



**Monitoring report form for CDM project activity
(Version 09.0)**

MONITORING REPORT

Title of the project activity	Poechos II hydroelectric plant project		
UNFCCC reference number of the project activity	1836		
Version number of the PDD applicable to this monitoring report	6		
Version number of this monitoring report	1		
Completion date of this monitoring report	12/07/2022		
Monitoring period number	4 (for the first crediting period)		
Duration of this monitoring period	01/01/2016 to 31/03/2016 (first and last days included)		
Monitoring report number for this monitoring period	N/A		
Project participants	Sindicato Energético S.A. Vert Conservation Pte Ltd		
Host Party	Peru		
Applied methodologies and standardized baselines	ACM0002: Grid-connected electricity generation from renewable sources - Version 06 EB24 (date May 19,2006).		
Sectoral scopes	1: Energy Industries (renewable /non-renewable sources)		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
		5,622	
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	5,692		

SECTION A. Description of project activity

A.1. General description of project activity

>> The purpose of the Poechos II hydroelectric power plant (herein referred to Poechos II) is to generate electricity, utilizing renewable energy sources, to be supply to the Peruvian National Inter-connected Electric Grid (SEIN). Poechos II's installed capacity is 10 MW. The Project will generate electricity without emitting GHGs. It will reduce anthropogenic GHG emissions by displacing GHGs that would have been emitted if fossil fuels were burned to generate power.

Poechos II takes advantage of the existing Poechos dam, which is 48 meters (m) high and approximately 1,000 m long, with a water discharge of 45 m³/s for Poechos I and 60 m³/s for Poechos II. The dam was constructed between 1971 and 1974 exclusively for the Chira-Piura¹ irrigation system. Poechos II's machine house was built downstream at the intake of the diversion channel, named Daniel Escobar, which transports water for irrigation purposes. The Project takes advantage of the 20 m drop between the water level of the Poechos reservoir and the water level of the diversion channel. The water concession granted to the project sponsors by the Peruvian Department of Agriculture stipulates that water discharges for agricultural needs will always have priority over water required for power generation. Although the reservoir allows for a multi-year storage of water, the Project not have facilities to discharge water for power generation because control of the discharges is managed by the Agricultural Authority of the Piura Region, except in the case when the Poechos reservoir is full and there are overflows of water that can be used for hydropower generation without any restrictions.

The spatial extent of the project boundary is the National Electric Grid (SEIN). Poechos II is connected to the SEIN through the Sullana Substation, which belongs to Electronoroeste S.A. (ENOSA), a state-owned enterprise, using a 60 kV transmission line from Poechos to Sullana, which was already constructed for Poechos I and is the property of Sindicato Energetico SA (SINERSA). The Project is expected to have a minimum plant operating life of 40 years.

Poechos II is the second phase of an existing hydroelectric power generation project, Poechos I. The first phase consisted of the construction of a 15.2 MW hydroelectric project, which utilizes the same reservoir and is located one kilometer away from Poechos II. Poechos I was registered as a CDM project on November 14, 2005 and shares with Poechos II most of the constraints that prevented its development in the absence of CDM. The project started to deliver electricity to the grid the 22 of May, 2009.

The Project has reduced in this monitoring period 5,622 tCO_{2e}¹. Methane and carbon dioxide that may be 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 will not be taken into account when calculating emission reductions (ERs).

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

A.2. Location of project activity

¹ ER estimates are based on the "Consolidated Baseline Methodology for grid-connected electricity generation from renewable sources" (ACM0002)

>> The Project is located in the Northwestern Peruvian Department of Piura, in the Sullana Province, Lancones District, and in the town of Lancones. The Project site is 1,100 Km North from the city of Lima, 40 Km from the Sullana City, and 30 km from the Peruvian-Ecuadorian border. The plant is located within the property of the Poechos dam, built over the Chira River² and 1,000 m away from the Poechos I hydroelectric plant. The coordinates of the project are Latitude 4°41'28.71" South, Longitude 80°30'13.71" West. In decimal point the coordinates are: Latitude 4.691308. Longitude 80.50308

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Peru	Sindicato Energético S.A.	No
Sweden	VERT CONSERVATION PTE LTD	No

A.4. References to applied methodologies and standardized baselines

>>

Version 06 of ACM0002 (dated May 19, 2006): "Consolidated baseline methodology for gridconnected electricity generation from renewable sources" (herein referred to as the "Baseline Methodology") was applied to the project activity. The Baseline Methodology will be used in conjunction with the approved monitoring methodology ACM0002 ("The Monitoring Methodology")

A.5. Crediting period type and duration

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

Starting date of the first crediting period is 01/04/2009 and the end is 31/03/2016

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

>> The construction of the project began in December 2007. The starting date of operation of the project activity was 22/05/2009. Although it was planned to commissioned in 01/04/2009 there was a delay in the manufacturing and taking over of Turbine 1 and 2 and therefore the project start operation in 22/05/2009.

