



**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**

<b>Title of the project activity</b>	Poechos I Project	
<b>UNFCCC reference number of the project activity</b>	0086	
<b>Version number of the monitoring report</b>	1	
<b>Completion date of the monitoring report</b>	11/01/2017	
<b>Monitoring period number and duration of this monitoring period</b>	7 01/04/2013 – 31/12/2015	
<b>Project participant(s)</b>	Sindicato Energetico S.A. (SINERSA) VERT CONSERVATION PTE LTD	
<b>Host Party</b>	Peru	
<b>Sectoral scope(s)</b>	1 : Energy industries (renewable - / non-renewable sources)	
<b>Selected methodology(ies)</b>	ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version 12.1.0	
<b>Selected standardized baseline(s)</b>	-	
<b>Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD</b>	90,337 <sup>1</sup> tCO <sub>2</sub> per two years and 9 months.	
<b>Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period</b>	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
	-	92,300 tCO <sub>2</sub> e

<sup>1</sup> Estimated Annual ERs = 0.56893 tCO<sub>2</sub>/MWh \* 57,740 MWh = 32,850 tCO<sub>2</sub> per year. As the monitoring period is two year and 9 months the expected emission reduction is 32,850 tCO<sub>2</sub> \*(2+9/12) = 90,337.5 tCO<sub>2</sub>, or 90,337 to be conservative.

## **SECTION A. Description of project activity**

### **A.1. Purpose and general description of project activity**

>> The Project is a hydroelectric power plant located in Peru, in the North-western Department of Piura and has an installed capacity of 15.2 MW.

This monitoring report covers the period 01/04/2013 – 31/12/2015, during the monitoring period the plant produced 166,456 MWh of electricity.

The objective of Poechos I Hydroelectric Plant is renewable electricity generation to be supplied to the Peruvian National Inter-connected Electric Grid (hereafter referred to as SEIN).

The Project generates electricity without emitting GHGs and supplies this electricity to the SEIN, displacing fossil-fuel based generation that would otherwise be supplied to the grid. Thus, the project will displace carbon dioxide emission.

Poechos I Hydroelectric Plant has reduced in this monitoring period 92,300 tCO<sub>2</sub>e. Methane and carbon dioxide that emitted to the atmosphere as a result of the construction and operation of the Project are negligible. Therefore, there is no need to monitor leakage, and such emissions were not taken into account when calculated emission reductions (ERs).

Poechos I Hydroelectric Power Project takes advantage of the existing Poechos reservoir, constructed between 1971 and 1974, exclusively for the irrigation system named Chira-Piura.

The technology employed is based on 2 conventional Kaplan turbines (7.8MW each) coupled to 2 three-phase synchronous generators (each of 9.5 MVA nominal capacity). The water is discharged into a tailrace channel (capacity 45 m<sup>3</sup> /s) connected to the existing energy dissipater (stilling basin) of the bottom outlet and, hence, is fed back to the irrigation system.

The construction of the Project started in June 2002 and the Project was commissioned in April 2004 with an expected plant operating life of 40 years.

The spatial extent of The Project boundary is the National Electric Grid (SEIN). The Project is connected to the SEIN through the Sullana Substation - which belongs to Electronoroeste S.A. (ENOSA).

#### **Relevant dates for the project:**

- HPP Poechos I was commissioned in 01/04/2004, and it has been in operation since then.
- The registration date of the project was 14 Nov 2005 and the first crediting period was 01 Apr 04 - 31 Mar 11.
- The renewal date of the crediting period was given on 09 Jun 2012 and the new crediting period is 01 Apr 11 – 31 Mar 18.

Monitoring report is based on the monitoring plan defined in Project Design Document (PDD).

### **A.2. Location of project activity**

>> The Project is located in the North-western Peruvian Department of Piura, in the Sullana Province, in the Lancones District, in the Lancones Town. The project site is 40 km from the Sullana district (capital of the Sullana Province), and 30 km from the Peruvian-Ecuadorian border. The plant is located within the property of Poechos dam, built over the Chira River. The power house is located 81 meters above sea level.

The coordinates of the project site are: Latitude: -4.68437, Longitude: -80.52519.

### 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)
Peru (Host)	Sindicato Energetico S.A. (SINERSA)	No
Sweden	VERT CONSERVATION PTE LTD	No

### A.4. Reference of applied methodology and standardized baseline

>> Title of the methodology: ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version 12.1.0

For more information regarding the baseline methodology and monitoring methodology, please refer to: <http://cdm.unfccc.int/methodologies/DB/UB3431UT9I5KN2MUL2FGZXZ6CV71LT>

This methodology also refers to the latest approved version of the following tool: • Tool to calculate the emission factor for an electricity system (Version 02.2.1).

### A.5. Crediting period of project activity

>> Renewable crediting period, seven (7) years, with the option of renewing the contract for two other 7-year crediting periods (total 21 years).

The second crediting period is 01/04/2011 – 31/03/2018

### A.6. Contact information of responsible persons/entities

>>

Lorenzo Eguren and Claudia Monsalve  
Consultants

The responsible persons are not project participants.

## SECTION B. Implementation of project activity

### B.1. Description of implemented registered project activity

>> The technology employed is based on conventional Kaplan turbines (2) and generators (2) that are widely used all over the world.

