Monitoring report form (Version 03.1)

Monitoring report

Title of the project activity	Poechos I Project
Reference number of the project activity	0086
Version number of the monitoring report	1
Completion date of the monitoring report	01/07/2013
Registration date of the project activity	14/11/2005
Monitoring period number and duration of this monitoring period	6 01/04/2011 – 31/03/2013
Project participant(s)	Sinersa, Peru International Bank for Reconstruction and Development (IBRD) as Trustee of the Netherlands CDM Facility (NCDMF)
Host Party(ies)	Peru
Sectoral scope(s) and applied methodology(ies)	1 : Energy industries (renewable - / non-renewable sources) ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” Version 12.1.0
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	65,160[1] tCO_2
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	97,310 tCO_2e

[1] Estimated Annual ERs = 0.56893 tCO_2/MWh * 57,740 MWh = 32,850 tCO_2 per year. As the monitoring period is two year the expected emission reduction is 32,850 tCO_2 * 2 = 65,160 tCO_2

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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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 01/04/2011 – 31/03/2013, during the monitoring period the plant produced 165,165 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 97,310 tCO_2e. 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 (7.6 MW 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 m3 /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

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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 if the Party involved wishes to be considered as project participant (Yes/No)
Peru (Host)	Sinersa, Peru	No
Netherlands	International Bank for Reconstruction and Development (IBRD) as Trustee of the Netherlands CDM Facility (NCDMF)	Yes

A.4. Reference of applied methodology

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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 (ver 02.2.1.).

A.5. Crediting period of project activity

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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

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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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 m3/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 moderns 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

	DESCRIPTION	TURBINE 1	TURBINE 2
	Manufacturer	ALSTOM	ALSTOM
A	Type	Kaplan	Kaplan
B	Nominal Power [MW]	7.6	7.6
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

	DESCRIPTION	UNIT 1	UNIT 2
	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 or applied methodology

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Not deviation applied to this monitoring period

B.2.2. Corrections

>>
Not applicable

B.2.3. Permanent changes from registered monitoring plan or applied methodology

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Not applicable

B.2.4. Changes to project design of registered project activity

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Not applicable

B.2.5. Changes to start date of crediting period

>>
Not applicable

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

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Not applicable

SECTION C. Description of monitoring system

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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:

	○ At the end of each month:
COES (Data Provider)	○ Report of hourly generation of the plants in the SEIN (measurement: 15' or 30' [2]) ○ Report of weekly dispatch merit orders for "hours of maximum demand [3]" ○ Report of net energy sold to the grid. ○ Use real NECs per power plant in the SEIN
Operator (Data processor)	○ Report of the Project hourly generation of the meters of the project ○ 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. ○ Monthly data filling in all the spreadsheets required, following the ERCP ○ Monthly report

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

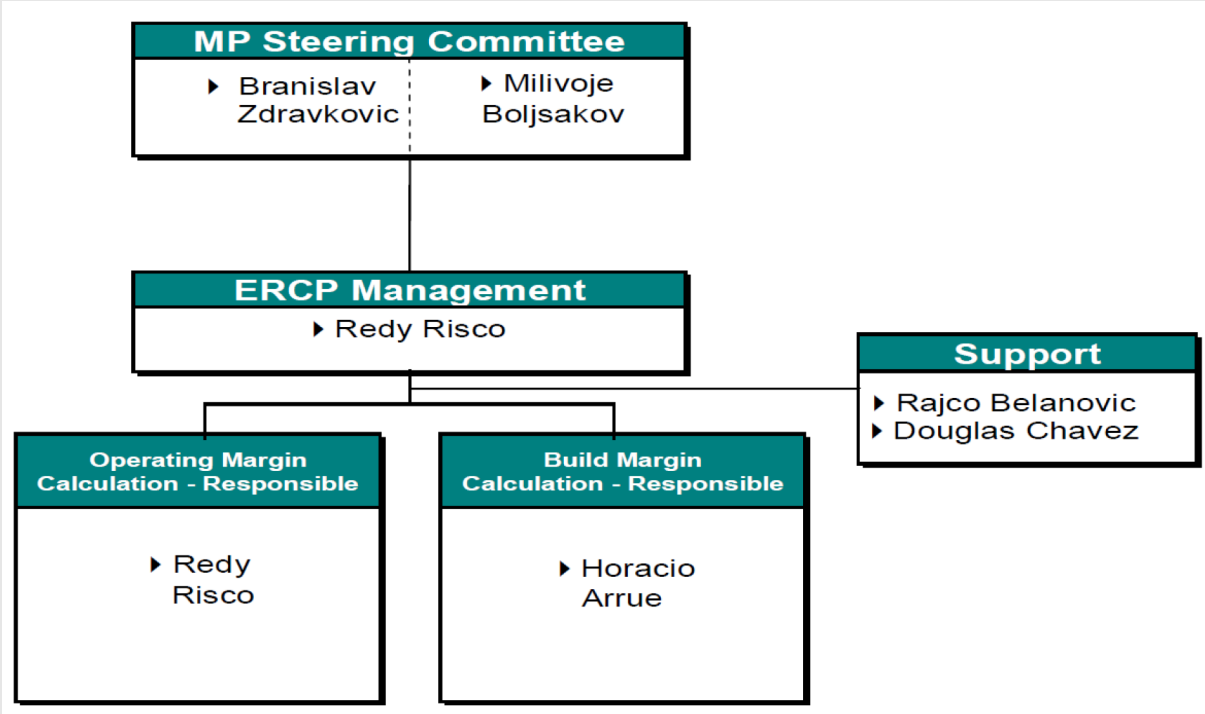
[2] Half an hour measurement is still acceptable if total SEIN production calculated with it does not deviate greatly (i.e. less than 1%) from total SEIN generation calculated with the 15-minute measured data.
[3] (6pm to 11 pm) to set a standard - weekly merit orders for hours of maximum, minimum and medium demand are similar.

