

MONITORING REPORT

Version 02 (17/01/2012)

Gangwon Wind Park Project

Reference Number: 0222

The 5th Monitoring Period: 01/01/2011 - 31/12/2011 (both days included)

SECTION A. General description of the project activity

A.1. Brief description of the project activity: >>

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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.

The Project started construction on 12/05/2005, commissioning on 02/12/2005 and commercial operation of all 49 units on 01/09/2006 and was registered as CDM project on 20/03/2006.

Total emission reductions achieved in this monitoring period are 142,869 tonCO₂e.

A.2. Project Participants

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Name of entity (party) of project participants are as follows:

Gangwon Wind Power Co., Ltd. (the Republic of Korea)

Korea Midland Power Co., Ltd. (the Republic of Korea)

Ecoeye Co., Ltd. (the Republic of Korea)

Marubeni Corporation (Japan)

Eurus Energy Japan Corporation (Japan)

A.3. Location of the project activity:

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The Project site is located in the Samyang farmland along the mountain ridge in the eastern part of the Pyeongchang-Gun in Gangwon Province at the mid-east of 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".

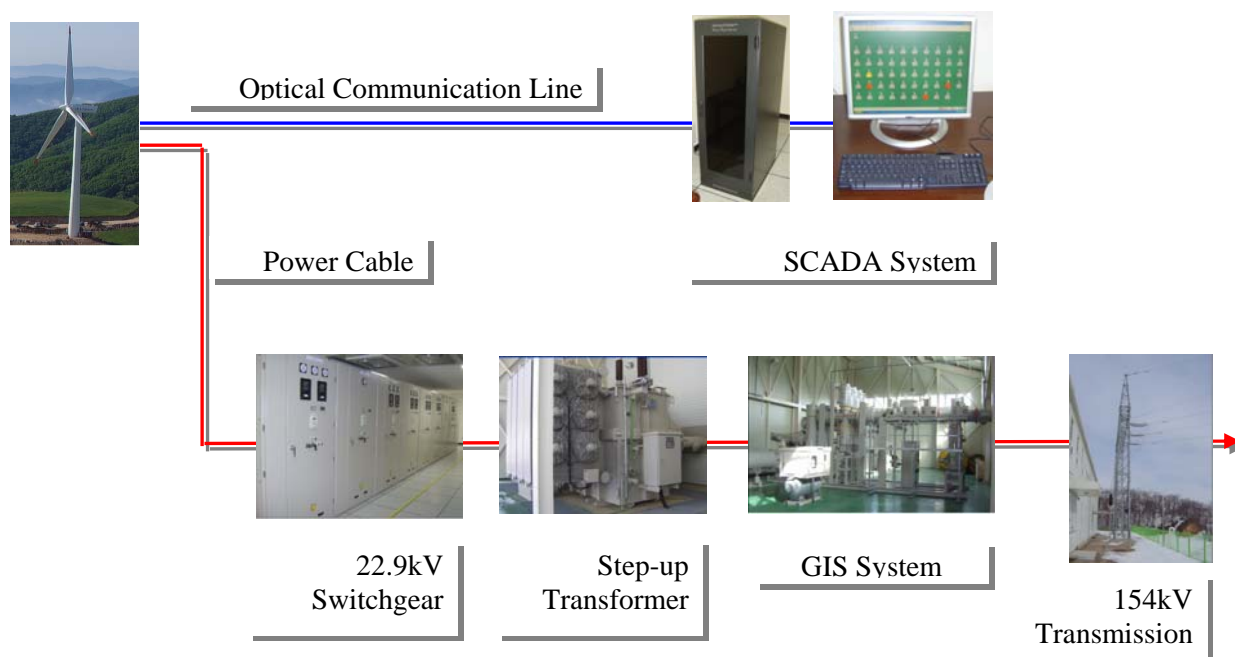
A.4. Technical description of the project

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The Project is the largest wind power generation project in the Republic of Korea with the total capacity of 98 MW by 49 units of wind turbines under operation. 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:



A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

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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.6. Registration date of the project activity:

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The project activity was registered as CDM project on 20/03/2006.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

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The starting date of the fixed crediting period for the project activity is 31/12/2006 and lasts until 30/12/2016.

