MONITORING REPORT FORM (CDM-MR) *
Version 01 - in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT
Version number: 1
Date: 02/08/2010

Title project activity: Poechos II hydroelectric plant project
Reference number: 1836
Monitoring period: 1
Dates of the monitoring period: 01 April 2009 - 31 March 2010

SECTION A. General description of the project activity

A.1. Brief description of the project activity: >>

Poechos II hydroelectric power plant (Poechos II) is located in Peru, in the North-western Department of Piura. The purpose of the project 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.

The Project has reduced in this monitoring period 30,494 tCO2e 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).

Poechos II is the second phase of an existing hydroelectric power generation project, Poechos I. The first phase consisted of the construction of a 15.5 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.

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 expected 40 GWh of electricity generated per year is sold to ENOSA, and a PPA has been signed between ENOSA and the Project's operator/sponsor, which is SINERSA. The Project is expected to have a minimum plant operating life of 40 years.

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

A.2. Project Participants

Name of Party involved (*) ((host) indicates a host Party):	Private and/or public entity(ies) project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Peru (host)	Sindicato Energético SA	No
Kingdom of Spain	Asin Carbono S.L.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party (ies) and any known project participants (e.g. those proposing a new methodology) shall be identified.		

A.3. Location of the project activity:

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 l located within the property of the Poechos dam, built over the Chira River[2] and 1,000 m away from the Poechos I hydroelectric plant.

The coordinates of the project are Latitude 4º41´28.71´´ South , Longitude 80º30´13.71´´ West.

A.4. Technical description of the project

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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 intake of the diversion channel. The penstock is bifurcated into two penstock pipes of 30 m^3/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 underground reinforced concrete structure, with other equipment in an above ground steel structure. The water is discharged into a tailrace channel (capacity 60 m^3/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 has a length of 38-km and 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	Effective Power [MW]	5	5

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

C	Number of blades	18	18
D	Arrangement	Horizontal	Horizontal
F	Nominal speed [rpm]	275	275
G	Minimum discharge [m3/s]	15	15
H	Maximum discharge [m3/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	Minimun voltage generatio [V]	9,500	9,500
L	Power Factor	0.9	0.9

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

Version 06 of ACM0002 (dated May 19, 2006): “Consolidated baseline methodology for grid-connected 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”).

Version 03 of the “Tool for the Demonstration and Assessment of Additionality” adopted at the 29th Meeting of the CDM Executive Board (EB 29) on 15-16 February 2007 was also applied to the activity.

A.6. Registration date of the project activity:

24/11/2008

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

01/04/ 2009 – 31/03/ 2016

A.8. Name of responsible person(s)/entity(ies):

Branislav Zdravkovic

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

The starting date of operation of the project activity was 22/05/2009

B.2. Revision of the monitoring plan

The monitoring plan has not been revised

B.3. Request for deviation applied to this monitoring period

No deviation applied to this monitoring period.

B.4. Notification or request of approval of changes

No applicable

SECTION C. Description of the monitoring system

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 from the Project's final client, ENOSA. Electricity production by the plant and any internal usage are metered continuously to account for the net level of electricity sold to the grid, and these records and sales receipts are cross-referenced with COES data (which 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 weekly dispatch merit orders for "hours of maximum demand [4]"
ENOSA (Data Provider)	-Report of the Project hourly generation purchased by ENOSA.
Operator (Data processor)	-Verification of ENOSA's report of the Project's hourly generation – comparison with own records; back up of any claims with receipt of sales -Monthly data filling in all the spreadsheets required, following the ERCP -Monthly report

The Operator calculate ERs on the basis of this MP (following the ERCP) for the purpose of claiming ERs credits.

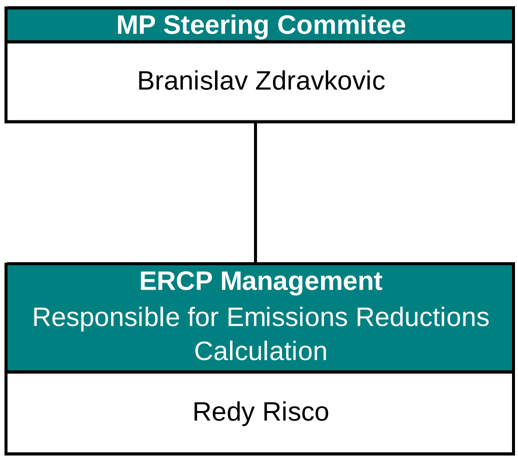
[3] Half an hour measurement is still acceptable if total SEIN production calculated with it does not deviate greatly (i.e. less than 1%) from total SEIN generation calculated with the 15-minute measured data.
[4] (6pm to 11 pm) to set a standard - weekly merit orders for hours of maximum, minimum and medium demand are similar.

