



Monitoring report form (Version 03.0)

Monitoring report

Title of the project activity	Gangwon Wind Park Project
Reference number of the project activity	0222
Version number of the monitoring report	Version 01
Completion date of the monitoring report	04/01/2013
Registration date of the project activity	20/03/2006
Monitoring period number and duration of this monitoring period	The 7 th Monitoring Period 01/10/2012 - 31/12/2012 (first and last days included)
Project participant(s)	Gangwon Wind Power Co., Ltd. Korea Midland Power Co., Ltd. Ecoeye Co., Ltd. Marubeni Corporation Eurus Energy Japan 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	37,691 tCO ₂ e (149,536 tCO ₂ e/year ÷ 365 x 92days)
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	39,903 tCO ₂ e

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 12/05/2005, commissioning on 02/12/2005 and commercial operation of all 49 units since 01/09/2006.

Total emission reductions achieved in this monitoring period are 39,903 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. Korea Midland Power Co., Ltd. Ecoeye Co., Ltd.	No
Japan	Marubeni Corporation Eurus Energy Japan 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

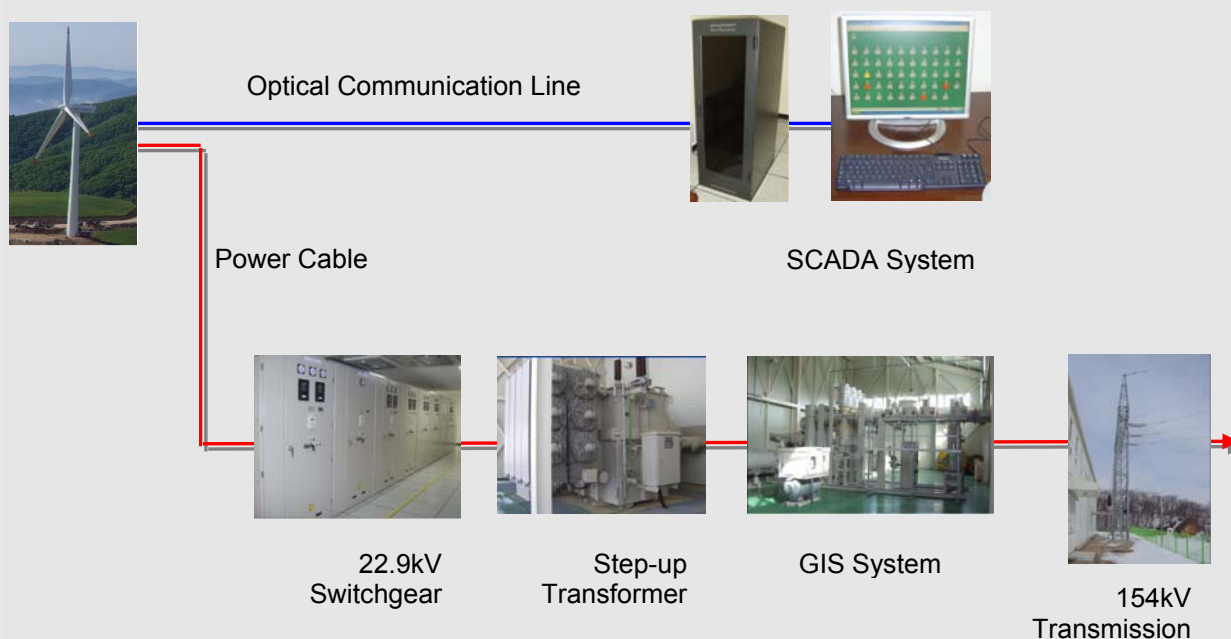
>> During this monitoring period, the average wind speed is 8.4 m/s, electricity generation is 65,492 MWh, capacity factor is 30.3% and availability is 98.5%.

Major maintenance work in this monitoring period is 1 HV transformer replacement for WTG No.13 on 25/11/2012.

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.