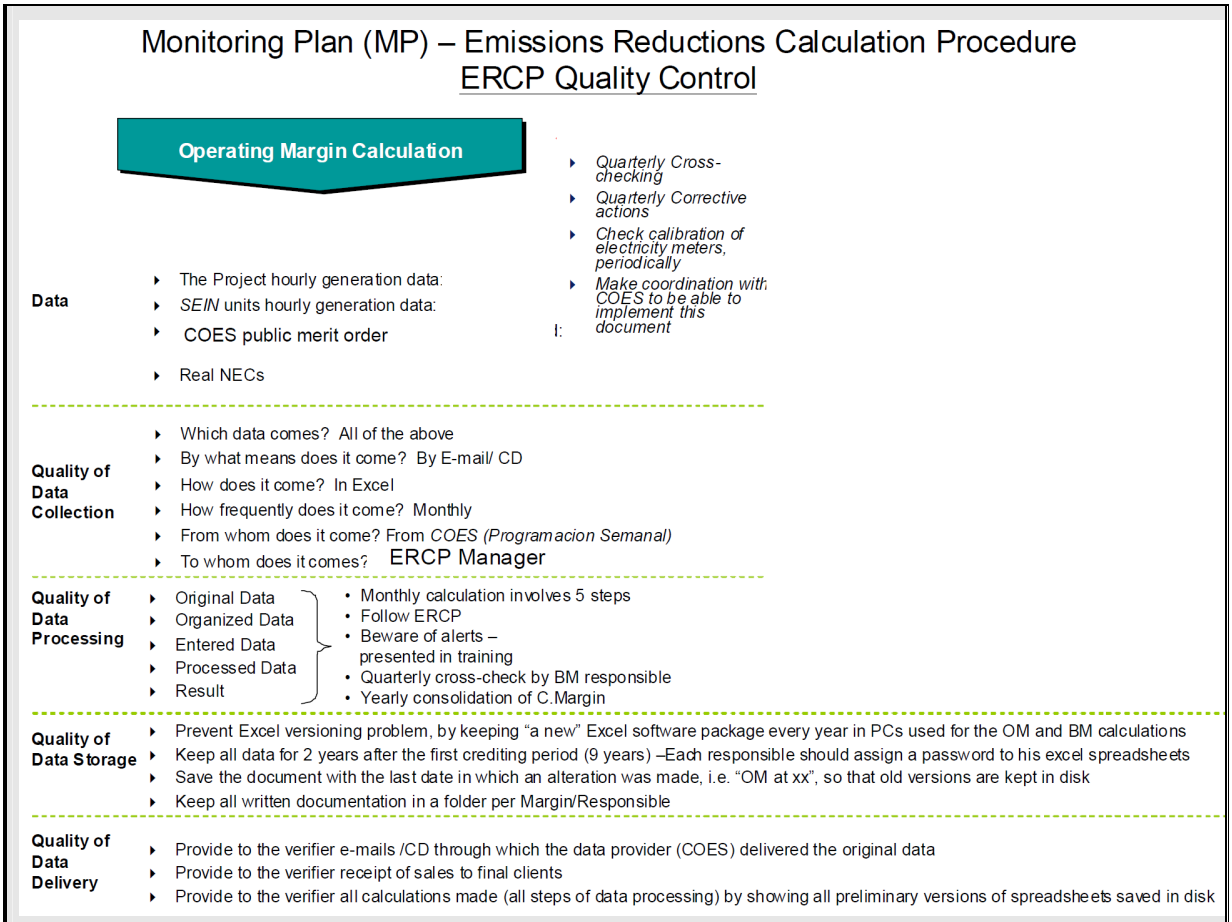
reported of Poechos II and Poechos I in each hour is equal to the net electricity metered in Sullana. Also in the last workbook of this spreadsheet it has been included a crosscheck with the invoices of the electricity sold.