The penstock of the powerhouse is connected to the existing steel pipe of the bottom outlet. The penstock is bifurcated in two penstock pipes leading to a powerhouse with two generating units each of 7.6 MW capacity. The generating units consist of two Kaplan turbines coupled to synchronous generators (3-phase) each of 9.5 MVA nominal capacity. The part of the powerhouse in which the main equipment is installed is an underground reinforced concrete structure, whereas the other part is an above ground steel structure. The water is discharged into a tailrace channel (capacity 45 m<sup>3</sup>/s) connected to the existing energy dissipater (stilling basin) of the bottom outlet

and, hence, is fed back into the irrigation system. The control building is installed adjacent to the powerhouse. This building contains the control room, offices and auxiliary installations. The control room is equipped with a modern system for automatic and remote control (SCADA).

The Project does also contain a 60 kV open-air switchyard with one main transformer of 29 MVA capacity. The power plant will be connected to the national grid through a new 60 kV overhead transmission line. The transmission line has a length of 38-km and will be connected to the existing Sullana substation

## **GENERATION EQUIPMENT**

### **TECHNICAL DATA - SUMMARY**

#### **Turbines**

	<b>DESCRIPTION</b>	<b>TURBINE 1</b>	<b>TURBINE 2</b>
	Manufacturer	ALSTOM	ALSTOM
A	Type	Kaplan	Kaplan
B	Nominal Power [MW]	7.8	7.8
C	Number of blades	6	6
D	Arrangement	Vertical	Vertical
E	Nominal speed [rpm]	400	400
F	Minimum discharge [m3/s]	9	9
G	Maximum discharge [m3/s]	22.5	22.5
H	Velocity for increase power [MW/min]	1	1
I	Velocity for decrease power [MW/min]	1	1
J	Minimum Power [MW]	2.5	2.5
K	Suspended solids limitations	No	No

#### **Generators**

	<b>DESCRIPTION</b>	<b>UNIT 1</b>	<b>UNIT 2</b>
	Manufacturer	ALSTOM	ALSTOM
A	Power [MVA]	9.5	9.5
B	Speed [rpm]	400	400
C	Runaway speed [rpm]	1007	1007
D	Number of phases	3	3
E	Minimum time for synchronization [min]	1	1
F	Current A	548.8	548.8
G	Excitation Vcc	129	129
	Acc	487	487
H	Nominal voltage generation [V]	10,000	10,000
I	Power factor	0.8	0.8

During this monitoring period the power plant has operated normally according to the water availability and approved energy dispatch. There have been some cuts in the energy production due to the maintenance of the irrigation infrastructure. The project sponsor take advantage of these stops to perform inspections and maintenance of the generation units.

**B.2. Post-registration changes****B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

&gt;&gt;

Not deviation applied to this monitoring period

**B.2.2. Corrections**

&gt;&gt;

Not applicable

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

&gt;&gt;

Not applicable

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

&gt;&gt;

Not applicable

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

&gt;&gt;

Not applicable

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

&gt;&gt;

Not applicable

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

&gt;&gt;

Not applicable

**SECTION C. Description of monitoring system**

&gt;&gt;

It is required that the project operator calculate the Project's ERs based on most recent available information, following The ERs Calculation Procedure (ERCP) presented in this report. The project operator must gather and process information needed to monitor ERs. All data required for calculating the Emission Margin will come from the COES information system and project meters. Electricity production by the plant and any internal usage will be metered continuously to account for the net level of electricity sold to the grid, and these records and sales receipts will be cross-referenced with COES data (which will itself contain a record of the plant output, along with all other plants in the SEIN).

Data gathering and processing should be done monthly by the Operator, as follows:

	<ul style="list-style-type: none"> <li>At the end of each month:</li> </ul>
<b>COES (Data Provider)</b>	<ul style="list-style-type: none"> <li>Report of hourly generation of the plants in the SEIN (measurement: 15' or 30' <sup>2</sup>)</li> <li>Report of dispatch merit orders for "hours of maximum demand"</li> <li>Report of net energy sold to the grid.</li> <li>Use real NECs per power plant in the SEIN</li> </ul>
<b>Operator (Data processor)</b>	<ul style="list-style-type: none"> <li>Report of the Project hourly generation of the meters of the project</li> <li>Verification of final client (ENOSA) report of the Project's generation sold to the grid – comparison with own records. The operator will verify that the sum of electricity reported of Poechos II and Poechos I in each hour is equal to the net electricity to the grid metered in the meter of Sullana.</li> <li>Monthly data filling in all the spreadsheets required, following the ERCP</li> <li>Monthly report</li> </ul>

The Operator should calculate ERs on the basis of this MP (following the ERCP) for the purpose of claiming ERs credits. It is believed that the MP approach presented here will result in an accurate, yet conservative calculation of ERs. However some uncertainties may lead to a deviation of monitored ERs and the verified ERs, especially errors in the data monitoring and processed system. The Operator is expected to prevent such errors and the verification audits are expected to uncover any possible errors. The CERs would be granted ex-post verification.

The baseline emissions are calculated originally using 2 spreadsheets: "Procedure of calculation of monthly order of merits" and "Poechos I DDA-OM.xls". It was decided to merge both spreadsheets in only one spreadsheet aiming to improve the accuracy in the results since now numbers of both spreadsheets are linked; the spreadsheet is called "Poechos I DDA-OM.xls". In addition, it has included also a spread sheet called "Poechos I EGh net electricity check.xls". This spread sheet will verify that the sum of electricity reported of Poechos II and Poechos I in each hour is equal to the net electricity metered in Sullana. Also in the last workbook of this spreadsheet it has been included a crosscheck with the invoices of the electricity sold.

