0.0008991	5,736.625	0.6119	3,510.241
October	10,284.546	76.514	11.297	0.0002549	10,196.734	0.6119	6,239.382
November	19,641.203	44.741	30.766	0.0000901	19,565.696	0.6119	11,972.250
December	25,187.513	29.179	41.849	0.0000383	25,116.484	0.6119	15,368.777
Total	210,290.565	857.211	330.844	0.003716	209,102.506		127,949.824

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 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 ($t CO_2e$)	GHG emission reductions or net GHG removals by sinks ($t CO_2e$) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	127,949.824	0	0	0	127,949.824	127,949.824

E.5. Comparison of actual emission reductions or net 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	127,949

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 127,949 tCO2e of emission reductions which is 14.4% lower than the estimation in the PDD because actual electricity generation during this monitoring period is only 210,290MWh. The main reason for low electricity generation is lack of wind resource that average wind speed is only 7.2m/sec.

Appendix 1. Contact information of project participants and responsible persons/entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	Gangwon Wind Power Co., Ltd.
Street/P.O. Box	688-206, Kkotbadyangji-gil, Daegwallyeong-myun
Building	
City	Pyeongchang-gun
State/region	Gangwon-do
Postcode	25341
Country	the Republic of Korea
Telephone	+82-1544-8302
Fax	+82-1544-8305
E-mail	cermaster@gawip.co.kr
Website	
Contact person	Jong-Woo Park
Title	President
Salutation	
Last name	Park
Middle name	
First name	Jong-Woo
Department	
Mobile	+82-10-2112-1081
Direct fax	+82-1544-8305
Direct tel.	+82-70-4015-6300
Personal e-mail	jwpark@gawip.co.kr

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Document information

Version	*Date*	*Description*
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
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 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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Document Type: Form
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