



Monitoring report form for CDM project activity
(Version 07.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT

Title of the project activity	Samdal Wind Power Project	
UNFCCC reference number of the project activity	4661	
Version number of the PDD applicable to this monitoring report	6	
Version number of this monitoring report	1.0	
Completion date of this monitoring report	23/03/2020	
Monitoring period number	2nd Monitoring period	
Duration of this monitoring period	01/07/2013 ~ 31/12/2018	
Monitoring report number for this monitoring period	N/A	
Project participants	Hanshin Energy Co.,Ltd	
Host Party	Republic of Korea	
Applied methodologies and standardized baselines	ACM0002 ver.11 – Consolidated methodology for grid-connected electricity generation from renewable sources	
Sectoral scopes	Scope 1: Energy Industries (Renewable/non-renewable sources)	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	N/A	206,229 tCO ₂ e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	298, 741 tCO ₂ e	

SECTION A. Description of project activity**A.1. General description of project activity**

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

Samdal Wind Power Project is to build a wind power generating plant on Samdal-ri, Seongsan-eup, Seogwipo-si, Jeju Special self-governing province, the Republic of Korea. The project utilizes wind power which is generating no greenhouse gases emission into the atmosphere. The project is also supporting the government policy to promote new & renewable energy technology in Korea.

The capacity of each turbine is 3.0MW at max and the total capacity consisting of 11 turbines for the project is 33MW. The utilization rate of the turbine is 30.7%, so the annual power generation is estimated about 88,948MWh.

- Brief description of the installed technology and equipment**

Samdal wind power project consists of 11 wind turbines and total capacity is 33MW.

Item	Samdal
Unit	Vestas
Model	V90~3.0MW
Capacity(MW)	33MW

- Relevant dates for the project activity**

Events	Date
Start Crediting Period	01/07/2011
Registration Date	13/04/2011
Completion of Construction	14/12/2009
Electricity equipment test period	21/09/2009 ~ 27/09/2009
Starting Date of Operation	27/09/2009

- Total emission reductions achieved in this monitoring period**

From 01 July 2013 to 31 December 2018, the net generated electricity by the project is 337,969.839 MWh, corresponds to the emission reductions of 206,229 tCO_{2e}.

A.2. Location of project activity

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Host Party	Republic of Korea
Region/State/Province etc.	Jeju special self-governing province
City/Town/Community etc.	Seongsan-eup, Seogwipo-si
Physical/Geographical location	Samdal-ri (33°22'N 126°50'E)



A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Korea (Host Party)	Private entity : Hanshin Energy Co.,Ltd	No

A.4. References to applied methodologies and standardized baselines

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Title and version: ACM0002 – “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, Version 11.0.0, EB52

Reference: <https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG>

Tools:

Version 2.0 – Tool to calculate the emission factor for and electricity system;

Version 5.2 – Tool for the demonstration and assessment of additionality;

Reference: <https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG>

A.5. Crediting period type and duration

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Type: Fixed

Start date: 01/07/2011

Length of the crediting period: 10 years (01/07/2011 ~ 30/06/2021)

2nd monitoring period: 01/07/2013 ~ 31/12/2018**SECTION B. Implementation of project activity****B.1. Description of implemented project activity**

