Monitoring report form for CDM project activity
(Version 06.0)

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

MONITORING REPORT		
Title of the project activity	San Antonio El Sitio Wind Power Project	
UNFCCC reference number of the project activity	6973	
Version number of the PDD applicable to this monitoring report	04.3	
Version number of this monitoring report	01	
Completion date of this monitoring report	19/09/2018	
Monitoring period number	01	
Duration of this monitoring period	19/04/2015 – 31/07/2018	
Monitoring report number for this monitoring report	01	
Project participants	Eólico San Antonio El Sitio, S.A.	
Host Party	Guatemala	
Sectoral scopes	Sectoral Scope 1: Energy Industries – Renewable Sources	
Applied methodologies and standardized baselines	ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 12.3.0)	
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
	0	230,549
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	291,654	

SECTION A. Description of project activity

A.1. General description of project activity

The San Antonio El Sitio Wind Power Project (the "Project") consists of installing sixteen 3.45 megawatt ("MW") Vestas V112 wind turbine generators ("WTG"), for a total capacity of 55.2 MW. San Antonio El Sitio is expected to provide an expected 135,654.59 GWh per year to the Guatemalan National Interconnected System.

The Project will be located in Guatemala, in Los Llanos village of the municipality of Villa Canales, in an area considered appropriate for wind energy generation. The Project is a Greenfield development, in an area where no other electricity generating plant has been previously sited.

The San Antonio El Sitio Wind Power Project will contain the basic elements of a wind farm: wind turbines, wind measuring stations, an operations building and an electrical substation. A WMP6000 control system will be used to supervise, monitor and control all relevant project components.

Wind energy technologies are considered environmentally safe; there are no greenhouse gases or other emissions due to the direct operation of these projects. Similarly the San Antonio El Sitio Wind Project will have no greenhouse gases ("GHG") or other harmful emissions related to its operation, and will displace carbon dioxide emissions from electricity generation derived from fossil fuelled power plants.

Around 47% of generation in the Guatemalan grid (namely, National Interconnected System, "NIS") is provided by fossil fuels including fuel oil, diesel and coal[1]. Therefore in the absence of the project activity, its electricity would be provided by the operation of grid-connected power plants (as well as by the addition of new generation sources), which in Guatemala have an estimated Combined Margin Emission Factor of 0.6 tCO2/MWh, as described below in Section B.6. This is the baseline scenario corresponding to this project activity. By providing 135,655 MWh/yr, the project is expected to annually displace 81,392 tCO2. This will occur since the wind energy will displace generation that would otherwise be derived from carbon-intensive power plants.

The San Antonio El Sitio Wind Power Project is an initiative of the private enterprise Eólico San Antonio El Sitio, S.A.

A.2. Location of project activity

Guatemala

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Guatemala (host)	Private entity (Eólico San Antonio El Sitio, S.A.)	No.

A.4. Reference to applied methodologies and standardized baselines

Approved baseline and monitoring methodology applied:

ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 12.3.0)

The following tools were applied together with the methodology:

- "Tool for the demonstration and assessment of additionality" (Version 06.0.0)

[1] Source: AMM Statistics (see baseline spreadsheet attached).

- "Tool to calculate the emission factor for an electricity system" (Version 06.0)
- "Guidelines on additionality of first-of-its-kind project activities" (Version 01.0)

A.5. Crediting period type and duration

Project has a fixed 10 year crediting period that commenced on 19/04/2015 and runs for 10 years until 18/14/2025.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

B.1.1 Implementation Status

All 16 units of the project were commissioned starting December 9, 2013 and commercial operation approval was granted on 19/04/2015. The project has been operating since 19/04/2015.

B.1.2. Operation of the activity

During the current monitoring period 288,785 MWh of electricity delivered to the Guatemalan National

Interconnected System (SIN). No events have impacted the applicability of the baseline and monitoring methodology since the project initiated commercial operation.

B.1.3 Installed technologies

The functional layout of the San Antonio El Sitio Wind Power Project location consists of all the main elements of a wind farm: wind turbines, wind measuring stations, an operations building (with metering equipment), internal roads between turbines and an electrical substation.