A.8. Name of responsible person(s)/entity(ies):

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SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

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All 49 units of wind turbines with their combined nominal installed capacity of 98 MW have been commercially operated since 01/09/2006 and detailed implementation milestones of the project activity are as follows:

Established Gangwon Wind Power Co., Ltd.:	15/09/2002
Start Construction:	12/05/2005
Financial Close:	20/05/2005
Commercial operation:	01/09/2006
Electricity generation in 2006:	113,259 MWh
Electricity generation in 2007:	232,380 MWh
Electricity generation in 2008:	223,936 MWh
Electricity generation in 2009:	214,977 MWh
Electricity generation in 2010:	246,338 MWh

During the present monitoring period the average wind speed is 7.41 m/s, electricity generation is 234,840 MWh, capacity factor is 27.4% and availability is 97.8%.

The 2 generators had been replaced as WTG No. 28 on 08/08/2011 and WTG No. 32 on 06/05/2011. The 5 gearboxes had been replaced as WTG No. 6 on 12/05/2011, WTG No. 7 on 25/02/2011, WTG No. 18 on 18/08/2011, WTG No. 20 on 09/09/2011 and WTG No. 34 on 21/07/2011.

There was no event or situation in this monitoring period, which may impact the applicability of the methodology.

B.2. Revision of the monitoring plan

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The request for the revision of the monitoring plan due to discrepancy of calibration frequency has 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.3. Request for deviation applied to this monitoring period

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There was no deviation applied to this monitoring period.

B.4. Notification or request of approval of changes

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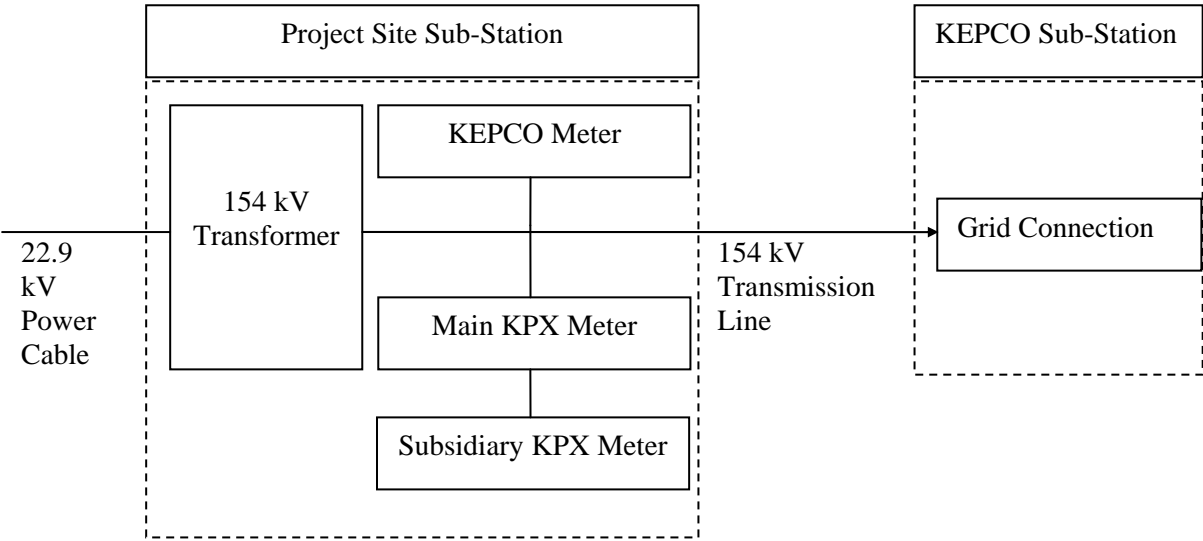
There was no notification or request of approval of changes from the project activity as described in the registered CDM-PDD.