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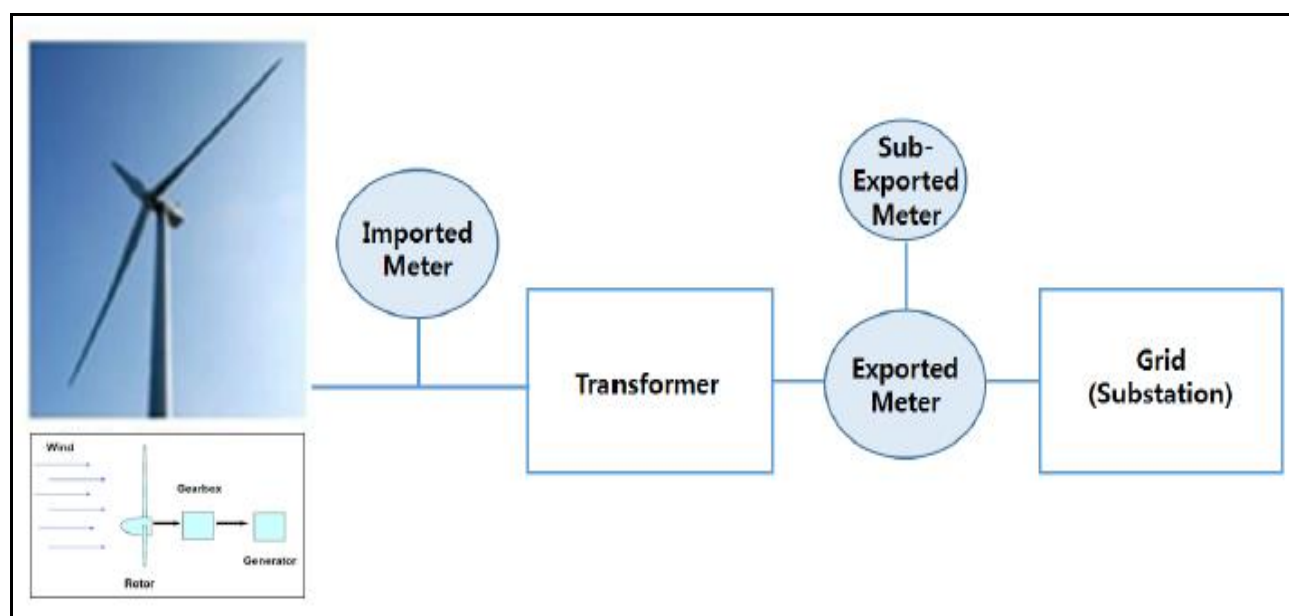
• Technical Process

Total installed capacity of this project is 33MW. The plant was installed total 11 wind turbines. Turbine model is V90-3.0MW produced by Vestas. V90-3.0MW has 3 blades consisting of carbon fibre for the load-bearing spars, by which it is relatively lighter than similar V80 tower.

The amount of generated electricity is depends on daily weather condition, especially wind velocity. The voltage of generated electricity is increased by the transformer at the plant for decreasing transmission loss. And the high voltage electricity is transmitted to substation which is connected with the grid. All of generated electricity is transmitted to the substation, and electricity for internal use is imported separately. The amount of export and imported electricity is checked by each watt-hour meter and technical process is monitored by computer system.

• System diagram

The flow diagram below illustrates the wind turbine system and the monitoring equipment locations to show the detail of the project activity:



- **Installed technology**

The table gives information about the technical specifications of the main equipment in the power-generating process:

Item	Details	
Rotor	Diameter	90 m
	Weight	41 t
	Area swept	6,362 m ²
	Normal resolutions	16.1 rpm
	Operational interval	9.9~18.4 rpm
	Number of blade	3
	Power regulation	Pitch/OptiSpeed
	Air brake	Full blade pitch by three separate hydraulic pitch cylinders
Operational Data	Cut-in wind speed	4 m/ sec
	Nominal wind speed (3000kW)	15 m/sec
	Stop wind speed	25 m/sec
Generator	Type	Asynchronous with OptiSpeed
	Rated output	3,060 kW
	Operational data	60 Hz, 1,000 V
Gearbox	Type : One planetary/helical three stages	
Control	Microprocessor-based control of all the turbine functions with the option of remote monitoring. Output regulation and optimisation via Optispeed and OptiTip pitch regulation.	
Tower	Hub height: 80 m Weight: 160 t	
Weight (IEC)	Tower	160 t
	Nacelle	70 t
	Rotor	41 t
	Total	271 t

- **Information on the implementation and actual operation of the project activity**

The details related to the actual operation of the project activity and the time which is not working during this monitoring period are shown below,

Event	Samdal Wind Power Project						
Downtime	Number of times of event per year						
	PAD No.	2013	2014	2015	2016	2017	2018
	Samdal 01	3	20	20	22	19	13
	Samdal 02	2	14	11	13	9	23
	Samdal 03	1	12	19	16	17	32
	Samdal 04	2	11	9	15	12	19
	Samdal 05	5	7	17	15	13	14
	Samdal 06	4	9	13	10	11	19
	Samdal 07	5	12	12	15	12	19
	Samdal 08	0	10	10	10	9	21

	Samdal 09	1	16	7	23	11	19
	Samdal 10	1	17	3	15	21	26
	Samdal 11	5	10	11	17	11	13
*Details of the above table are attached in Excel							
Equipment exchange	N/A						

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

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N/A

B.2.2. Corrections

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• PRC-4661-001 (Approval date:28/04/2014)

- Main equipment of correction based on typing miss.