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 in year 2011,2012 and 2013. The name of those spreadsheets are:

1. Poechos I DDA-OM 01 Apr 2011 -31 Dec 2011.xls
2. Poechos I DDA-OM 01 Jan 2012 -31 Dec 2012.xls
3. Poechos I DDA-OM 01 Jan 2013 -31 Mar 2013.xls

Emission Reductions Calculation Procedure(ERCP)
ERCP Organizational Structure



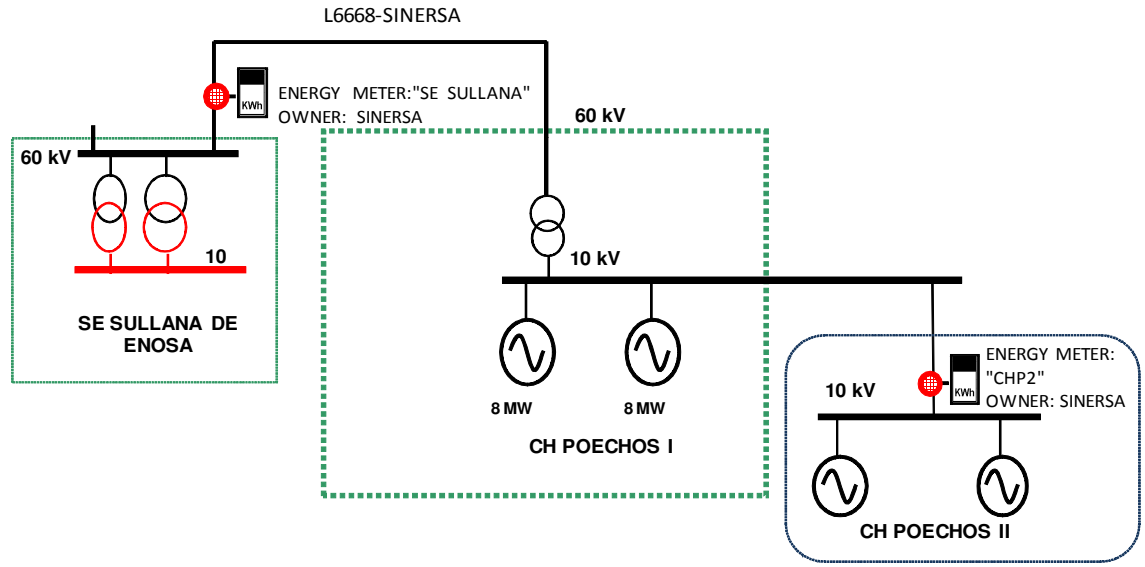


Electricity Meter Location

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

DIAGRAM LOCATION OF ENERGY METERS FOR THE POECHOS I y II PROJECT



DESCRIPTION

ENERGY METER:"SE SULLANA" Measures the Energy delivered to the National Grid.

ENERGY METER:"CHP2" Measures all the Energy delivered by HPP Poechos II.

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

Data / Parameter:	**Project emissions**
Unit:	tCO_2
Description:	GHG emissions produced by the project activity
Source of data:	N/A (as suggested in the Methodology)
Value(s) applied):	0
Purpose of data:	Calculation of project emissions
Additional comment:	The project does not lead to any GHG emissions. Small run of river hydropower plants with not reservoir are classified as zero emission projects, for which there are no associated emissions in the Project boundary.

Data / Parameter:	**Ly**
Unit:	tCO_2
Description:	GHG emissions produced by leakage of the project activity
Source of data:	N/A (as suggested in the Methodology)
Value(s) applied):	0
Purpose of data:	Leakage emission calculations
Additional comment:	According to the Baseline Methodology, project participants do not need to consider leakage.