SECTION C. Description of the monitoring system

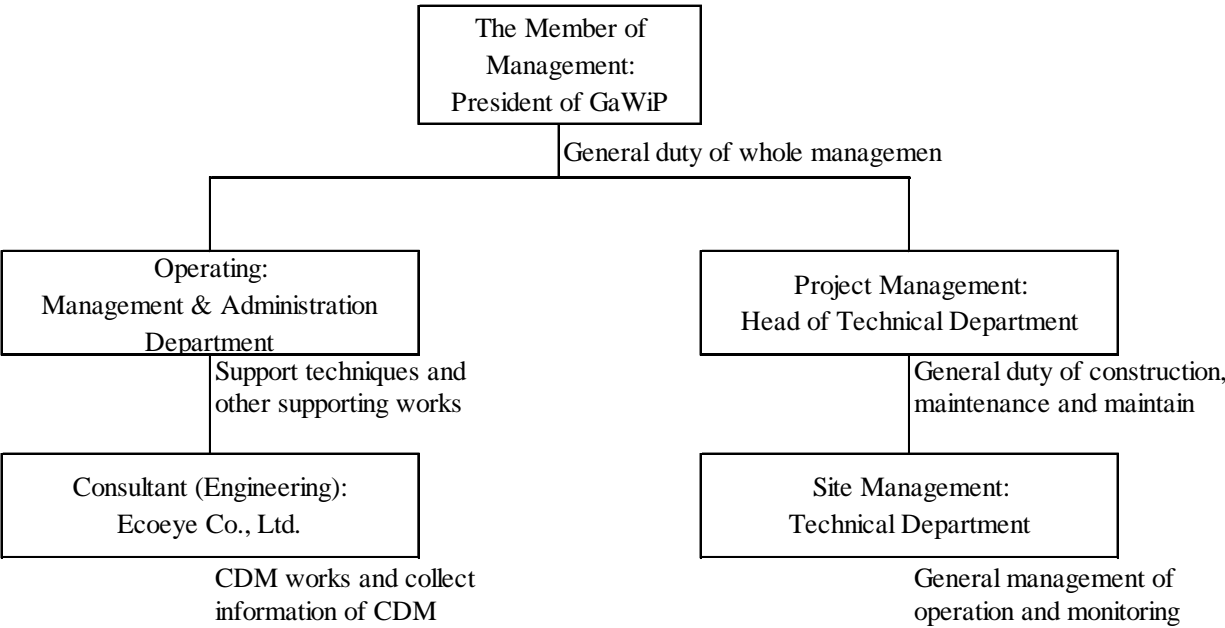
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The KPX (Korea Power Exchange) electricity meters (one main and one subsidiary) for measuring the amount of delivered electricity to the grid of KEPCO (Korea Electricity Power Company) is sealed after confirmation on the correct set up of the meters 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:

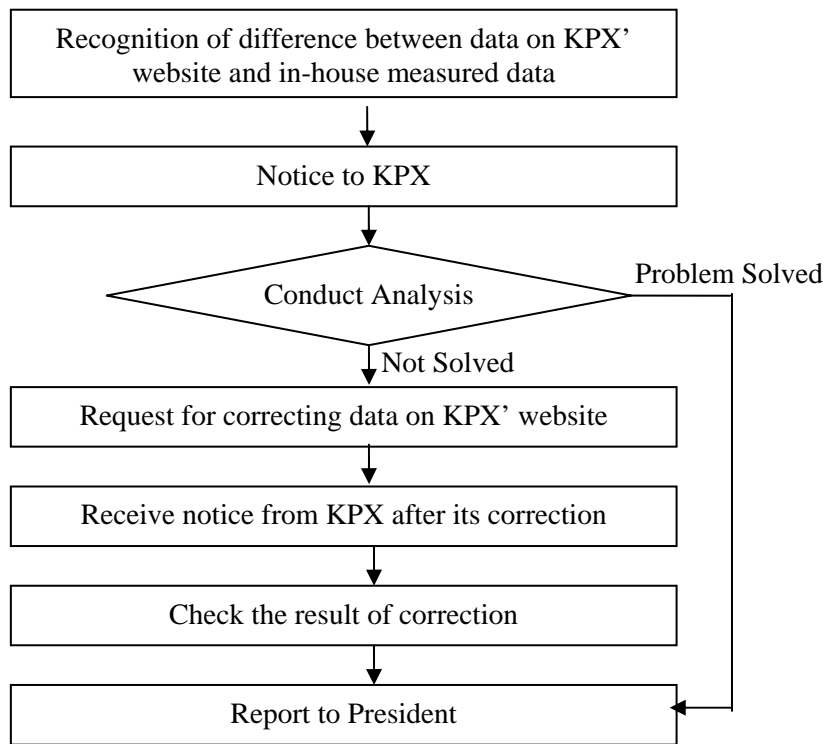


In accordance with monitoring plan, the operational and management structure to monitor emission reductions generated by the project activity is set up as follows:



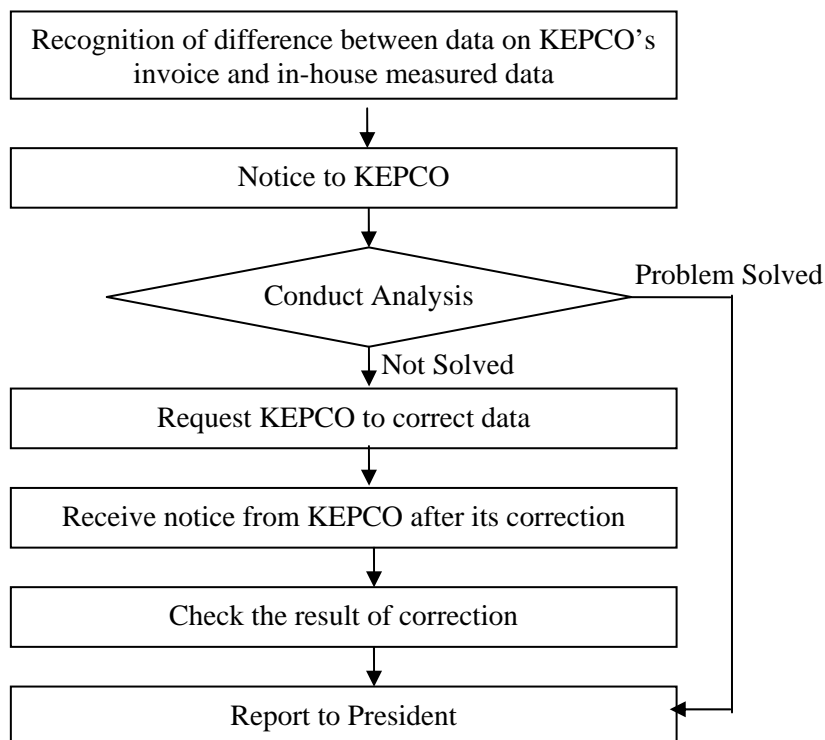
The amount of electricity delivered to the grid is measured automatically by the KPX meters and wireless transmitted to KPX on real time basis. The assigned monitoring members of the project activity collect and store the measured data electronically on hourly, daily, weekly and monthly basis. The measured 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 determined at registration and not monitored during the monitoring period, including default values and factors	
<i>(Copy this table for each data and parameter. To report multiple values, a table may be used)</i>	
Data / Parameter:	EF_v
Data unit:	tCO ₂ e/MWh
Description:	Baseline emission factor
Source of data used:	Registered PDD
Value(s) :	0.6119
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculation.
Additional comment:	

D.2.1 Data and parameters monitored			
<i>(Copy this table for each data and parameter. To report multiple values, a table may be used)</i>			
Data / Parameter:	Electricity delivered		
Data 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:	234,839.871		
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculation.		
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 ± 6 months from last calibration	3 years and 6 months ± 6 months from last calibration
	Last Calibration Date	29/09/2009	29/09/2009
	Validity	28/09/2013	28/09/2013
Measuring/ Reading/ Recording frequency:	This data is continuously measured, hourly read and daily recorded.		
Calculation method (if applicable):			
QA/QC procedures applied:	Double-check against collected data on KPX' website and KPX' receipt of sales.		