Data	Registered monitoring plan	Changes
Operational interval of Rotor	8.6~18.4 rpm	9.9~18.4 rpm
Rated Output of Generator	3,000kW	3,060kW
Type of Gear Box	Two Planetary/ helical three stages	One Planetary/ helical three stages

- This table of EG_y value is simple declared error when draw up the PDD.

Data	Registered monitoring plan	Changes
EG _y	"0.6351"	"0.6102"

B.2.3. Changes to the start date of the crediting period

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N/A

B.2.4. Inclusion of monitoring plan

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N/A

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

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• PRC-4661-001 (Approval date: 28/04/2014)

- Data and parameters monitored (Section B.7.1.)

Data	Registered monitoring plan	Changes
EG _{export,y}	"Main meter is installed at substation."	"Main and Sub meter for EG export and Sub will be used when the Main is malfunctioned."
EG _{consumption,y}	"The allowable error of data must be within $\pm 0.2\%$."	"The allowable error of data must be within $\pm 0.5\%$."

- Description of the monitoring plan (Section C 1. Monitoring equipment)

Data	Registered monitoring plan	Changes
QA/QC	"1-3. The meters shall be calibrated when they are installed, and re-calibrated every three years after the installation. (Act on operation of electricity market 7.3.1, 2009.1.1)"	"The exported meters shall be calibrated when they are installed, and re-calibrated every three years after the installation. (Act on operation of electricity market 7.3.1, 2009.1.1) The watt-hour meter for electricity imported from the grid is not within the control of project participants and calibration frequency of the watt-hour meter in national standard is once in 7 years."
	"1-5. Allowable error of the export and import meter is $\pm 0.2\%$."	"Allowable error of the export meter is $\pm 0.2\%$ and imported meter is $\pm 0.5\%$."

B.2.6. Changes to project design

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N/A

B.2.7. Changes specific to afforestation or reforestation project activity

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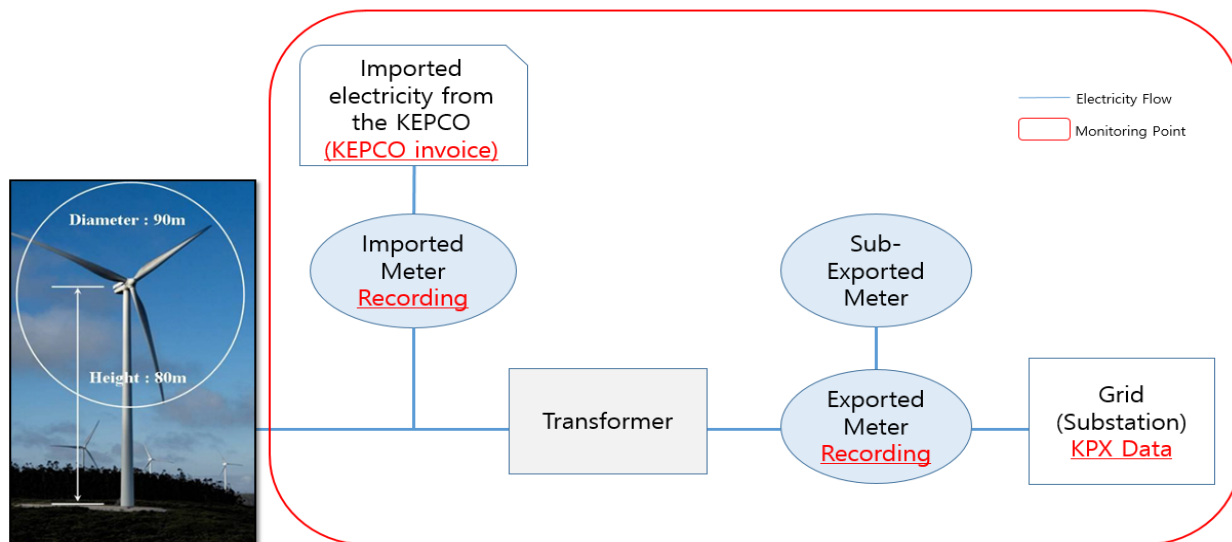
N/A