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 took advantage of these stops to perform inspections and maintenance of the generation units.

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 intake of the diversion channel. The penstock is bifurcated into two penstock pipes of 30 m³/s, with each leading to a powerhouse with two generating units each of 5 MW capacity. The generating units consist of two Kaplan turbines coupled to synchronous generators (3-phase) each of 5.4 MVA nominal capacity. The part of the powerhouse housing the main equipment is an

² In 1974, with the sole purpose of providing provide irrigation for 110,000 inhabitants living in the Chira and Piura valleys.

underground reinforced concrete structure, with other equipment in an above ground steel structure. The water is discharged into a tailrace channel (capacity 60 m³/s) connected to the existing energy dissipater of the diversion channel and fed back into the 'Daniel Escobar' irrigation diversion channel. The control building contains the control room, offices and auxiliary installations. The control room is equipped with a modern system for automatic and remote control (SCADA). Poechos II is connected to Poechos I through a transmission line of 10kV, of 1 km length. The power plant is connected to the national grid through an existing 60 kV overhead transmission line. The transmission line is connected to the existing Sullana substation.

GENERATION EQUIPMENT

TECHNICAL DATA - SUMMARY

Turbines

	DESCRIPTION	TURBINE 1	TURBINE 2
	Manufacturer	CKD	CKD
A	Type	Kaplan, Tipo S	Kaplan, Tipo S
B	Installed Power [MW]	5	5
C	Number of blades	18	18
D	Arrangement	Horizontal	Horizontal
F	Nominal speed [rpm]	275	275
G	Minimum discharge [m ³ /s]	15	15
H	Maximum discharge [m ³ /s]	30	30
I	Velocity for increase power [MW/min]	1	1
J	Velocity for decrease power [MW/min]	1	1
K	Minimum Power [MW]	2.5	2.5
L	Suspended solids limitations	no	no

Generators

	DESCRIPTION	UNIT 1	UNIT 2
	Manufacturer	WEG	WEG
A	Power [MVA]	5.4	5.4
B	Speed [rpm]	720	720
C	Runaway speed [rpm]	1683	1683
D	Number of poles	10	10
E	Minimum time for synchronization [min]	1	1
F	Current A	311.8	311.8
G	Excitation V	80	80
	A	15	15
H	Reactive power without load [MVAR]	0.0	0.0
I	Reactive power at 50% of load [MVAR]	1	1
J	Reactive power at 100% of load [MVAR]	2	2
J	Maximum voltage generation [V]	10,500	10,500
K	Minimum voltage generatio [V]	9,500	9,500
L	Power Factor	0.9	0.9

B.2. Post-registration changes

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

>> Not deviation applied to this monitoring period

B.2.2. Corrections

>> Not applicable

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

>> Not applicable

B.2.4. Inclusion of monitoring plan

>> Not applicable

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

>> Not applicable

B.2.6. Changes to project design

>> Not applicable

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

>> Not applicable

SECTION C. Description of monitoring system

>> 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' ³) ○ Report of dispatch merit orders for "hours of maximum demand" ○ Report of net energy sold to the grid. ○ Use real NECs per power plant in the SEIN

³ 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.

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
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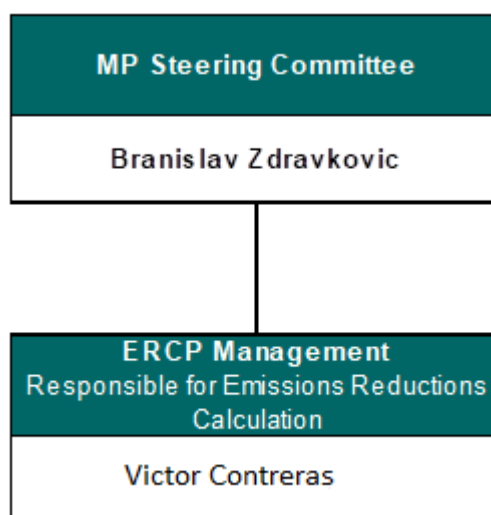
The Operator should calculate ERs on the basis of this MP (following the ERCP) for the purpose of claiming ERs credits. It is believed that the MP approach presented here will result in an accurate, yet conservative calculation of ERs. However, some uncertainties may lead to a deviation of monitored 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.