The Wind Turbine Generator ("WTG") chosen for the Project activity is the Vestas 112, which is 84 meters high. This generator has a generating capacity of 3.45 MW and 16 units will be installed, to provide a total capacity of 55.2 megawatt. The Project will have a net energy production of 135,654 MWh per year.

A VMP6000 (Vestas Multi Processor) control system will supervise, monitor and control all equipment in the wind farm (i.e. WTGs, meteorological masts, and electrical substation, among others). The control system functions in real time to operate individual turbines continuously, and is designed to react to variable wind speed to maximize power output and minimize loads and noise.

The equipment has been developed and tested with regard to the following main standards:

- Load Assumptions according to IEC 61400-22, Class IIA
- Safety System of Machinery, Safety – related Parts of Control Systems. IEC 13849-1
- Safety System of Machinery – Electrical Equipment of Machines, IEC 60204-1
- Rotor Blade diameter 112.0 m
- Machinery Components 50/60 Hz
- Tubular Steel Tower, Hub Heights at 84 meters, IEC 64100-1 Edition 3
- Lightning protection IEC 62305-1: 2006, IEC 62305-3: 2006, IEC 62305-4: 2006; IEC/TR 61400-24:2002
- Nacelle Cover and Hub IEC 64100-1 Edition 3 and EN 50308
- Design lifetime 20 years according to Vestas.

The power curve used for the calculation of the annual production of energy corresponds with the power curve furnished in the WindLogics wind study for the Project. Vestas has reviewed power curves of the potential WTG for the site and forecasted the P50 Net Capacity Factor to be 143,436

MWh per year. This value is adjusted for 97% availability and 2.5% electrical losses, for a net production of 135,654.59.

The energy produced by each of the turbines will be delivered to the collector substation through 34.5 Kv underground circuit cables. The collector substation consists of a building that will house the system of medium voltage, control equipment, protection and communications associated with substations. This substation will raise the voltage from 34.5 Kv to 230 Kv.

B.2. Post-registration changes

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

No temporary deviations have been applied during this monitoring period.

B.2.2. Corrections

No corrections were made to project information or parameters fixed at the registration of the project activity.

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

The following changes were made to project information or parameters fixed at the registration of the project activity:

Changes	Status	Approval dates and reference numbers
Changes to the start date of the crediting period from 01/11/2013 to 19/04/2015.	(b) Correction approved by the Board as applicable from this monitoring period.	06/09/2018 PRC-6973-001

B.2.4. Inclusion of monitoring plan

Monitoring Plan was submitted with original registered PDD.

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

No permanent changes have been applied to the monitoring plan or applied methodology. Due to the project delay the baseline data was updated to reflect a more conservative baseline.

Permanent Changes	Status	Approval dates and reference numbers
Project emission factor was updated.	(b) Correction approved by the Board as applicable from this monitoring period.	06/09/2018 PRC-6973-001

B.2.6. Changes to project design

The following changes were made to project design of the project activity

Corrections	Status	Approval dates and reference numbers
The effective output capacity was changed due to an increase in	(b) Correction approved by the Board as applicable from this monitoring	06/09/2018 PRC-6973-001

installed capacity.	period.	