SECTION C. Description of monitoring system

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• Data collection procedure and Monitoring Point for the project

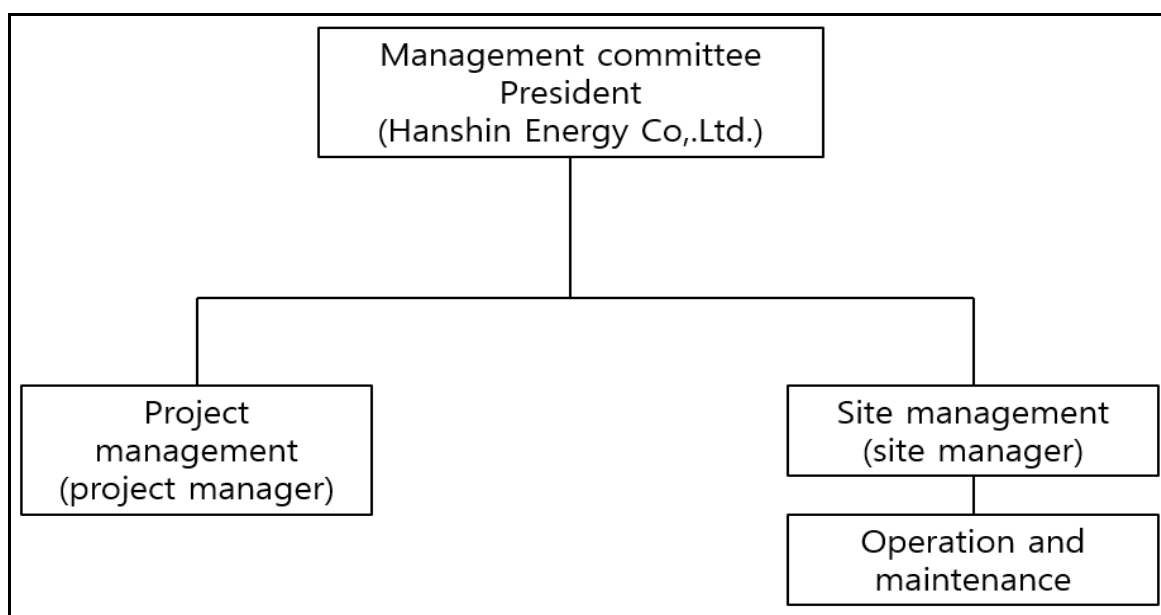
The diagram describes the way in which electricity is generated and how it is then used in the process of



- 1) Measurement of electricity meters established on the site
- 2) Aggregation of measured data
- 3) Recording of measured data
- 4) Transfer of measured data to KPX
- 5) Recording of KPX data and KEPCO data
- 6) Calculation of emission reduction

- **Operational and management structure**

The diagram below shows the operation and management structure for monitoring:



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

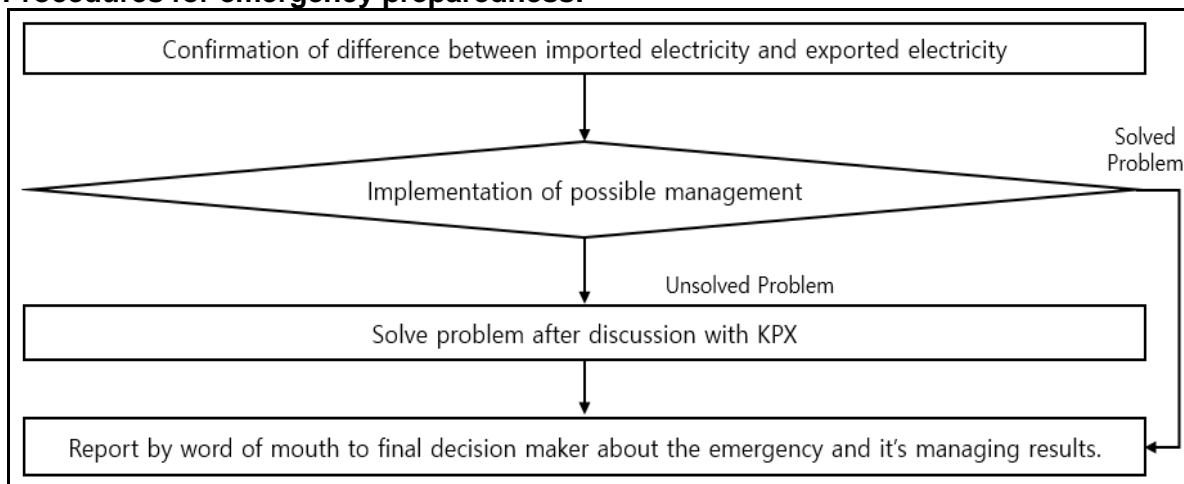
- **Monitoring equipment**

1. Electricity measuring meters is set up transparently in accordance with “Law regarding measurement” and “Act on operation of electricity market” and shall be sealed after affirmation of Korea Power Exchange.
2. The meters is authorized through the due formal certifying process (the valid period for the authorized certification: 7 years.) (Act on operation of electricity market 7.3.8, 2009.1.1)
3. The meters is calibrated when they are installed, and re-calibrated every three years after the installation. (Act on operation of electricity market 7.3.1, 2009.1.1). The Watt-hour meter for electricity imported from the grid is not within the control of project participants and calibration frequency of the watt-hour meter in national standard is once in 7 years.
4. The metering equipment measuring point is installed and maintained. (Act on operation of electricity market 4.1.1, 2009.1.1)
5. Allowable error of the export meter is $\pm 0.2\%$ and imported meter is $\pm 0.5\%$.

- **Monitoring of amount of electricity**

1. The amount electricity transmitted to the grid is measured automatically by the established meters. The measured variables are simultaneously transferred to Samdal wind park central control system.
2. The measured amount of electricity is collected daily, weekly and monthly and is archived in electronic way.
3. The collected variables compared in clause 2. is compared with those of Korea Power Exchange.
4. If the two variables compared in clause 3. are different, the operation of condition of electricity meters and other equipments are examined. In case meters are improperly operated equipment, internal investigation and correction procedure shall be followed and be certified by the final decision-maker and Korea Power Exchange.

- **Procedures for emergency preparedness:**



- **Management of monitoring and electricity safety and training**

1. The person in charge for monitoring and electricity safety is attend the monitoring courses regularly. Initial training or employees in site are provided by the equipment supplier. If there are additional employees or changes of operating manual, VESTAS is responsible for training them. VESTAS is undergo training for operation of monitoring system, emergency preparedness and management of data following operating manual. Training include an organized course of theoretical and practical components.
2. In case of absence of the responsible person, the second responsible person is selected.
3. If the responsibility for monitoring and electricity safety is transferred to another person, one is approval by the final decision-maker.
4. If metering equipment is properly maintained and checked according to the national or professional requirement by qualified third party designated if being out of work.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	EF _y
Unit	tCO ₂ /MWh
Description	CO ₂ emission factor of the Jeju special self-governing province.
Source of data	This value was calculated according to "Tool to calculate the mission factor for an electricity system.(Ver.2)" Applied value was calculated by referring Statics of Electric Power in 2005-2007, KEPCO 2006-2008 and Status of Generation facility (2008) (Korea Power Exchange). When the OM _{EF} supplied to Jeju Special self-governing province by using a weight average of OM(inland). Electricity generation in Jeju Special self-governing province, so interconnection tie from inland must be needed.
Value(s) applied	0.6102
Choice of data or measurement methods and procedures	Calculated
Purpose of data/parameter	Emission reduction calculation
Additional comments	<ul style="list-style-type: none"> - The same value will be applied during the crediting period without updating. - For detail calculation method, refer to the PDD of this project.