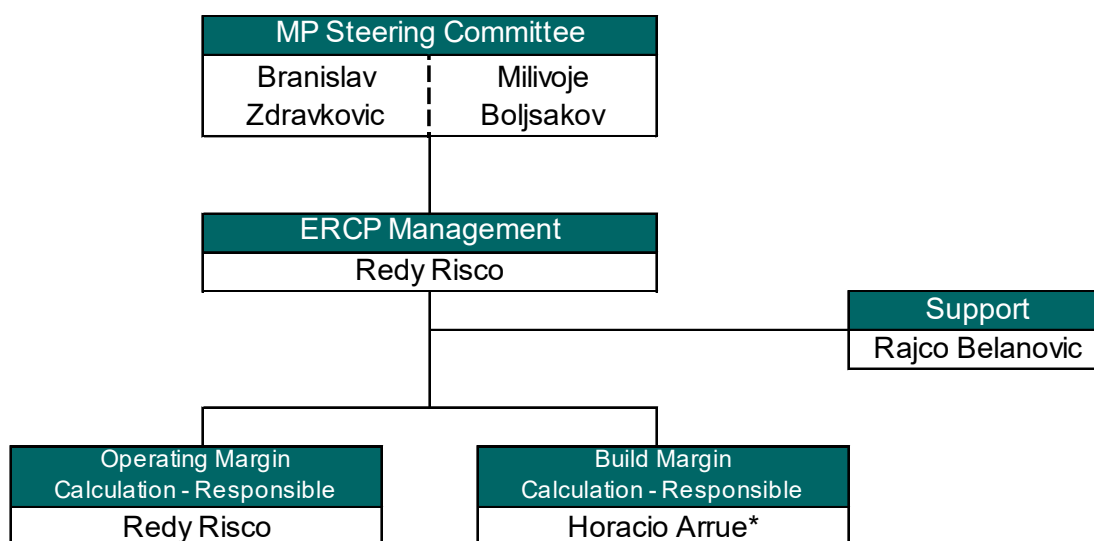
As this monitoring period covers three calendar years, three Poechos I DDA-OM.xls spreadsheets has been prepared to measure the emission reductions of the months occurred between 01/04/2013 – 31/12/2015. The name of those spreadsheets are:

1. Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls
2. Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls
3. Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls

### Emission Reductions Calculation Procedure(ERCP) ERCP Organizational Structure

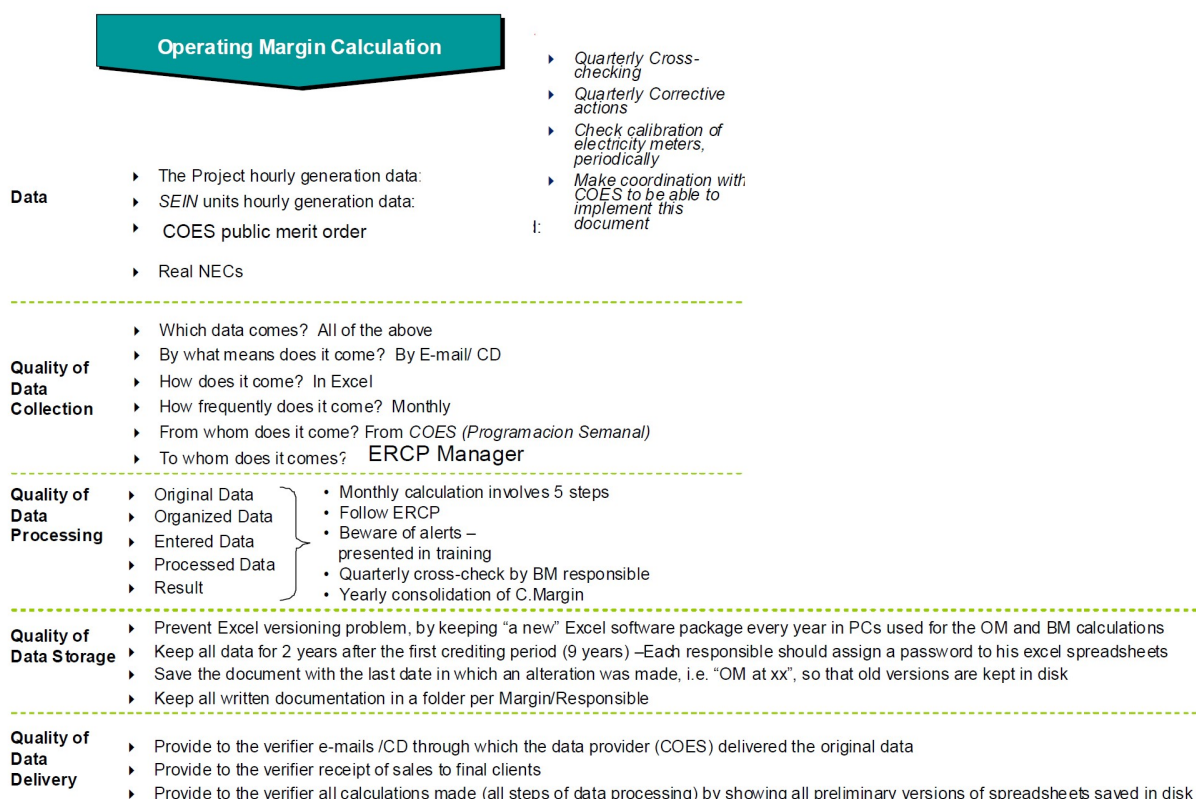
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<sup>2</sup> Half an hour measurement is still acceptable if total SEIN production calculated with it does not deviate greatly (i.e. less than 1%) from total SEIN generation calculated with the 15-minute measured data.