Data / Parameter:	**$EF_{grid, BMy}$**
Unit:	tCO_2/MWh

Description:	Build margin CO2 emission factor in year y (tCO2/MWh) calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data:	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.
Value(s) applied):	0.50665 tCO2/MWh
Purpose of data:	Baseline emission calculation
Additional comment:	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

D.2. Data and parameters monitored

Data / Parameter:	**$EF_{grid,CM,y}$**
Unit:	tCO2/MWh
Description:	Combined margin CO_2 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: o Workbook 12, cell C14 of the Spreadsheet "Poechos I DDA-OM 01 Apr 2011 -31 Dec 2011.xls" for the period 01 Apr 2011 -31 Dec 2011 o Workbook 15, cell C14 of the Spreadsheet Poechos I DDA-OM 01 Jan 2012 -31 Dec 2012.xls" for the period 01 Jan 2012 -31 Dec 2012 o Workbook 6, cell C14 of the Spreadsheet Poechos I DDA-OM 01 Jan 2013 -31 Mar 2013.xls" for the period 01 Jan 2013 -31 Mar 2013
Value(s) of monitored parameter:	o 0.57847 for the period 01 Apr 2011 -31 Dec 2011 o 0.59285 for the period 01 Jan 2012 -31 Dec 2012 o 0.60071 for the period 01 Jan 2013 -31 Mar 2013
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 comment:	-

Data / Parameter:	**$EF_{grid,OM,y}$**
Unit:	tCO_2/MWh
Description:	Operating 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"
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: o Workbook 12, cell C12 of the Spreadsheet "Poechos I DDA-OM 01 Apr 2011 -31 Dec 2011.xls" for the period 01 Apr 2011 -31 Dec 2011 o o Workbook 15, cell C12 of the Spreadsheet Poechos I DDA-OM 01 Jan 2012 -31 Dec 2012.xls" for the period 01 Jan 2012 -31 Dec 2012 o Workbook 6, cell C12 of the Spreadsheet Poechos I DDA-OM 01 Jan 2013 -31 Mar 2013.xls" for the period 01 Jan 2013 -31 Mar 2013
Value(s) of monitored parameter:	o 0.65030 for the period 01 Apr 2011 -31 Dec 2011 o 0.67905 for the period 01 Jan 2012 -31 Dec 2012 o 0.69478 for the period 01 Jan 2013 -31 Mar 2013
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 comment:	-

Data / Parameter:	**$EG_{m,y}$ and $EG_{n,h}$**
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 form the web page of COES. Period: 01/04/2011 to 31/03/2013.

Value(s) of monitored parameter:	See dispatch hourly data of all power plants in: o For the period 01 Apr 2011 -31 Dec 2011 see Workbooks 3 to 11, of the Spreadsheet "Poechos I DDA-OM 01 Apr 2011 -31 Dec 2011.xls" o For the period 01 Jan 2012 -31 Dec 2012 see Workbooks 3 to 14, of the Spreadsheet Poechos I DDA-OM 01 Jan 2012 -31 Dec 2012.xls" o For the period 01 Jan 2013 -31 Mar 2013 see Workbook 3 to 5, of the Spreadsheet Poechos I DDA-OM 01 Jan 2013 -31 Mar 2013.xls" .
Monitoring equipment:	The information is provided by COES. No monitoring equipment is necessary for the project operator other than computers to down load the information.
Measuring/ Reading/ Recording frequency:	Directly measured every 15 minutes by power plants energy meters and reported to COES. 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):	No applicable
QA/QC procedures:	Data has been taken from COES official information
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**$EG_{PJ,h}$**
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, 2011 to March 31st, 2013. The values are in column "EE" in the monthly workbooks of the spread sheets: o Poechos I DDA-OM 01 Apr 2011 -31 Dec 2011.xls o Poechos I DDA-OM 01 Jan 2012 -31 Dec 2012.xls o Poechos I DDA-OM 01 Jan 2013 -31 Mar 2013.xls
Monitoring equipment:	

	Sullana Meter	Poechos II Meter	
		Permanent	Provisional[4]
Manufacturer	Power Measurement	Schneider Electric	Schneider Electric
Type	ION 7600	ION 7650	ION 7650
Accuracy class	0.2	0.2	0.2

[4] The electricity meter manufacturer installed a provisional electricity meter in march 27, 2010 while the permanent one was arriving. By May 25,2010, the permanent meter started to operate.