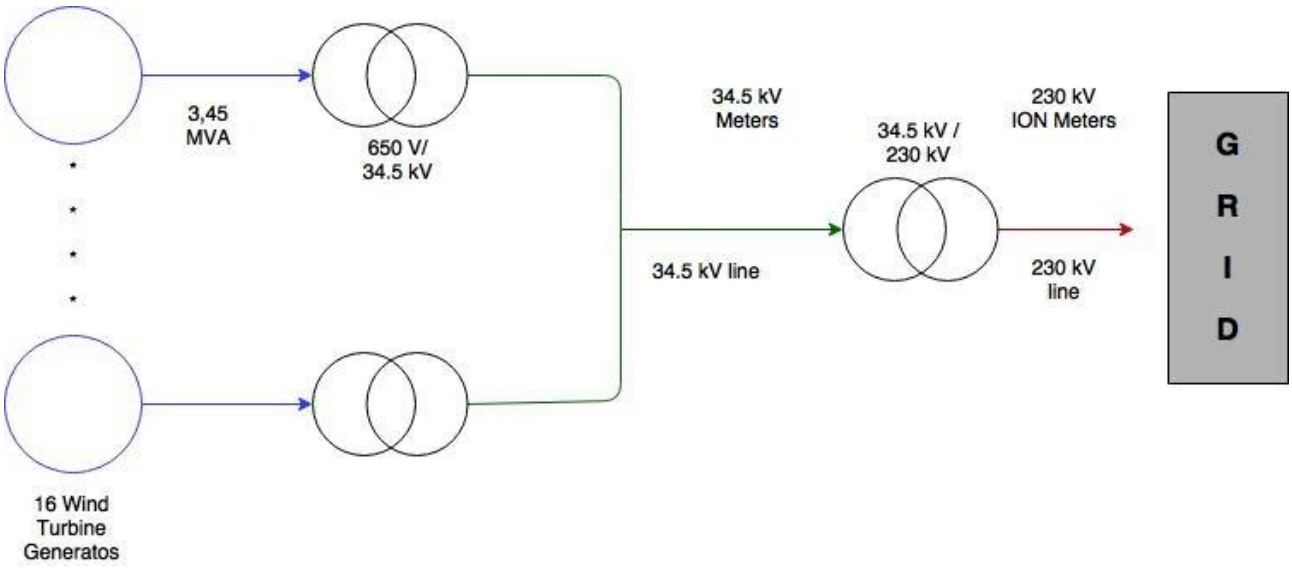
SECTION C. Description of monitoring system

The monitoring plan comprises the compilation and filling of all relevant data needed to estimate the emissions reductions by the CDM project activity. Its objective is to assure the complete, consistent, clear, and accurate monitoring and calculation of emissions reductions within the project activity boundaries, during this monitoring period

The Project has formed a multidisciplinary team which is responsible for monitoring the parameters, recording and analysing the data obtained. As per methodology ACM0002, version 12.3, the following parameter should be monitored:

- Net electricity generation supplied by the project plant/unit to the grid in period *y* ($EG_{facility,y}$)

Figure 1 Connection diagram



In Guatemala the interconnected system relies on a highly regulated metering system required to make payments for electricity possible. Therefore the main role for monitoring data is keeping records of hourly generation that the central dispatch maintains on file and cross referencing with billing information and public information of electricity generation from the Wholesale Market Administrator (or AMM in Spanish).

Monitoring is based on continuous metering of electricity generation on site using digital measurement equipment (ION 8650) at the substation (interconnection facility to the grid). Such meters are used for commercial, and maintenance purposes, in addition to the CDM reporting requirements. The data is read remotely using tele-measurement technology via a MWP6000 software.

For QA/QC there is a backup meter to ensure proper function of main meter. Additionally all information is compared with the official information made public by the Wholesale Market Administrator.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/TJ
Description	CO_2 emission factor
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National Greenhouse Gas Inventories. Available at: http://www.ipccnggip.iges.or.jp/public/2006gl/index.html
Value(s) applied	Fuel Oil: 75.5 tCO2/TJ Diesel: 72.6 tCO2/TJ Coal: 87.3 tCO2/TJ
Choice of data or measurement methods and procedures	No other data is publicly available. IPCC guidelines have been used in a conservative manner
Purpose of data/parameter	Calculations of baseline emissions
Additional comments	

Data/Parameter	$EG_{m,y}$
Unit	MWh
Description	Annual electricity generation of each power plant in the grid
Source of data	AMM
Value(s) applied	Data for the 2012-2014 period is shown on: **Table 8 (operating margin) and Table 10 (build margin) of PDD**
Choice of data or measurement methods and procedures	Data is obtained from official sources (AMM)
Purpose of data/parameter	Estimation of combined margin emission factor.
Additional comments	Annual data is available at: http://www.amm.org.gt/ (option “Generación” on the left column) Hourly generation data necessary for the lambda coefficients obtained from: http://www.amm.org.gt/portal/?page_id=145h (availability of both websites was consulted on 30/04/2017)

D.2. Data and parameters monitored

Data/Parameter	$EG_{facility,y}$
Unit	MWh in period y
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in period *y*
Measured/calculated/ default	Measured
Source of data	On-site metering system
Value(s) of monitored parameter	