\*Horacio Arrue was in charge of the ex-ante calculation of the Build Margin.

### Monitoring Plan (MP) – Emissions Reductions Calculation Procedure ERCP Quality Control

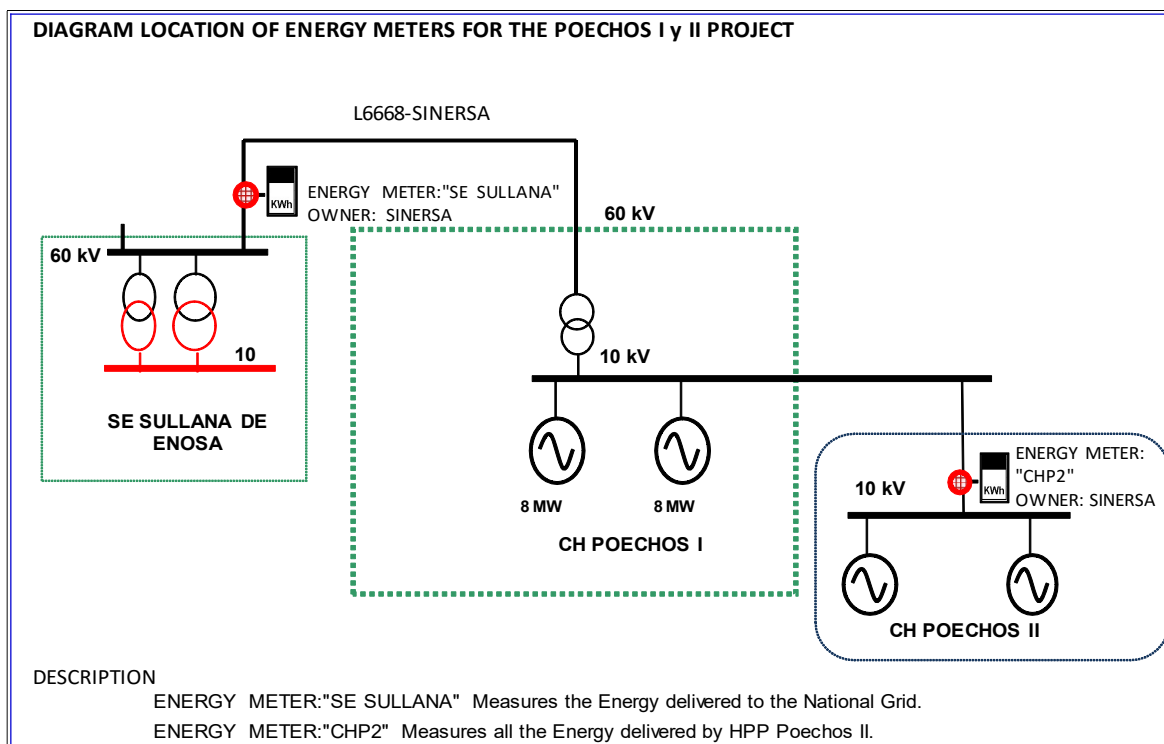


### Electricity Meter Location

The net electricity to the grid of Poechos I is metered in the energy meter of Sullana. However, the project participant built recently other hydro power plant called Poechos II which its energy is also metered in the energy meter of Sullana. Poechos II also has its own energy meter located in its facility.

Therefore the net electricity to the grid of Poechos I is the electricity metered in the meter of Sullana minus the energy metered in the energy meter of Poechos II.

Figure 1. Diagram location of energy meters for Poechos I



During this monitoring period there were some training activities for engineers and technicians regarding securities issues and operation of the electronic equipment. Also virtual classes have been given by TECSUP to the mechanics of the plant about operation and maintenance of pumping equipments.

## 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)

<b>Data/parameter:</b>	<b>EF<sub>grid, BMy</sub></b>
<b>Unit</b>	tCO <sub>2</sub> /MWh
<b>Description</b>	Build margin CO <sub>2</sub> emission factor in year y (tCO <sub>2</sub> /MWh ) calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
<b>Source of data</b>	Calculated according to the "Tool to calculate the emission factor for an electricity system (Version 02.2.1)" based in COES annual statistics. The last one was published in year 2009.
<b>Value(s) applied)</b>	0.50665 tCO <sub>2</sub> /MWh



Choice of data or measurement methods and procedures	In terms of vintage of data, project participants have chosen option 2: For the second crediting period, the build margin emission factor is calculated ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation.
Purpose of data	Baseline emission calculation
Additional comments	-

## D.2. Data and parameters monitored

(Copy this table for each piece of data and parameter)

<b>Data/parameter:</b>	<b>EF<sub>grid,CM,y</sub></b>
Unit	tCO <sub>2</sub> /MWh
Description	Combined margin CO <sub>2</sub> 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"
Measured/calculated/default	Calculated
Source of data	Project sponsor's own calculations based on COES and project data. The results of the calculations are in: <ul style="list-style-type: none"> <li>○ Workbook 12, cell C14 of the Spreadsheet "Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls" for the period 01 Apr 2013 -31 Dec 2013</li> <li>○ Workbook 15, cell C14 of the Spreadsheet Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls" for the period 01 Jan 2014 -31 Dec 2014</li> <li>○ Workbook 15, cell C14 of the Spreadsheet Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls" for the period 01 Jan 2016 -31 Dec 2015</li> </ul>
Value(s) of monitored parameter	<ul style="list-style-type: none"> <li>○ 0.61830 for the period 01 Apr 2013 -31 Dec 2013</li> <li>○ 0.56314 for the period 01 Jan 2014 -31 Dec 2014</li> <li>○ 0.51334 for the period 01 Jan 2015 -31 Dec 2015</li> </ul>
Monitoring equipment	No especial monitoring equipment is needed. There is a Monitoring Plan and pre-programmed spreadsheets such that the Project sponsor only need to collect the information as described and apply the formulas as instructed in the Monitoring Plan
Measuring/reading/recording frequency:	Calculated yearly. The proportion of data to be monitored is 100% and the data have been archived electronically.
Calculation method (if applicable):	As per the "Tool to calculate the emission factor for an electricity system" based on COES and project data
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