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data/Parameter	$EG_{\text{facility},y}$
Unit	MWh
Description	The Quantity of net electricity generated supplied by the project plant to the grid in year y
Measured/calculated/default	Calculated
Source of data	Calculated as export of electricity($EG_{\text{export},y}$) minus consumption of electricity($EG_{\text{consumption},y}$)
Value(s) of monitored parameter	Net electricity: 337,969.839 MWh <ul style="list-style-type: none"> Net electricity = Exported electricity – Imported electricity (337,969.839 MWh = 340,111.458 MWh – 2,141.619 MWh)
Monitoring equipment	Watt-hour meters for exported and imported electricity
Measuring/reading/recording frequency	<ul style="list-style-type: none"> Exported electricity: real-time measured and daily recorded Imported electricity: real-time measured and monthly recorded
Calculation method (if applicable)	$EG_{\text{facility},y} = EG_{\text{export}} - EG_{\text{consumption},y}$
QA/QC procedures	<ul style="list-style-type: none"> Allowable error Exported electricity data: within $\pm 0.2\%$ Imported electricity data: within $\pm 0.5\%$
Purpose of data/parameter	This value is used for baseline emission calculation
Additional comments	-

Data/Parameter	$EG_{\text{export},y}$
Unit	MWh
Description	The Quantity of annual electricity delivered to the grid by proposed project
Measured/calculated/default	Measured
Source of data	Measured by Watt-hour meters installed at the project site
Value(s) of monitored parameter	340,111.458 MWh
Monitoring equipment	Measurement equipment <ul style="list-style-type: none"> Type: Watt-hour meter Quantity: 2 (Main meter: 1, Backup meter: 1)
Measuring/reading/recording frequency	Real-time measured and daily recorded
Calculation method (if applicable)	Not applicable
QA/QC procedures	The allowable error of data is $\pm 0.2\%$
Purpose of data/parameter	This value is used for baseline emission calculation
Additional comments	-

Data/Parameter	$EG_{\text{consumption},y}$
Unit	MWh
Description	The Quantity of annual electricity delivered to the grid by proposed project
Measured/calculated/default	Measured
Source of data	Measured by Watt-hour meters installed at the project site
Value(s) of monitored parameter	2,141.619 MWh

Monitoring equipment	Measurement equipment - Type: Watt-hour meter - Quantity: 1
Measuring/reading/recording frequency	Real-time measured and monthly recorded
Calculation method (if applicable)	Not applicable
QA/QC procedures	The allowable error of data is $\pm 0.5\%$
Purpose of data/parameter	This value is used for baseline emission calculation
Additional comments	-

D.3. Implementation of sampling plan

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N/A

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

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The formulae used to calculate the baseline emission is:

$$BE_y = EG_{PJ,y} * EF_{grid,CM,y}$$

Where:

BE_y Baseline emissions in year y (tCO₂/yr)

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ Combined margin CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO₂/MWh)

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

$EG_{PJ,y}$ Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EG_{facility,y}$ Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

$$EG_{facility,y} = EG_{export} - EG_{consumption}$$

$$\begin{aligned} BE_y &= 337,969.839 \text{ MWh/year} * 0.6102 \text{ tCO}_2/\text{MWh} \\ &= 206,229.2 \text{ tCO}_2/\text{yr} \end{aligned}$$

E.2. Calculation of project emissions or actual net removals

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According to the methodology ACM0002 version 11, for most renewable power generation project activities are 0. Therefore, the amount of project emissions is zero.

$$PE_y = 0 \text{ tCO}_2$$

E.3. Calculation of leakage emissions

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In accordance with the methodology ACM 0002 version 11, no leakage emissions are considered.

$$LE_y = 0 \text{ tCO}_2$$

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	206,229.2	0	0	-	206,229.2	206,229.2

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
206,229	298,741

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

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The annual emission reduction estimated in the PDD is 298,741 tons.

This monitoring period (01/07/2013 ~ 31/12/2018) is 2009 days. Therefore, amount estimated ex-ante for this monitoring period in the PDD is 298,741 tons.

E.6. Remarks on increase in achieved emission reductions

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The actual amount of emission reduction in the monitoring period is 206,229 tCO₂e, which is about 31% lower than estimated in the PDD.

E.7. Remarks on scale of small-scale project activity

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N/A

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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 <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • 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 (EB 70, 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).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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