	<table><tr><td>Serial Number</td><td>PL-0305A001-01</td><td>PJ-1004A406-02</td><td>PJ-1002A216-02</td></tr><tr><td>Calibration frequency</td><td>3years</td><td>3 years</td><td></td></tr><tr><td>Previous Calibration</td><td>July 1,2009</td><td>April 22, 2010.</td><td></td></tr><tr><td>Date of last calibration</td><td>May 18, 2012</td><td>May 18, 2012</td><td>February 13,2010</td></tr><tr><td>Validity</td><td>OK</td><td>OK</td><td>OK</td></tr></table> ✓ The calibration interval for the electricity metering system is performed at least once every three years. ✓ SINERSA has a quality control procedure, based on the comparison of the electricity measures in equipment of TOTAL meter at with the patron meter. ✓ The result of the calibration is documented in a Calibration Test Protocol. ✓ The procedure of calibration is in document “CHP2-Procedimiento calibracion de medidores.docx”
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:	-

Data / Parameter:	$\eta_{m,y}$
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_{ELs} calculation” column F of the spreadsheets: o Poechos I DDA-OM 01 Apr 2011 -31 Dec 2011.xls o Poechos I DDA-OM 01 Jan 2012 -31 Dec 2012.xls o Poechos I DDA-OM 01 Jan 2013 -31 Mar 2013.xls - For the period: 01 Apr 2011 -31 Dec 2011 it was used the COES Annual statistics of year 2011. - For the period: 01 Jan 2012 -31 Dec 2012 it was used the COES Annual statistics of year 2012. - For the period: 01 Jan 2013 -31 Mar 2013 it was used the COES Annual statistics of year 2012.
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 comment:	-

Data / Parameter:	$EG_{pj,y}$
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:	
Monitoring equipment:	

	Sullana Meter	Poechos II Meter	
		Permanent	Provisional[5]
Manufacturer	Power Measurement	Schneider Electric	Schneider Electric
Type	ION 7600	ION 7650	ION 7650
Accuracy class	0.2	0.2	0.2
Serial Number	PL-0305A001-01	PJ-1004A406-02	PJ-1002A216-02
Calibration frequency	3years	3 years	
Previous Calibration	July 1,2009	April 22, 2010.	
Date of last calibration	May 18, 2012	May 18, 2012	February 13,2010
Validity	OK	OK	OK

- ✓ The calibration interval for the electricity metering system is performed at least once every three years.
- ✓ SINERSA has a quality control procedure, based on the comparison of the electricity measures in equipment of TOTAL meter at with the patron meter.
- ✓ The result of the calibration is documented in a Calibration Test Protocol.
- ✓ The procedure of calibration is in document "CHP2-Procedimiento calibracion de medidores.docx"

[5] The electricity meter manufacturer installed a provisional electricity meter in march 27, 2010 while the permanent one was arriving. By May 25,2010, the permanent meter started to operate.

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:	-

Data / Parameter:	**$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$**
Unit:	tCO_2/GJ
Description:	CO_2 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 *ex ante* at the start of the second crediting period
Calculation method (if applicable):	-
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

D.3. Implementation of sampling plan

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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_2 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_v	=	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 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 year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

The Baseline emission factor (EF_v) is calculated as a combined margin (CM), following the guidance in the Tool to calculate the emission factor for an electricity system, *Version 02.2.1*.According to the *Tool*, the baseline emission factor is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$) where the weights W_{OM} and W_{BM}, by default, are 50% (i.e., $W_{OM} = W_{BM} = 0.5$). 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 or exports from other grid have been neither reported by the SEIN dispatch center or the Ministry of Energy and Mines.

If it would be the case, for the purpose of determining the operating margin emission factor, it will be assumed a CO2 emission factor(s) for net electricity imports 0 tCO2/MWh;

Electricity exports should not be subtracted from electricity generation data used for calculating and monitoring the electricity emission factors.

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 ($EF_{grid,OM,v}$) 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. The Simple OM method cannot be used since low cost, must-run resources constitute more than 50% of total grid generation in Peru. Also, it was not necessary to use either the Simple Adjusted OM approach or the Average OM approach because detailed dispatch data is available.