<b>Data/parameter:</b>	<b>EF<sub>grid,OM,y</sub></b>
Unit	tCO <sub>2</sub> /MWh
Description	Operating margin CO <sub>2</sub> 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"

Measured/calculated/default	Calculated
Source of data	Project sponsor's own calculations based on COES and project data. The results of the calculation are in: <ul style="list-style-type: none"> <li>○ Workbook 12, cell C12 of the Spreadsheet "Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls" for the period 01 Apr 2013 -31 Dec 2013</li> <li>○ Workbook 15, cell C12 of the Spreadsheet Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls" for the period 01 Jan 2014 -31 Dec 2014</li> <li>○ Workbook 15, cell C12 of the Spreadsheet Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls" for the period 01 Jan 2016 -31 Dec 2015</li> </ul>
Value(s) of monitored parameter	<ul style="list-style-type: none"> <li>○ 0.72995 for the period 01 Apr 2013 -31 Dec 2013</li> <li>○ 0.61963 for the period 01 Jan 2014 -31 Dec 2014</li> <li>○ 0.52002 for the period 01 Jan 2015 -31 Dec 2015</li> </ul>
Monitoring equipment	No special monitoring equipment is needed. There is a Monitoring Plan and pre-programmed spreadsheet such that the Project sponsor only need to collect the information as described and apply the formulas as instructed in the Monitoring Plan
Measuring/reading/recording frequency:	Calculated for this monitoring period. The proportion of data to be monitored is 100% and the data have been archived electronically
Calculation method (if applicable):	As per the "Tool to calculate the emission factor for an electricity system" based on COES and project data
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

<b>Data/parameter:</b>	<b>EG<sub>m,y</sub> and EG<sub>n,h</sub></b>
Unit	MWh
Description	Net electricity generated by power plant / unit m, or n in year y or hour h.
Measured/calculated/default	Measured
Source of data	COES records. Raw data has been gotten from the web page of COES. Period: 01/04/2013 to 31/12/2015.
Value(s) of monitored parameter	See dispatch hourly data of all power plants in: <ul style="list-style-type: none"> <li>○ For the period 01 Apr 2013 -31 Dec 2013 see Workbooks 3 to 11, of the Spreadsheet "Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls"</li> <li>○ For the period 01 Jan 2014 -31 Dec 2014 see Workbooks 3 to 14, of the Spreadsheet Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls"</li> <li>○ For the period 01 Jan 2015 -31 Dec 2015 see Workbooks 3 to 14, of the Spreadsheet Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls"</li> </ul>
Monitoring equipment	The information is provided by COES. No monitoring equipment is necessary for the project operator other than computers to download the information.
Measuring/reading/recording frequency:	Directly measured every 15 minutes by power plants energy meters and reported to COES. This data is processed and recorded hourly by project participant in "Poechos I DDA-OM.xls" spreadsheet. The proportion of data to be monitored is 100% and the data will be archived electronically.

Calculation method (if applicable):	No applicable
QA/QC procedures:	Data has been taken from COES official information
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

Data/parameter:	EG <sub>PJ,h</sub>																											
Unit	MWh																											
Description	Electricity displaced by the project activity in hour h of year y																											
Measured/calculated/default	Calculated																											
Source of data	Calculated based in information provided by project electricity meters																											
Value(s) of monitored parameter	Real hourly data of Poechos I during year April 1st, 2013 to December 31st, 2015. The values are in column “EE” in the monthly workbooks of the spread sheets: <ul style="list-style-type: none"><li>○ Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls</li><li>○ Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls</li><li>○ Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls</li></ul>																											
Monitoring equipment	<table><tr><td></td><td>Sullana Meter</td><td>Poechos II Meter</td></tr><tr><td>Manufacturer</td><td>Power Measurement</td><td>Schneider Electric</td></tr><tr><td>Type</td><td>ION 7600</td><td>ION 7650</td></tr><tr><td>Accuracy class</td><td>0.2</td><td>0.2</td></tr><tr><td>Serial Number</td><td>PL-0305A001-01</td><td>PJ-1004A406-02</td></tr><tr><td>Calibration frequency</td><td>3years</td><td>3 years</td></tr><tr><td>Previous Calibration</td><td>May 18, 2012</td><td>May 18, 2012</td></tr><tr><td>Date of last calibration</td><td>October 01, 2015</td><td>October 02, 2015</td></tr><tr><td>Validity</td><td>OK</td><td>OK</td></tr></table> <ul style="list-style-type: none"><li>✓ The calibration interval for the electricity metering system is performed at least once every three years.</li><li>✓ SINERSA has a quality control procedure, based on the comparison of the electricity measures in equipment of TOTAL meter at with the patron meter.</li><li>✓ The result of the calibration is documented in a Calibration Test Protocol.</li><li>✓ The procedure of calibration is in document “CHP2-Procedimiento calibracion de medidores.docx”</li></ul>		Sullana Meter	Poechos II Meter	Manufacturer	Power Measurement	Schneider Electric	Type	ION 7600	ION 7650	Accuracy class	0.2	0.2	Serial Number	PL-0305A001-01	PJ-1004A406-02	Calibration frequency	3years	3 years	Previous Calibration	May 18, 2012	May 18, 2012	Date of last calibration	October 01, 2015	October 02, 2015	Validity	OK	OK
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Previous Calibration	May 18, 2012	May 18, 2012																										
Date of last calibration	October 01, 2015	October 02, 2015																										
Validity	OK	OK																										
Measuring/reading/recording frequency:	Directly measured every 15 minutes by power plants energy meters. This data is processed s and recorded hourly by project participant in “Poechos I DDA-OM.xls” spread sheet. The proportion of data to be monitored is 100% and the data will be archived electronically.																											