There are only 2 required spreadsheets to update with new data: Poechos II EGh net electricity check.xls and Poechos II DDA-OM and BM.xls. The names of these files should be kept as they are, but should also reflect the date for which the latest adjustment is made.

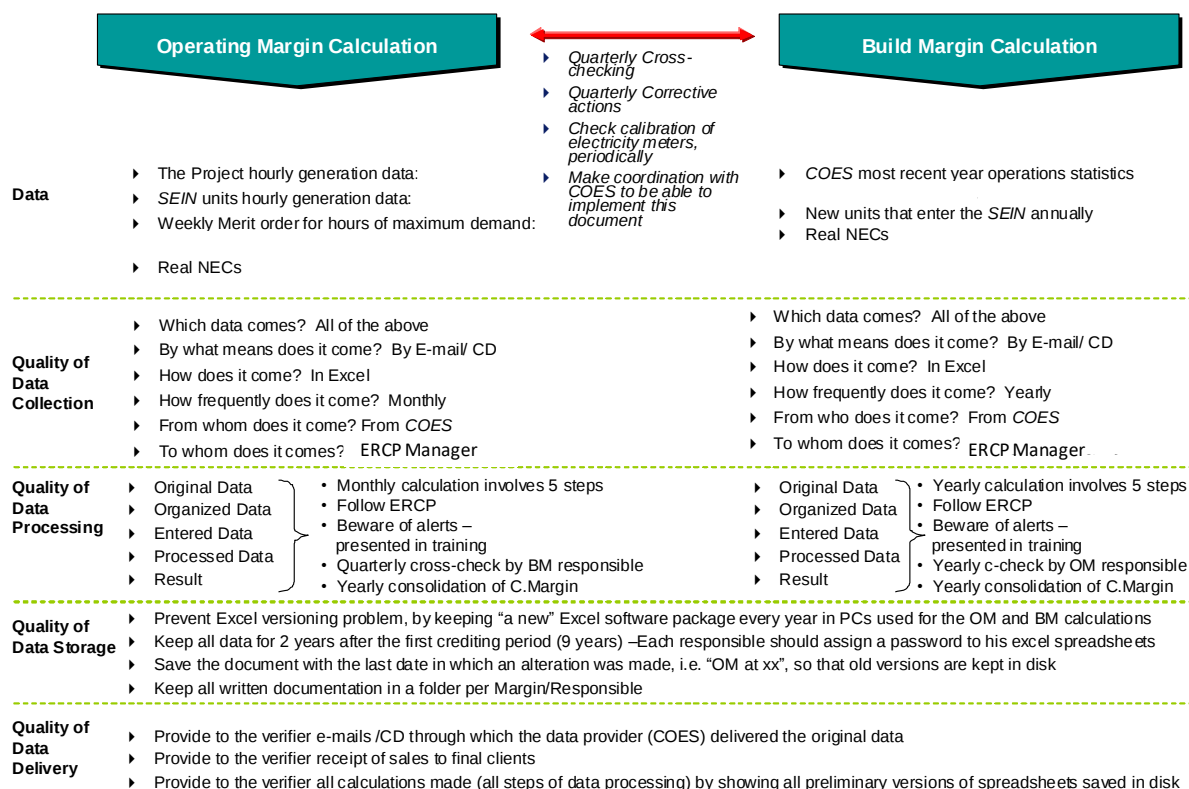
As this monitoring period covers three months, one Poechos II DDA-OM.xls spreadsheet has been prepared to measure the emission reductions of the months occurred between 01/01/2016 – 31/03/2016. The name of this spreadsheets is:

1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls

Emission Reductions Calculation Procedure(ERCP) ERCP Organizational Structure



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



Electricity Meter Location

The net electricity to the grid of Poechos II is metered in the energy meter of Poechos II. The connection to the grid is in the substation of Sullana, therefore the electricity meter of Sullana is used to measure net energy to the grid.

However, this meter measures also electricity from other CDM registered project, the hydropower plant of Poechos I, which belongs to the same project developer.