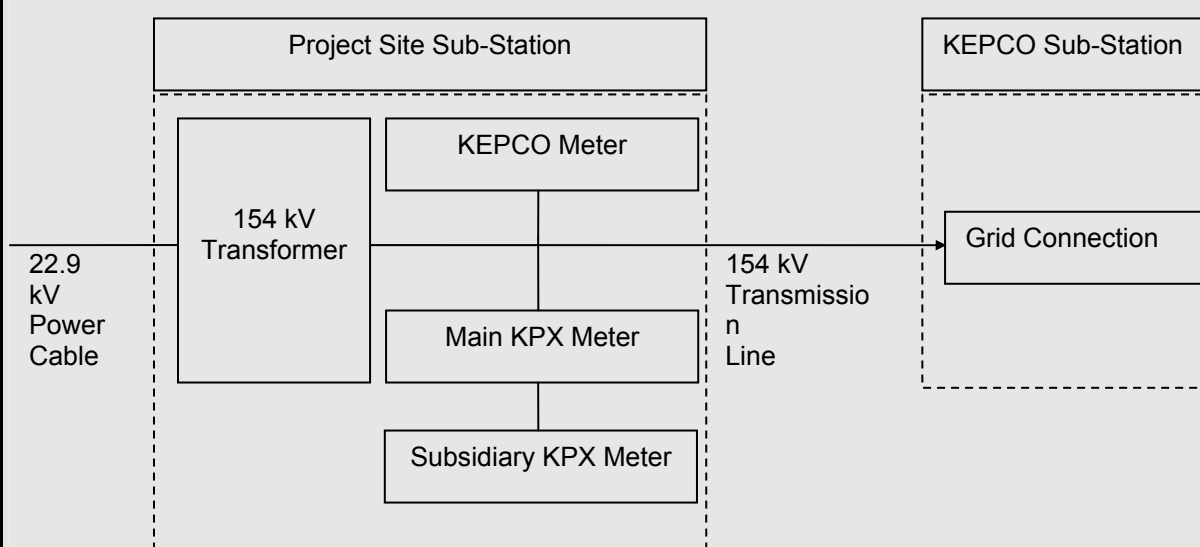
B.2.6. Types of changes specific to afforestation or reforestation project activity

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

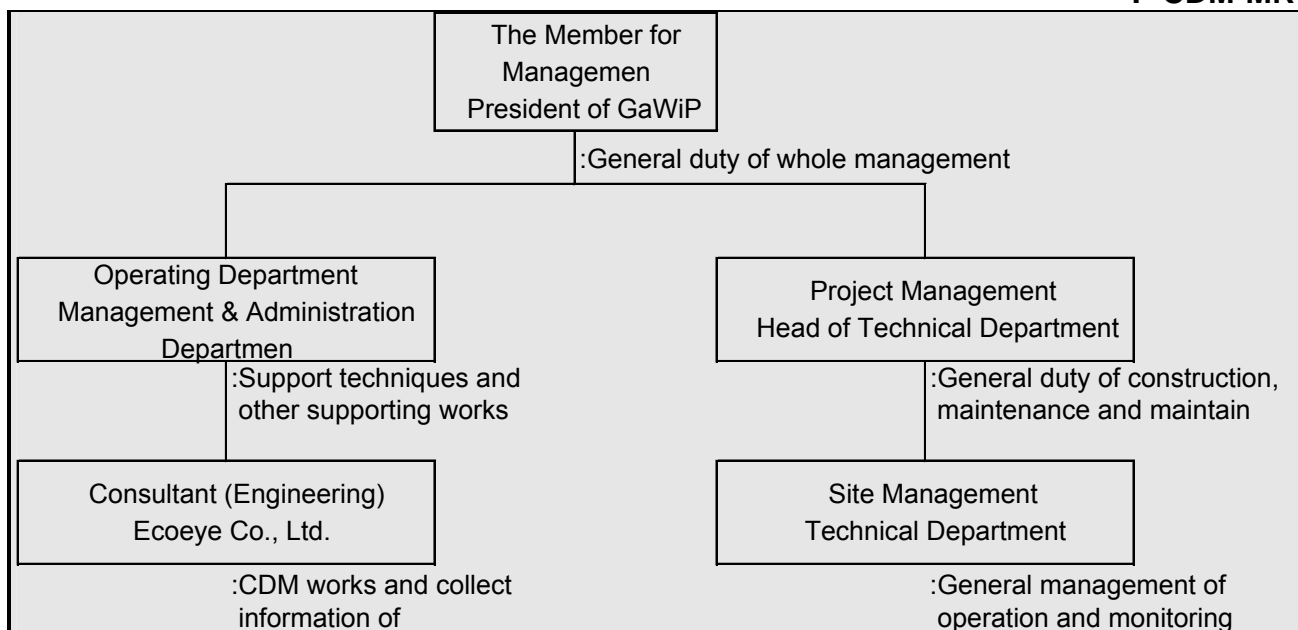
SECTION C. Description of monitoring system