Calculation method (if applicable):	The net electricity to the grid of Poechos I is calculated as the difference between the energy meter of the substation of Sullana and the meter of the hydropower plant of Poechos II.
QA/QC procedures:	Sales records to the SEIN or to the final client are used to ensure consistency.
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

<b>Data/parameter:</b>	$\eta_{m,y}$
Unit	%
Description	Average net energy conversion efficiency of power unit m in year y (NEC)
Measured/calculated/default	Calculated
Source of data	Data from the dispatch center (COES) Annual statistics
Value(s) of monitored parameter	See the Workbook "(WS-0) EF <sub>ELs</sub> calculation" column F of the spreadsheets: <ul style="list-style-type: none"> <li>○ Poechos I DDA-OM 01 Apr 2013 -31 Dec 2013.xls</li> <li>○ Poechos I DDA-OM 01 Jan 2014 -31 Dec 2014.xls</li> <li>○ Poechos I DDA-OM 01 Jan 2015 -31 Dec 2015.xls</li> </ul> - For the period: 01 Apr 2013 -31 Dec 2013 it was used the COES Annual statistics of year 2013. - For the period: 01 Jan 2014 -31 Dec 2014 it was used the COES Annual statistics of year 2014. - For the period: 01 Jan 2015 -31 Dec 2015 it was used the COES Annual statistics of year 2015.
Monitoring equipment	The information is provided by COES, no monitoring equipment is necessary
Measuring/reading/recording frequency:	Directly Measured based on the information provided by COES. Every year this data is checked with the last available annual report of COES
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The dispatch center COES officially monitors and publishes the efficiency of the thermal plants of the Peruvian grid each year.
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

<b>Data / Parameter:</b>	EG <sub>pj,y</sub>
Unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
Measured/ Calculated / Default:	Calculated
Source of data:	Calculated based in information provided by project electricity meters
Value(s) of monitored parameter:	Period: 01/04/2013 - 31/12/2013: 36,969 MWh/yr. Period 01/01/2014- 31/12/2014: 59,715 MWh/yr Period 01/01/2015- 31/12/2015: 69,772 MWh/yr

Monitoring equipment:		Sullana Meter	Poechos II Meter
	Manufacturer	Power Measurement	Schneider Electric
	Type	ION 7600	ION 7650
	Accuracy class	0.2	0.2
	Serial Number	PL-0305A001-01	PJ-1004A406-02
	Calibration frequency	3years	3 years
	Previous Calibration	May 18, 2012	May 18, 2012
	Date of last calibration	October 02, 2015	October 02, 2015
	Validity	OK	OK
		<ul style="list-style-type: none"> <li>✓ The calibration interval for the electricity metering system is performed at least once every three years.</li> <li>✓ SINERSA has a quality control procedure, based on the comparison of the electricity measures in equipment of TOTAL meter at with the patron meter.</li> <li>✓ The result of the calibration is documented in a Calibration Test Protocol.</li> <li>✓ The procedure of calibration is in document "CHP2-Procedimiento calibracion de medidores.docx"</li> </ul>	
Measuring/ Reading/ Recording frequency:	Directly measured every 15 minutes by power plants energy meters. This data is processed s and recorded hourly by project participant in "Poechos I DDA-OM.xls" spread sheet. The proportion of data to be monitored is 100% and the data will be archived electronically.		
Calculation method (if applicable):	The net electricity to the grid of Poechos I is calculated as the difference between the energy meter of the substation of Sullana and the meter of the hydropower plant of Poechos II.		
QA/QC procedures:	Sales records to the SEIN or to the final client are used to ensure consistency.		
Purpose of data:	Calculation of baseline emissions		
Additional comment:s:	-		

Data / Parameter:	EF <sub>CO<sub>2</sub>,i,y</sub> and EF <sub>CO<sub>2</sub>,m,i,y</sub>
Unit:	tCO <sub>2</sub> /GJ
Description:	CO <sub>2</sub> emission factor of fossil fuel type i used in power unit m in year y
Measured/ Calculated / Default:	Default
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 Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) of monitored parameter:	Diesel Oil = 72,600 Residual Fuel Oil = 75,500 Natural Gas = 54,300 Coal = 87,300 Landfill Gas = 46,200

Monitoring equipment:	-
Measuring/ Reading/ Recording frequency:	Dispatch data OM: Annually for the year $y$ in which the project activity is displacing grid electricity or, if available, hourly. Further guidance can be found in Step 3 of the Tool to calculate the emission factor for an electricity system;  BM: For the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period
Calculation method (if applicable):	-
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comment:s:	-