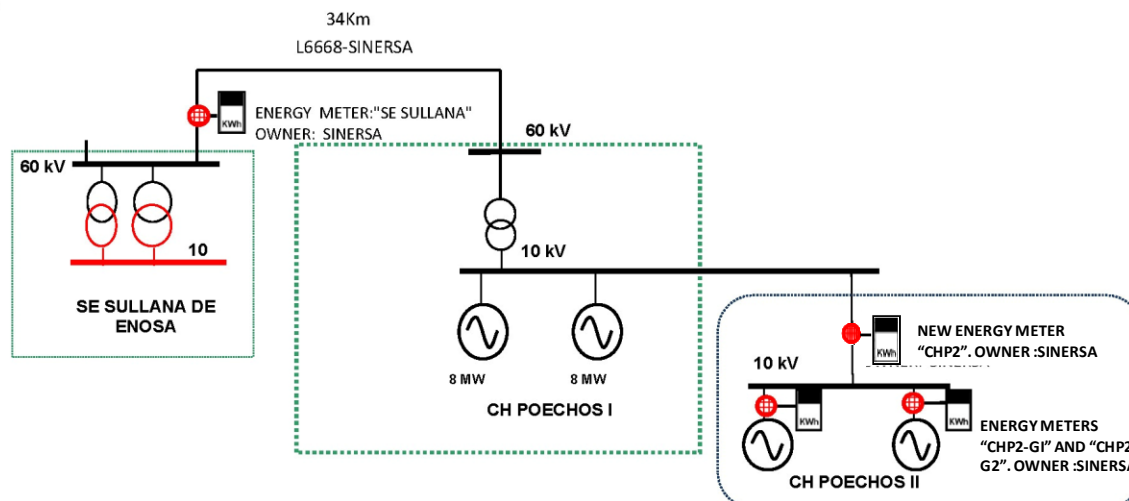
Consequently, the sum of net electricity to the grid eligible for CERs of both projects will be the electricity metered in Sullana. It doesn't matter how this electricity will be distributed between these two projects; in the end the project participant will receive CERs from both projects. Since Poechos I does not has its own electricity meter, its net electricity to the grid is the difference between the electricity metered in Sullana and the electricity metered in Poechos II (MWhSullana - MWhPoechos II). Therefore, transformation and transmission losses as well as auxiliary electricity consumption of Poechos II will be absorbed by Poechos I

So, the net electricity to the grid for Poechos II is the electricity metered in the electricity meters of Poechos II and reported to final client (ENOSA). (Auxiliary electricity consumption, transformation losses and transmission losses will not affect the supply of electricity of Poechos II since the electricity calculation of Poechos I absorbed it).

The monitoring report verifies that the sum of electricity reported of Poechos II and Poechos I in each hour is equal to the net electricity metered in Sullana.

Figure 1. Diagram location of energy meters for Poechos II

DIAGRAM LOCATION OF ENERGY METERS FOR THE POECHOS II PROJECT



DESCRIPTION

ENERGY METER: "SE SULLANA" Measures the Energy delivered to ENOSA from CHP1 y CHP2

ENERGY METER: "CHP2-G1", "CHP2-G2" Measures all the Energy delivered by HPP Poechos 2 from the Units.

NEW ENERGY METER "CHP2" Measures all the energy delivered by HPP Poechos II after Auxiliary electricity consumption available since April 2010.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

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
Choice of data or measurement methods and procedures	The project does not lead to any GHG emissions. Hydropower plants without important reservoirs are classified as zero emission projects, for which there are no associated emissions in the Project boundary.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

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
Choice of data or measurement methods and procedures	According to the Baseline Methodology, project participants do not need to consider leakage.
Purpose of data/parameter	Leakage emission calculations
Additional comments	-

Data/Parameter	Carbon Content
Unit	tC/TJ

Description	Carbon content for each type of fuel					
Source of data	IPCC default carbon content as provided in table 1.3 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories					
Value(s) applied	Default values:					
		Type of Fuel				
		D2	Residual	Natural Gas	Coal	Biogas
	Carbon Content	20.20	21.10	15.30	25.80	14.90
Choice of data or measurement methods and procedures	The carbon content is used to calculate the CO ₂ emission coefficients of the power plants in the grid. It is incorporated in CEF calculation in workbook “(WS-0) CEF calculation” In the column titled as “C” of spreadsheet: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls					
Purpose of data/parameter	Baseline emission calculation					
Additional comments	-					