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

The formula for the OM-DD 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_2 emission factor in year, y (tCO_2/MWh)
$EG_{PJ,h}$	=	Electricity displaced by the project activity in hour, h of year, y (MWh)
$EF_{EL,DD,h}$	=	CO_2 emission factor for grid power units in the top of the dispatch order in hour, h in year, y (tCO_2/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_2 emission factor for grid power units in the top of the dispatch order in hour, h in year, y (tCO_2/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_2 emission factor of grid power unit, n in year, y (tCO_2/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%; 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.

$$EF_{EL,m,y} = (EF_{CO2} * 3.6)/(\eta_{m,y})$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type i used in power unit m in year y (tCO_2/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	=	Applicable year during monitoring (ex-post option)

Where several fuel types are used in the power unit, use the fuel type with the lowest CO_2 emission factor for $EF_{CO2,m,i,y}$.

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

$EF_{grid,OM-DD,}y$ for the period 01 Apr 2011 -31 Dec 2011= $\sum hEG_{PJ,h}*EF_{EL,h} / EG_{PJ,y}$ = 35,279.62 / 54,251.27 = **0.65030 tCO_2/MWh**

$EF_{grid,OM-DD,}y$ for the period 01 Jan 2012 -31 Dec 2012= $\sum hEG_{PJ,h}*EF_{EL,h} / EG_{PJ,y}$ = 60,415.46 / 88,971 = **0.67905 tCO_2/MWh**

$EF_{grid,OM-DD,}y$ for the period 01 Jan 2013 -31 Mar 2013= $\sum hEG_{PJ,h}*EF_{EL,h} / EG_{PJ,y}$ = 15,245.35 / 21,942.8 = **0.69478 tCO_2/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_2/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

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year, y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year, y (tCO_2/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:

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

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

$EF_{grid,CM,y}$ for the period 01 Apr 2011 -31 Dec 2011 = 0.25*(0.65030) + 0.75*(0.50665) = **0.57847 tCO2/MWh**

$EF_{grid,CM,y}$ for the period 01 Jan 2012 -31 Dec 2012= 0.25*(0.67905) + 0.75*(0.50665) = **0.59285 tCO2/MWh**

$EF_{grid,CM,y}$ for the period 01 Jan 2013 -31 Mar 2013= 0.25*(0.69478) + 0.75*(0.50665) = **0.60071 tCO2/MWh**

Value of the baseline emissions:

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

For the period 01 Apr 2011 -31 Dec 2011 = 54251.27*0.57847= 31,383 tCO2
For the period 01 Jan 2012 -31 Dec 2012 = 88,971*0.59285= 52,746 tCO2
For the period 01 Jan 2013 -31 Mar 2013 = 21,942.84*0.60071= 13,181 tCO2

Total Baseline Emissions for the period 01 Apr 2011 to 31 Mar 2013 = 31,383 + 52,746 + 13,181 = **97,310 tCO2**

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

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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

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

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Total baseline emissions:

97,310 tCO_2

Total project emissions:

0

Total leakage:

0

Total emission reductions:

For the period 01/04/2011 – 31/03/2013 :

Baseline Emissions – Project Emissions – Leakage Emissions =97,310 tCO_2e – 0 – 0 = 97,310 tCO_2e

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total	97,310	0	0	97,310

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	65,700	97,310

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

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

For the project, the main parameter that defines annual energy production and consequently reduction of the emission of CO_2, is hydrology. HPP Poechos I could produce up to 133 GWh/year or 266 GWh/year in two years , if it operates during the whole year with maximum required volume of water and in that way establishing conditions for the maximum theoretical production of the plant.

The PDD has used an annual production close to 58 GWh/year or 116GWh for two years. From the above presented data it is noticeable that each year for the hydrology of the Chira River varies widely.

In this verification period for example, year 2012 had a hydrology 162% above the average[6] . We can notice that for this two year monitored period that goes from April 1st, 2011-March to 31st, 2013 the energy production has been 165,165 MWh which is 42% more than expected.

Anyhow, even under these real operational conditions, power plant operational factor (relation between really produced energy and maximum possible energy production) is only 62% (165,165 / 266,000 GWh), which indicates that HPP Poechos I operated during the analyzed period within expected ranges of possible energy production.

Therefore, the total energy production for the verification period April 1st, 2011 – March 31st, 2013 was more than average, which directly resulted in increase of the corresponding reduction of CO_2 emissions.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	84,129	13,181

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[6] According to the hydrology of the Chira river from year 1976 to 2004(one year before the date of project registration) the average yearly hydrology excluding the atypical years of 1982 and 1998 when the Niño phenomenon occurred, was 3,314.5 m^3 while the hydrology of year 2012 was 8,698.3 m^3.

Document information

Version	*Date*	*Description*
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 anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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