### D.3. Implementation of sampling plan

>> Not applicable

## SECTION E. Calculation of emission reductions or GHG removals by sinks

### E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>> Baseline emissions include only CO<sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

- $BE_y$  = Baseline emissions in year  $y$  (tCO<sub>2</sub>/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 CO<sub>2</sub> 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" (tCO<sub>2</sub>/MWh)

The Baseline emission factor ( $EF_y$ ) is calculated as a combined margin(CM) emission factor ( $EF_{grid,CM,y}$ ), following the guidance in the Tool to calculate the emission factor for an electricity system, *Version 05.0*. According to the *Tool*, the baseline emission factor is calculated as the weighted average of the Operating Margin emission factor ( $EF_{grid,OM,y}$ ) and the Build Margin

emission factor ( $EF_{grid,BM,y}$ ) where the weights  $W_{OM}$  and  $W_{BM}$ , by default in this crediting period, are 25% and 75% respectively (i.e.,  $W_{OM} = 0.25$   $W_{BM} = 0.75$ ). This is presented below:

Estimated anthropogenic emissions were calculated for the Project following a 6-step-process:

- STEP 1. Identify the relevant electricity systems;
- STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
- STEP 3. Select a method to determine the operating margin (OM);
- STEP 4. Calculate the operating margin emission factor according to the selected method;
- STEP 5. Calculate the build margin (BM) emission factor;
- STEP 6. Calculate the combined margin (CM) emission factor.

### Step 1: Identify the relevant electricity systems

The power plant is connected to the national grid through a 60 kV overhead transmission line. The transmission line has a length of 38-km and is connected to the existing Sullana substation – which belongs to Electronoroeste S.A. (ENOSA).

Electricity imports have been reported by the SEIN dispatch center. For the purpose of determining the operating margin emission factor, it is assumed a CO<sub>2</sub> emission factor(s) for net electricity imports 0 tCO<sub>2</sub>/MWh;

### Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Since project participants considered only grid power plants for the calculation of the operating margin and build margin emission factor, this step is not taken in account.

### Step 3: Select a method to determine the operating margin (OM)

The calculation of the Operating Margin emission factor ( $EF_{grid,OM,y}$ ) is based on one of the following methods, which are described under Step 4:

1. Simple OM, or
2. Simple adjusted OM, or
3. Dispatch Data Analysis OM, or
4. Average OM.

Out of four options for the OM, the Dispatch Data Analysis OM was selected since Hourly data from each power plant on power generation and fuel type and fuel consumption are available.

### Step 4: Calculate the operating margin emission factor according to the selected method

The formula for the OM emission factor ( $EF_{grid,OM-DD,y}$ ) used was provided by the tool as follows:

$$EF_{grid,OM-DD,y} = \sum h EG_{PJ,h} * EF_{EL,DD,h} / EG_{PJ,y}$$

Where,

- $EF_{grid,OM-DD,y}$  = Dispatch data analysis operating margin CO<sub>2</sub> emission factor in year, y (tCO<sub>2</sub>/MWh)
- $EG_{PJ,h}$  = Electricity displaced by the project activity in hour, h of year, y (MWh)
- $EF_{EL,DD,h}$  = CO<sub>2</sub> emission factor for grid power units in the top of the dispatch order in hour, h in year, y (tCO<sub>2</sub>/MWh)
- $EG_{PJ,y}$  = Total electricity displaced by the project activity in year, y (MWh)
- h = Hours in year, y, in which the project activity is displacing grid electricity
- y = Year in which the project activity is displacing grid electricity

Since hourly fuel consumption data is not available, the hourly emissions factor is determined based on the energy efficiency of the grid power unit and the fuel type used, as follows:

$$EF_{EL,DD,h} = \sum_n EG_{n,h} * EF_{EL,n,y} / \sum_n EG_{n,h}$$

- $EF_{EL,DD,h}$  = CO<sub>2</sub> emission factor for grid power units in the top of the dispatch order in hour, h in year, y (tCO<sub>2</sub>/MWh)
- $EG_{n,h}$  = Net quantity of electricity generated and delivered to the grid by grid power unit n in hour, h (MWh)
- $EF_{EL,n,y}$  = CO<sub>2</sub> emission factor of grid power unit, n in year, y (tCO<sub>2</sub>/MWh)
- n = Grid Power units in the top of the dispatch.  
At each hour, h, stack each grid power unit's generation using the merit order. The group of power units n in the dispatch margin includes the units in the top x% of total electricity dispatched in the hour h, where x% is equal to the greater of either:
- (a) 10% (if 10 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation); or
- (b) The quantity of electricity displaced by the project activity during hour h divided by the total electricity generation by the grid power plants during that hour, h.
- h = Hours in year y in which the project activity is displacing grid electricity

The  $EF_{EL,n,y}$  is calculated as per the guidance for the simple OM, using the option A2.

$$EF_{EL,m,y} = (EF_{CO_2} * 3.6) / (\eta_{m,y})$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit m in year y (tCO<sub>2</sub>/MWh)
- $EF_{CO_2,m,i,y}$  = Average CO<sub>2</sub> emission factor of fuel type i used in power unit m in year y (t CO<sub>2</sub>/GJ)
- $\eta_{m,y}$  = Average net energy conversion efficiency of power unit m in year y (ratio)
- m = All power units serving the grid in year y except low-cost/must-run power Units
- y = Year in which the project activity is displacing grid electricity

Where several fuel types are used in the power unit, use the fuel type with the lowest CO<sub>2</sub> emission factor for  $EF_{CO_2,m,i,y}$ .