>> 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:

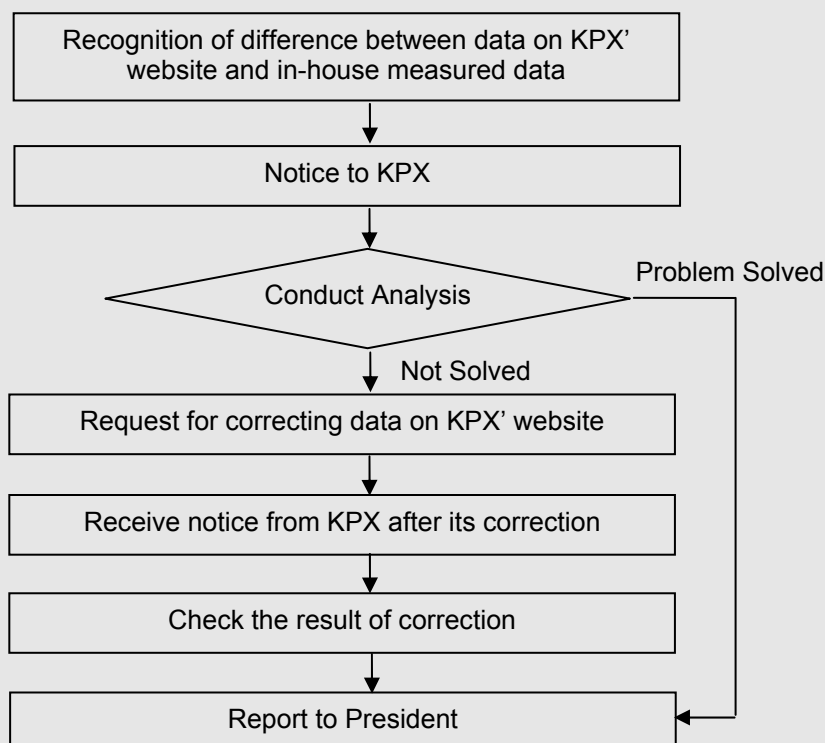


In accordance with monitoring plan, the operational and management structure to monitor emission reductions generated by the project activity is set up as follows:



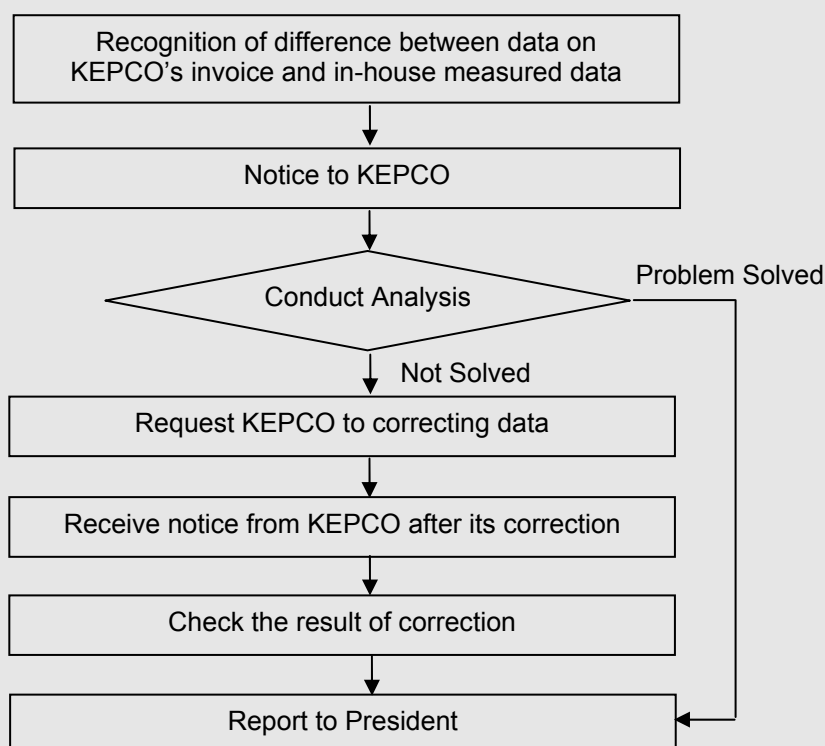
The amount of electricity delivered to the grid is measured automatically by the KPX meters and wireless transmitted to KPX on real time basis. The assigned monitoring members of the project activity collect and store the measured data electronically on hourly, daily, weekly and monthly basis. The measured 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 ₂ e/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:	R₁
Unit:	Ω
Description:	Wire Resistance of one transmission line
Source of data:	Specifications of transmission cable maker
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:	65,491.506		
Monitoring equipment:	KPX Meter	Main	Subsidiary
	Type	SC8000AY1B_b	TWR-ALM1
	Accuracy Class	0.2	0.5
	Serial Number	AR-0111A064-02	4349760
	Calibration Frequency	3 years and 6 months \pm 6 months from last calibration	3 years and 6 months \pm 6 months from last calibration
	Last Calibration Date Validity	11/09/2012 10/09/2016	11/09/2012 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:	169.238		