<table>
<tr><td>Monitoring equipment</td><td>
<table>
<tr><td>Model</td><td>Serial</td><td>Main/Back-up</td><td>Last Calibration event</td><td>Remarks</td></tr>
<tr><td>ION 8650</td><td>MW-1412A961-01</td><td>MAIN</td><td>27/03/2018</td><td>Used for ER Calculations</td></tr>
<tr><td>ION 8650</td><td>MW-1412A962-01</td><td>BACK UP</td><td>27/03/2018</td><td>Used for cross checking</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Hourly measurements and monthly recording. Records of energy supplied to the grid are publicly available on the website for the Wholesale Market Administrator (www.amm.org.gt- resultados de operación)[2]</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Data will be continuously metered; generation data will be aggregated monthly for billing purposes. Electricity consumption from the grid (for start-up or auxiliary purposes) will be deducted from gross exports to the latter in order to obtain net electricity supplied to the NIS.</td></tr>
<tr><td>QA/QC procedures</td><td>The responsible of the meters and measurements according with the Wholesale Market Administrator Normative (Resolution Number 307-02) is in this case San Antonio El Sitio[3]. The AMM verifies the compliance with the normatives and the measurement data sent.

The standard procedures include:

Initially the project developer must provide all the information related to the project. During the unpacking of the meters a lab test is done, electricity is applied to verify its measurement. Furthermore, AMM does a site inspection of the functioning of the meters.

Meters have an accuracy rating of +/- 0.2% and will be calibrated annually by authorized entity AMM, or and qualified company. If during the test a condition isn´t optimal, the same test must be repeated in an early date. In addition the AMM can also effectuate a non-periodical verification (at least one)[4]. Data can be cross-checked with the receipts of sales.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Data used to calculate baseline emissions</td></tr>
<tr><td>Additional comments</td><td>Not applicable.</td></tr>
</table>

D.3. Implementation of sampling plan

Not applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

According to the methodology used in the registered PDD (ACM0002 version 12.3), baseline emissions are calculated using the following formula:

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

Where,

BE_y: Baseline emissions in year *y* (tCO_2/yr)

$EG_{PJ,y}$: Quantity of net electricity generation that is produced and fed into the grid as a result of the

[2] III. GHG Emissions/ Folders: AMM Production Report and Energy Reports (Summarized in Production Summary AMM excel file)

[3] Article 2, subsection 14.2

[4] Article 2, subsection 14.12 – 14.13

implementation of the CDM project activity in year *y* (MWh/yr)

$EF_{grid,CM,y}$: Combined margin CO_2 emission factor for grid connected power generation in period *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system (version 06.0)" (tCO_2/MWh)

For the specific case of greenfield projects, the methodology uses the notation $EG_{PJ,y} = EG_{facility,y}$ i.e. quantity of net electricity generation supplied by the project plant to the grid in period y.

Likewise, the CO_2 emission factor of the national connected grid ($EF_{grid,CM,y}$) is calculated ex-ante using the formula for the Combined Margin Emission Factor, consisting of the weighted average Operating Margin emission factor ($EF_{grid,OM,y}$) and Build Margin emission factors ($EF_{grid,BM,y}$), as follows:

$$EF_{grid,CM,y}: EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$$

The CO_2 emission factor is calculated ex-ante as 0.6 tCO2e/MWh and will be used throughout the first crediting period (i.e. this value will not be recalculated in every monitoring period).

Calculations of Baseline Emissions

	Unit	91/04/2015-31/07/2018
Net Electricity supplied to the grid by the project activity (EG_y)	MWh	384,248.56
CO2 emission factor of the national connected grid (EF_y)	tCO2/MWh	0.6
Baseline emissions (BE_y)	tCO2e	230,549.13

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

The proposed CDM project activity is a wind power system that does not generate project GHG emissions according to the methodology. A value of zero emissions is assigned to the project emissions, $PE_y = 0$.

E.3. Calculation of leakage emissions

No leakage emissions are considered: $LE_y = 0$.

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

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	230,549.13	0	0	0	230,549.13	230,549.13

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_2e)	Amount estimated ex ante (t CO_2e)
230,549.13	291,654.67

E.6. Remarks on increase in achieved emission reductions

Due to projects dependence on wind for energy production actual values will always differ from estimated values.