The resulting DDA-OM emission factor was calculated as follows:

$$EF_{grid,OM-DD,y} \text{ for the period 01 Apr 2013 -31 Dec 2013} = \sum h EG_{PJ,h} * EF_{EL,h} / EG_{PJ,y} = 26,985.51 / 36,969 = \mathbf{0.72995 \text{ tCO}_2/\text{MWh}}$$

$$EF_{grid,OM-DD,y} \text{ for the period 01 Jan 2014 -31 Dec 2014} = \sum h EG_{PJ,h} * EF_{EL,h} / EG_{PJ,y} = 37,001.42 / 59,715 = \mathbf{0.61963 \text{ tCO}_2/\text{MWh}}$$

$$EF_{grid,OM-DD,y} \text{ for the period 01 Jan 2015 -31 Dec 2015} = \sum h EG_{PJ,h} * EF_{EL,h} / EG_{PJ,y} = 36,282.6 / 69,772 = \mathbf{0.52002 \text{ tCO}_2/\text{MWh}}$$



**Step 5: Calculate the build margin (BM) emission factor;**

In terms of vintage of data, project participants have chosen option 2: For the second crediting period, the build margin emission factor is calculated ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. At the time of the validation submission the latest year that information that was publicly available was from the annual statistics of COES of year 2009.

The calculation of the build margin established in the renewed PDD was set in **0.50665 tCO<sub>2</sub>/MWh**. This value would remain fix for the hold second crediting period.

**Step 6: Calculate the combined margin emissions factor**

The combined margin emissions factor is calculated as weighted average CM as follows

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

Where:

$EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year, y (tCO<sub>2</sub>/MWh)

$EF_{grid,OM,y}$  = Operating margin CO<sub>2</sub> emission factor in year, y (tCO<sub>2</sub>/MWh)

$W_{OM}$  = Weighting of operating margin emissions factor (%)

$W_{BM}$  = Weighting of build margin emissions factor (%)

The following default values should be used for  $W_{OM}$  and  $W_{BM}$ :

$W_{OM} = 0.5$  and  $W_{BM} = 0.5$  for the first crediting period, and  $W_{OM} = 0.25$  and  $W_{BM} = 0.75$  for the second and third crediting period.

As Poechos I is in the second crediting period , the formula is:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * 0.25 + EF_{grid,BM,y} * 0.75$$

The resulting combined margin emission factor for the monitoring period are:

$$EF_{grid,CM,y} \text{ for the period 01 Apr 2013 -31 Dec 2013} = 0.25*(0.72995) + 0.75*(0.50665) = \mathbf{0.61830tCO_2/MWh}$$

$$EF_{grid,CM,y} \text{ for the period 01 Jan 2014 -31 Dec 2014} = 0.25*(0.61963) + 0.75*(0.50665) = \mathbf{0.56314 tCO_2/MWh}$$

$$EF_{grid,CM,y} \text{ for the period 01 Jan 2015 -31 Dec 2015} = 0.25*(0.52002) + 0.75*(0.50665) = \mathbf{0.51334 tCO_2/MWh}$$

**Value of the baseline emissions:**

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

For the period 01 Apr 2013 -31 Dec 2013 = 36,969\*0.61830= 22,857 tCO<sub>2</sub>

For the period 01 Jan 2014 -31 Dec 2014 = 59,715\*0.56314= 33,627 tCO<sub>2</sub>

For the period 01 Jan 2015 -31 Dec 2015 = 69,772\*0.51334= 35,816 tCO<sub>2</sub>

**Total Baseline Emissions for the period 01 Apr 2013 to 31 Mar 2016 = 22,857 + 33,627 + 35,816 = 92,300 tCO<sub>2</sub>**

**E.2. Calculation of project emissions or actual net GHG removals by sinks**

&gt;&gt;

The project does not lead to any GHG emissions. Hydropower plants using existing reservoirs without increasing its capacity are classified as zero emission projects, for which there are no associated emissions in the Project boundary.

**E.3. Calculation of leakage**

>> According to the Baseline Methodology, project participants do not need to consider leakage

**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 <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	GHG emission reductions or net GHG removals by sinks (t CO <sub>2</sub> e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
<b>Total</b>	92,300	0	0	0	92,300	92,300

**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 <sub>2</sub> e)	90,337.5	92,300

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

&gt;&gt;

The achieved emission reductions during the monitoring period are greater than those stated in the registered CDM-PDD is only 2%.

In the other hand, the PDD has used an annual production close to 58 GWh/year or 159.5GWh for two years and 9 months. In this monitoring period from 01/04/2013 to 31/12/2015 the production of energy has been 166.5 GWh which is only 4% greater than the expected in the PDD. As the difference is small from the annual expected average, we consider this difference normal and within the expectations.

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

<b>Project participant and/or responsible person/ entity</b>	<input checked="" type="checkbox"/> Project participant <input type="checkbox"/> Person/entity responsible for completing the CDM-MR-FORM
<b>Organization name</b>	Sindicato Energetico S.A. (SINERSA)
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<b>Website</b>	
<b>Contact person</b>	
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<b>Middle name</b>	
<b>First name</b>	Branislav
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<b>Direct tel.</b>	
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<b>Salutation</b>	Mr.
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**CDM-MR-FORM**

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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to the Host Party;</li> <li>• Remove reference to programme of activities;</li> <li>• Overall editorial improvement.</li> </ul>
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
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.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		