Data/Parameter	Oxidation Factor																		
Unit	%																		
Description	Percentage of carbon that is oxidized or converted to carbon dioxide during the combustion of fossil fuels																		
Source of data	IPCC default carbon content as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories																		
Value(s) applied	Default values <table><tr><td></td><th colspan="5">Type of Fuel</th></tr><tr><td></td><th>D2</th><th>Residual</th><th>Natural Gas</th><th>Coal</th><th>Biogas</th></tr><tr><th>Oxidation Factor</th><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table>		Type of Fuel						D2	Residual	Natural Gas	Coal	Biogas	Oxidation Factor	1	1	1	1	1
	Type of Fuel																		
	D2	Residual	Natural Gas	Coal	Biogas														
Oxidation Factor	1	1	1	1	1														
Choice of data or measurement methods and procedures	The oxidation factor is used to calculate the CO₂ emission coefficients of the power plants in the grid. The oxidation factor is used to calculate the CO₂ emission coefficients of the power plants in the grid. It is incorporated in CEF calculation in workbook “(WS-0) CEF calculation” In the column titled as “O” of spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls																		
Purpose of data/parameter	Baseline emission calculation																		
Additional comments	-																		

D.2. Data and parameters monitored

(Copy this table for each data or parameter.)

Data/parameter:	EG_n
Unit	MWh
Description	Electricity supplied to the SEIN by the Project.

Measured/calculated/default	Measured																											
Source of data	COES																											
Value(s) of monitored parameter	See column titled "EGH Project hourly generation" of monthly worksheets of the Spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls																											
Monitoring equipment	<table border="1"> <thead> <tr> <th></th><th>Sullana Meter</th><th>Poechos II Meter</th></tr> </thead> <tbody> <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>October 01, 2015</td><td>October 02, 2015</td></tr> <tr> <td>Date of last calibration</td><td>September 11,2018</td><td>September 11,2018</td></tr> <tr> <td>Validity</td><td>OK</td><td>OK</td></tr> </tbody> </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"		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	October 01, 2015	October 02, 2015	Date of last calibration	September 11,2018	September 11,2018	Validity	OK	OK
	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	October 01, 2015	October 02, 2015																										
Date of last calibration	September 11,2018	September 11,2018																										
Validity	OK	OK																										
Measuring/reading/recording frequency:	Electricity supplied to the SEIN by the Project is measured in the meter of Poechos II. This data will be measured continuously and recorded hourly. The proportion of data to be monitored is 100% and all data will be archived electronically, and backed up regularly. Moreover, this information will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. Poechos II have a separate control and measuring system, distinct from that for Poechos I, and as per requirements by COES. The electricity meter will be calibrated at least every three years.																											
Calculation method (if applicable):	Not applicable																											
QA/QC procedures:	The monitoring report 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 the meter of Sullana. Sales records to the grid, is used to ensure consistency.																											
Purpose of data:	Calculation of baseline emissions																											
Additional comments:	Electricity supplied by the project activity to the grid. Double check with receipt of sales																											

Data/parameter:	EF _y						
Unit	tCO _{2e} /MWh						
Description	CO _{2e} emission factor of the grid						
Measured/calculated/default	Calculated						
Source of data	Project sponsor's own calculations based on COES data The results of the calculation are in the workbooks titled (WS- #) ERs of the spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls						
Value(s) of monitored parameter		<table><tr><th>Period</th><th>tCO_{2e}</th></tr><tr><td>01 January 2016 -31 March 2016</td><td>0.49844</td></tr></table>	Period	tCO _{2e}	01 January 2016 -31 March 2016	0.49844	
Period	tCO _{2e}						
01 January 2016 -31 March 2016	0.49844						
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):	Calculated as a weighted sum of the OM and BM emission factors according to Version 06 of ACM0002.						
QA/QC procedures:	-						
Purpose of data:	Calculation of baseline emissions						
Additional comments:	-						

Data/parameter:	EF _{OM,y}						
Unit	tCO _{2e} /MWh						
Description	CO _{2e} Operating Margin Emission Factor of the grid						
Measured/calculated/default	Calculated						
Source of data	Project sponsor's own calculations based on COES data The results of the calculation are in the workbooks titled (WS- #) ERs of the spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls						
Value(s) of monitored parameter		<table><tr><td>Period</td><td>tCO_{2e}</td></tr><tr><td>01 January 2016 -31 March 2016</td><td>0.66154</td></tr></table>	Period	tCO _{2e}	01 January 2016 -31 March 2016	0.66154	
Period	tCO _{2e}						
01 January 2016 -31 March 2016	0.66154						
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):	Calculated according to the Dispatch Data Analysis Operating Margin Emission Factor (DDA-OM) formulas established in Version 06 of ACM0002						
QA/QC procedures:	-						
Purpose of data:	Calculation of baseline emissions						
Additional comments:	-						