D.2.2 Data and parameters monitored
<i>(Copy this table for each data and parameter. To report multiple values, a table may be used)</i>

Data / Parameter:	Electricity obtained	
Data 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:	962.256	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculation.	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	KEPCO Meter	
	Type	LK3410CP-005
	Accuracy Class	1.0
	Serial Number	1298472
	Calibration Frequency	every year
	Last Calibration Date	06/09/2011
	Validity	31/12/2012
Measuring/ Reading/ Recording frequency:	This data is continuously measured, daily read and monthly recorded.	
Calculation method (if applicable):		
QA/QC procedures applied:	Compare with monthly KEPCO's invoice.	

D.2.3 Data and parameters monitored		
<i>(Copy this table for each data and parameter. To report multiple values, a table may be used)</i>		
Data / Parameter:	Delivered Transmission Loss	
Data unit:	MWh	
Description:	Delivered transmission loss to the grid	
Measured /Calculated /Default:	Calculated	
Source of data:		
Value(s) of monitored parameter:	392.430	
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculation.	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)		
Measuring/ Reading/ Recording frequency:		
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) PF : Power Factor of electricity generation</p>	

	V : 158kV T : Hours R ₃ : Wire Resistance of three transmission lines Note) Delivered transmission loss is calculated by daily basis.
QA/QC procedures applied:	

D.2.4 Data and parameters monitored	
<i>(Copy this table for each data and parameter. To report multiple values, a table may be used)</i>	
Data / Parameter:	Obtained Transmission Loss
Data unit:	MWh
Description:	Obtained transmission loss from the grid
Measured /Calculated /Default:	Calculated
Source of data:	
Value(s) of monitored parameter:	0.0042
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculation.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	
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 : Obtained power from the grid (measured) PF : Power Factor of electricity generation V : 158kV T : Hours R ₃ : Wire Resistance of three transmission lines Note) Obtained transmission loss is calculated by monthly basis.
QA/QC procedures applied:	

D.2.5 Data and parameters monitored	
<i>(Copy this table for each data and parameter. To report multiple values, a table may be used)</i>	
Data / Parameter:	EG_v
Data unit:	MWh
Description:	Net electricity supplied by the Project to the grid
Measured /Calculated /Default:	Calculated
Source of data:	
Value(s) of monitored parameter:	233,485.181
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This data is used for baseline emission calculation.

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Electricity delivered – (Electricity obtained + Delivered Transmission Loss + Obtained Transmission Loss)
QA/QC procedures applied:	

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

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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:

$$\begin{aligned}
 BE_{2011} &= EG_{2011} \times EF_{2011} \\
 &= 233,485.181 \text{ MWh} \times 0.6119 \text{ tCO}_2e/\text{MWh} \\
 &= 142,869.582 \text{ tCO}_2e
 \end{aligned}$$

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. $EF_y = 0.6119 \text{ tCO}_2e/\text{MWh}$.

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_2011' and the final results are as follows:

Transmission losses for electricity amount delivered to the grid: 392.430 MWh
Transmission losses for electricity amount obtained from the grid: 0.0042 MWh

The following <Table 1> shows the results of the baseline emissions during the present monitoring period (01/01/2011 to 31/12/2011). 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 the monitoring year 2011.