Monitoring equipment:	KEPCO Meter	
	Type	LK3410CP-005
	Accuracy Class	1.0
	Serial Number	1298472
	Calibration Frequency	every year
	Last Calibration Date	26/09/2012
	Validity	31/12/2013
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:	109.199
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	$I_p = P / (1.732 \times V \times T)$ $I = I_p / PF$ $MW \text{ Loss} = I^2 R_3 / 1,000$ $MWh \text{ Loss} = I^2 R_3 \times T / 1,000$ <p>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 (0.988) R₁ : Wire Resistance of one transmission line (0.813 Ω) R₃ : Wire Resistance of three transmission lines V : Voltage on the transmission line (159.145kV)</p>
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_2012-2.

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:	0.0005 (Rounded to the forth position after decimal point.)
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	$I_p = P / (1.732 \times V \times T)$ $I = I_p / PF$ $MW \text{ Loss} = I^2 R_3 / 1,000$ $MWh \text{ Loss} = I^2 R_3 \times T / 1,000$ <p> 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) R₁ : Wire Resistance of one transmission line (0.813 Ω) R₃ : Wire Resistance of three transmission lines V : Voltage on the transmission line (159.145kV) </p>
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_2012-2.

Data / Parameter:	EGy
Unit:	MW _y
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:	65,213.068
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_v in tCO_2e) are the product of the baseline emission factor (EF_v in tCO_2e/MWh) times the electricity supplied by the project activity to the grid (EG_v in MWh), as follows:

$$\begin{aligned}
 BE_{2012-2} &= EG_{2012-2} \times EF_{2012-2} \\
 &= 65,213.068 \text{ MWh} \times 0.6119 \text{ tCO}_2e/MWh \\
 &= 39,903.877 \text{ tCO}_2e
 \end{aligned}$$

The baseline emission factor EF_v 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. $EF_v = 0.6119 \text{ tCO}_2e/MWh$.

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_v 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_2012-2' and the final results are as follows:

Transmission losses for electricity amount delivered to the grid: 109.199MWh
 Transmission losses for electricity amount obtained from the grid: 0.0005MWh

The following table shows the results of the baseline emissions during the present monitoring period (01/10/2012 to 31/12/2012). 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_{2012-2} (MWh)	EF_{2012-2} (tCO_2e/MWh)	BE_{2012-2} Baseline Emission (tCO_2e)
	A	B	C	D	$E=A-(B+C+D)$	F	$G=E \times F$
October	16,274.684	99.209	23.858	0.0004247	16,151.617	0.6119	9,883.174
November	22,950.126	37.608	38.467	0.0000631	22,874.051	0.6119	13,996.632
December	26,266.696	32.421	46.874	0.0000454	26,187.401	0.6119	16,024.071
Total	65,491.506	169.238	109.199	0.000533	65,213.068		39,903.877

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 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	39,903.877	0	0	39,903.877

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)	37,691	39,903	-	-

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

>> The estimated emission reduction in the PDD is 37,691 tCO₂e (149,536 tCO₂e/year ÷ 365 x 92days) based on an electricity generation of 61,602MWh (244,400MWh/year ÷ 365 x 92days). The actual electricity generation of 65,492MWh from 01/10/2012 to 31/12/2012 is higher than the long-term average annual estimation because the average wind speed of 8.4m/sec during this monitoring period, which include the windiest months of November and December, is higher than long-term average annual estimation of 7.65m/sec. The project activity has achieved 39,903 tCO₂e of emission reductions which is 5.87% higher than the estimation in the PDD. However, total value of emission reductions achieved in full 2012 is 134,232 tCO₂e which is lower than estimated emission reduction in the PDD of 149,536 tCO₂e.

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
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Emission reductions or GHG removals by sinks (t CO ₂ e)	39,903	-	
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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		