Data/parameter:	EF _{BM,y}						
Unit	tCO _{2e} /MWh						
Description	CO _{2e} Build Margin emission factor of the grid						
Measured/calculated/default	Calculated						
Source of data	Project sponsor's own calculations based on COES data The results of the calculation are in the workbooks titled (WS- #) ERs of the spreadsheets: Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls						
Value(s) of monitored parameter		<table><tr><th>Period</th><th>tCO_{2e}</th></tr><tr><td>01 January 2016 -31 March 2016</td><td>0.33534</td></tr></table>	Period	tCO _{2e}	01 January 2016 -31 March 2016	0.33534	
Period	tCO _{2e}						
01 January 2016 -31 March 2016	0.33534						
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):	Calculated as [Σm,y GEN,m,y, *COEFm] / [ΣmGENmy] for the recently built power plants defined in the Baseline Methodology (BM2) of Version 06 of ACM0002.						
QA/QC procedures:	-						
Purpose of data:	Calculation of baseline emissions						
Additional comments:	-						

Data/parameter:	Fi		
Unit	TJ		
Description	Amount of each fossil fuel consumed by each power plant per MWh		
Measured/calculated/default	Calculated		
Source of data	Project sponsor's own calculation using COES net efficiency conversions (NECs) annual data.		
Value(s) of monitored parameter	See column "PFR per MWh" of worksheet (WS-0) of the Spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls		
Monitoring equipment	No especial 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 yearly. The proportion of data to be monitored is 100% and the data will be archived electronically.		
Calculation method (if applicable):	Since data of the amount of fuel i (in a mass or volume unit) consumed by relevant power sources are not available in Peru, it is reliably estimated with the Plant Fuel Requirement per MWh (PFR per MWh) Formula: $3.6 \cdot 10^9 / (NEC \cdot 10^{12}) = TJ$, where the NECs are the actual ones of each power plant as provided in the most recent COES Annual Statistics. The parameter is monitored using the most recent information published by the COES which for the years of this monitoring period are the annual statistics 2016.		
QA/QC procedures:	-		

Purpose of data:	Calculation of baseline emissions
Additional comments:	-

Data / Parameter:	COEF_i
Unit:	tCO ₂ /MWh
Description:	CO ₂ emission coefficient of each power plant
Measured/ Calculated / Default:	Calculated
Source of data:	Project sponsor's own calculation using COES net efficiency conversions (NECs) annual data
Value(s) of monitored parameter:	It is incorporated in COEF calculation in workbook "(WS-0) CEF calculation" of the spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls
Monitoring equipment:	No especial 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 yearly. The proportion of data to be monitored is 100% and the data will be archived electronically.
Calculation method (if applicable):	COEFs have been updated annually with actual NECs that are published annually by COES. In this monitoring period, it was used the annual statistics 2016. COEFs per plant are calculated separately by the ERCP Manager, using actual NECs for each plant. The COEF formula to be used is: COEFs per plant = $F_i \times [(44/12) \times C \times O] = [3.6 \times 10^9 / (NEC \times 10^{12})] \times [(44/12) \times C \times O] = [3.6 \times (44/12) \times C \times O] / [10^3 \times NEC \text{ per plant}]$.
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comment:s:	-

Data / Parameter:	GEN
Unit:	MWh
Description:	Hourly electricity generation of all units of the grid
Measured/ Calculated / Default:	Measured
Source of data:	COES records.
Value(s) of monitored parameter:	See hourly power plant generation in the monthly worksheets of the spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.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 based on the information provided by COES. This data is measured every 15 minutes and recorded hourly. The proportion of data to be monitored is 100% and the data is archived electronically.
Calculation method (if applicable):	Not applicable

QA/QC procedures:	Data has been taken from COES official information
Purpose of data:	Calculation of baseline emissions
Additional comment:s:	-

Data / Parameter:	Plant Name
Unit:	Text
Description:	Identification of power plants for the OM
Measured/ Calculated / Default:	Default
Source of data:	COES.
Value(s) of monitored parameter:	See workbooks zero of the spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.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:	The proportion of data to be monitored is 100% of set of plants and the data will be archived electronically.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Data has been taken from COES official information.
Purpose of data:	Calculation of baseline emissions.
Additional comment:s:	-

Data / Parameter:	Plant Name
Unit:	Text
Description:	Identification of power plants for the BM
Measured/ Calculated / Default:	Default
Source of data:	COES.
Value(s) of monitored parameter:	See workbooks "(WS- #) BM2" of the spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.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:	The proportion of data to be monitored is 100% of set of plants and the data will be archived electronically.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Data has been taken from COES official information.
Purpose of data:	Calculation of baseline emissions.