< Table 1 > Baseline Emissions Calculation

Month	Electricity Delivered (MWh)	Electricity Obtained (MWh)	Delivered Transmission Loss (MWh)	Obtained Transmission Loss (MWh)	EG ₂₀₁₁ (MWh)	EF ₂₀₁₁ (tCO ₂ e/MWh)	BE ₂₀₁₁ Baseline Emission (tCO ₂ e)
	A	B	C	D	E=A-(B+C+D)	F	G=E*F
January 2011	30,138.870	14.914	51.404	0.0000097	30,072.552	0.6119	18,401.395
February 2011	14,179.583	91.427	19.934	0.0004051	14,068.222	0.6119	8,608.345
March 2011	24,136.521	35.015	38.448	0.0000537	24,063.058	0.6119	14,724.185
April 2011	25,737.481	57.061	49.524	0.0001473	25,630.896	0.6119	15,683.545
May 2011	21,850.643	74.568	42.947	0.0002434	21,733.128	0.6119	13,298.501
June 2011	19,552.709	86.240	34.292	0.0003364	19,432.177	0.6119	11,890.549
July 2011	16,023.944	112.177	22.397	0.0005509	15,889.369	0.6119	9,722.705
August 2011	11,498.417	164.050	18.778	0.0011781	11,315.588	0.6119	6,924.008
September 2011	11,996.662	88.833	12.559	0.0003570	11,895.270	0.6119	7,278.715
October 2011	11,449.604	115.419	14.667	0.0005832	11,319.517	0.6119	6,926.413
November 2011	21,067.932	64.194	36.569	0.0001864	20,967.169	0.6119	12,829.811
December 2011	27,207.505	58.358	50.911	0.0001491	27,098.236	0.6119	16,581.411
Total	234,839.871	962.256	392.430	0.004200	233,485.181		142,869.582

E.2. Project emissions calculation

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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. Leakage calculation

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

E.4. Emission reductions calculation / table

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The project activity reduces carbon dioxide (CO₂) through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The amount of the emission reduction caused by the project activity during the monitoring period of 2011 is calculated as follows:

The emission reduction ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y).

$$\begin{aligned}
 ER_{2011} &= BE_{2011} - PE_{2011} - L_{2011} \\
 &= 142,869.582 \text{ tCO}_2\text{e} - 0 \text{ tCO}_2\text{e} - 0 \text{ tCO}_2\text{e} \\
 &= 142,869.582 \text{ tCO}_2\text{e}
 \end{aligned}$$

The amount of the emission reduction caused by the Project during the monitoring period of 2011 is calculated as below <Table 2>.

<Table 2> Emission Reductions Calculation

Month	BE ₂₀₁₁ Baseline Emission (tCO ₂ e)	PE ₂₀₁₁ Project Emission (tCO ₂ e)	L ₂₀₁₁ Leakage (tCO ₂ e)	ER ₂₀₁₁ Emission Reduction (tCO ₂ e)
	G=E*F	H	I	J=G-H-I
January 2011	18,401.395	0	0	18,401.395
February 2011	8,608.345	0	0	8,608.345
March 2011	14,724.185	0	0	14,724.185
April 2011	15,683.545	0	0	15,683.545
May 2011	13,298.501	0	0	13,298.501
June 2011	11,890.549	0	0	11,890.549
July 2011	9,722.705	0	0	9,722.705
August 2011	6,924.008	0	0	6,924.008
September 2011	7,278.715	0	0	7,278.715
October 2011	6,926.413	0	0	6,926.413
November 2011	12,829.811	0	0	12,829.811
December 2011	16,581.411	0	0	16,581.411
Total	142,869.582	0	0	142,869.582

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

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Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO ₂ e)	149,536	142,869

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

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The estimated emission reduction in the PDD is 149,536 tCO₂e based on an electricity generation of 244,400 MWh/year. The electricity generation of 234,840 MWh from 01/01/2011 to 31/12/2011 was lower than the long-term average annual estimation because the average wind speed of 7.41m/sec during this monitoring period was slightly lower than long-term average annual estimation of 7.65m/sec. The project activity has achieved 142,869 tCO₂e of emission reductions based on an electricity generation of 234,840 MWh, which is 4.46% lower than the estimation in the PDD.