Additional comment:s:	-
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Data / Parameter:	Merit Order
Unit:	Text
Description:	The merit order in which power plants are dispatched by documented evidence
Measured/ Calculated / Default:	Calculated
Source of data:	COES
Value(s) of monitored parameter:	See worksheet (WS-2) "Merit order by month" of the Spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls The thermal plants are ordered according to their weekly merit order. We used the variable cost of thermal plants from the SEIN. Source: www.coes.org.pe
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:	Measured weekly. It is used the merit order public available in the monthly statistics of COES (www.coes.org.pe). For each moth, it is used the average variable cost of thermal plants from the SEIN. The proportion of data to be monitored is 100% of all plants in the merit order. The data have been archived electronically.
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Data has been taken from COES official information
Purpose of data:	Calculation of baseline emissions
Additional comment:s:	-

Data / Parameter:	GEN imports
Unit:	MWh
Description:	Electricity imports to the Project's electricity system
Measured/ Calculated / Default:	Measured
Source of data:	COES records
Value(s) of monitored parameter:	See hourly power plant generation in the monthly worksheets of the spreadsheets: 1. Poechos II DDA-OM and BM 01 January 2016 -31 March 2016.xls
Monitoring equipment:	The information is provided by COES. No monitoring equipment is necessary for the project operator other than computers to down
Measuring/ Reading/ Recording frequency:	The proportion of data to be monitored is 100% and the data will be archived electronically. Recording frequency: Once a year.
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Data has been taken from COES official information

Purpose of data:	Calculation of baseline emissions
Additional comment:s:	-

Data / Parameter:	COEF imports
Unit:	tCO ₂ /MWh
Description:	CO ₂ emission coefficient of fuels used in connected electricity systems (if imports occur)
Measured/ Calculated / Default:	Default
Source of data:	COES
Value(s) of monitored parameter:	0 tCO ₂ /MWh
Monitoring equipment:	No monitoring equipment is necessary for the project operator other than computers.
Measuring/ Reading/ Recording frequency:	The proportion of data to be monitored is 100% and the data will be archived electronically. Recording frequency: Once a year.
Calculation method (if applicable):	For imports from a connected electricity system located in another country, the emission factor is zero (0 tCO ₂ /MWh). For imports from other grids within the same host country, the COEF should be calculated as the methodology indicates (Please not that this case is not applicable in Peru, since there is only one interconnected grid in Peru, which is the SEIN).
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions
Additional comments:	-

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

>>

Baseline Emissions = EF_y * (Annual Generation in MWh)

The baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps:

STEP 1. Calculate the Operating Margin emission factor (EF_{OM,y})

STEP 2. Calculate the Build Margin emission factor (EF_{BM,y})

STEP 3. Calculate the baseline emission factor EF_y as the weighted average of the Operating

Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

STEP 1. Calculate the Operating Margin emission factor ($EF_{OM,y}$)

The formula for the Dispatch Data Analysis OM used was provided by the Baseline Methodology as follows:

$$EF_{OM,y} \text{ Dispatch Data (tCO}_2\text{/MWh)} = E_{OM,y}/EG_y$$

Where,

$E_{OM,y}$: Sum of average tCO₂/MWh emitted by plants that fall within the top 10% of grid dispatch each hour of the year multiplied by the annual generation in MWh each hour of the year.

$$E_{OM,y} = \sum_h EG_h \cdot EF_{DD,h}$$

Where EG_h is the generation of the project (in MW_h) in each hour h and $EF_{DD,h}$ is the hourly generation weighted average emissions per electricity unit (tCO₂/MWh) of the set of power plants (n) in the top 10% of grid system dispatch order during hour h :

$$EF_{DD,h} = (\sum_{i,n} GEN_{i,n,h} \cdot COEF_n) / \sum_n GEN_{n,h}$$

Where:

$GEN_{i,n,h}$: The hourly electricity generated within the period 01/01/2016 – 31/03/2016 of each calendar year by each unit of the SEIN of the set of power plants (n) in the top 10% of grid system dispatch order.

$COEF_{i,n}$: The emission factors in tCO₂/MWh assigned to each plant in the SEIN based on its technology. For hydropower plants and solar plants the COEF equals 0.

Since data of the amount of fuel i (in a mass or volume unit) consumed by relevant power sources are not available in Peru, In Poechos II it was not used the amount of fuel but the Plant Fuel Requirement per MWh (PFR per MWh). In this way, the PFR per MWh is calculated for each plant according to its Net Efficiency Conversion (NEC). The formula is $3.6/(NEC \text{ per plant} \cdot 10^3) = \text{TJ/MWh}$, where the NECs are the actual ones of each power plant as provided in the most recent COES Annual Statistics. The parameter is monitored using the most recent information published by the COES which is the annual statistics 2016 for this monitoring period. Based on the PFR, it is calculated the $COEF_n$ for each plant. $COEF_n \text{ per plant} = [3.6 / (10^3 \times NEC \text{ per plant})] \times (44/12) \times C \times O$

EG_y : Annual generation of the Project

The information of the hourly generation of all plants in the SEIN and their associated emission factors was catalogued using Excel software, and organized in columns, where the position of the

columns was determined by the monthly grid dispatch merit order⁴. This organization helped to identify the plants that fall within top 10% of grid dispatch each hour of the year.

The resulting Dispatch Data Analysis Operating Margin emission factor was calculated as follows:

For the period 01/01/2016 – 31/03/2016:

$$E_{OM,y} / EG_y = 7,462.22 / 11,280 = 0.66154 \text{ tCO}_2\text{e/MWh}$$

STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$)

According to the Baseline Methodology, the BM is defined as the generation-weighted average emission factor of either (1) the 5 most recently built power plants, or (2) the most recently built power plants accounting for 20% of all power generation, whichever group's annual generation is greater. Both groups must exclude power plants that are registered, or are in the process of registering, as CDM projects. Out of these two options for the calculation of the BM, option (2) was selected for the sake of being conservative because this option does not include plants that are under construction and requires an annual *ex-post* calculation for the first crediting period.

The formula applied to the selected sample was:

$$EF_{BM,y} (\text{tCO}_2/\text{MWh}) = [\sum_m \text{GEN}_{m,y} * \text{COEF}_m] / [\sum_m \text{GEN}_{m,y}]$$

Where,

$\text{GEN}_{m,y}$: The electricity generated by each unit of the SEIN of the set of power plants (m) in the BM selected Sample. It is considered the year 2016 since this year have been the most recently published Annual COES statistics at the time of each calendar year of the monitoring period.

COEF_m : The emission factors in tCO_2/MWh assigned to each plant in the SEIN based on its technology. For hydropower plants and solar plants the COEF equals 0.

Any additions to installed capacity in the SEIN were identified and considered.

The resulting Build Margin Emission Factors are:

For the period 01/01/2016 – 31/03/2016 :0.33534 $\text{tCO}_2\text{e/MWh}$

STEP 3. Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y}$$

where the weights w_{OM} and w_{BM} , by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh .

For the period 01/01/2016 – 31/03/2016:

⁴ This was done by a simple average of the four weekly Santa Rosa Equivalent Cost Soles/MWh (merit orders) assigned to each unit of the SEIN, by COES, in a month.

$$EF_y = 0.5 \times (0.66154) + 0.5 \times (0.33534) = 0.49844 \text{ tCO}_{2e}/\text{MWh}$$

Value of the baseline emissions:

Baseline Emissions = $EF_y \times (\text{Annual Generation in MWh})$

For the period 01 January 2016 -31 March 2016 = $0.49844 \times 11,280 = 5,622 \text{ tCO}_{2e}$

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

>> 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 emissions

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

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

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)			
				Before 01/01/2013	From 01/01/2013 until 31/12/2020	From 01/01/2021	Total amount
Total	5,622	0	0	0	5,622		5,622

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

Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
5,622	5,692

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

>> The ex-ante estimates of emission reductions valid for the monitoring period represents the sum of monthly ER valid for the period 01/01/2016 to 31/03/2016

E.6. Remarks on increase in achieved emission reductions

>> GHG emission reductions achieved by the project activity during the considered monitoring period is not greater than the amount based on the ex-ante estimation in the registered PDD.

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

>> Not applicable

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
09.0	8 October 2021	Revision to: • Ensure consistency with version 03.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN).
08.0	6 April 2021	Revision to: • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.
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