The ERCP is the basic instrument for gathering, recording and processing information that will result in the measured ERs. The Operator shall keep the Project ERCP as a manual. The ERCP contain: i) data gathered from the Project's final client: ENOSA[5], ii) data gathered from COES information system, and iii) data processed by the Operator. All data processing should be done in Excel. The ERCP is designed for monthly calculation, based on final monthly COES reports and the final client monthly recording. Although it is only possible to know the ERs at the end of each year (March 31st for the Project), filling data monthly in the required spreadsheets provide time to review formulas, minimize errors and have data readily available for the Verifier in any period of the year.

There are only 2 required spreadsheets to update with new data: Poechos DDA-OM.xls and Poechos BM2.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.

Monitoring plan (MP) - Emissions Reductions Calculation Procedure (ERCP)

ERCP Organizational Structure



[5] When the Project Operator becomes an active member of COES, all data will come from COES.

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

Operating Margin Calculation ↔ **Build Margin Calculation**

- *Quarterly Cross-checking*
- *Quarterly Corrective actions*
- *Check calibration of electricity meters, periodically*
- *Make coordination with COES to be able to implement this document*

	Operating Margin Calculation	Build Margin Calculation
Data	The Project hourly generation data: *SEIN* units hourly generation data: Weekly Merit order for hours of maximum demand: Real NECs	*COES* most recent year operations statistics New units that enter the *SEIN* annually Real NECs
Quality of Data Collection	Which data comes? All of the above By what means does it come? By E-mail/ CD How does it come? In Excel How frequently does it come? Monthly From whom does it come? From *COES (Programacion Semanal)* **To whom does it comes? ERCP Manager**	Which data comes? All of the above By what means does it come? By E-mail/ CD How does it come? In Excel How frequently does it come? Yearly From who does it come? From *COES* (EE. Economicos) To whom does it comes **? ERCP Manager**
Quality of Data Processing	Original Data Organized Data Entered Data Processed Data Result • Monthly calculation involves 5 steps • Follow ERCP • Beware of alerts – presented in training • Quarterly cross-check by BM responsible • Yearly consolidation of C.Margin	Original Data Organized Data Entered Data Processed Data Result • Yearly calculation involves 5 steps • Follow ERCP • Beware of alerts presented in training • Yearly c-check by OM responsible • Yearly consolidation of C.Margin

Quality of Data Storage

- Prevent Excel versioning problem, by keeping "a new" Excel software package every year in PCs used for the OM and BM calculations
- Keep all data for 2 years after the first crediting period (9 years) –Each responsible should assign a password to his excel spreadsheets
- Save the document with the last date in which an alteration was made, i.e. "OM at xx", so that old versions are kept in disk
- Keep all written documentation in a folder per Margin/Responsible

Quality of Data Delivery

- Provide to the verifier e-mails /CD through which the data provider (COES) delivered the original data
- Provide to the verifier receipt of sales to final clients
- Provide to the verifier all calculations made (all steps of data processing) by showing all preliminary versions of spreadsheets saved in disk

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**Project emissions**
Data unit:	**tCO_2**
Description:	GHG emissions produced by the project activity
Source of data used:	N/A (as suggested in The Methodology)
Value(s) :	0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project/ emission calculations
Additional comment:	The Project does not lead to any GHG emissions. Hydropower plants built over existing reservoirs where the volume of the reservoir is not increased are classified as zero emission projects, for which there are no associated emissions in the Project boundary.

Data / Parameter:	Ly
Data unit:	tCO_2
Description:	GHG emissions produced by leakage of the project activity
Source of data used:	N/A (as suggested in The Methodology)
Value(s) :	0
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Leakage emission calculations
Additional comment:	According to the Baseline Methodology, project participants do not need to consider leakage.

Data / Parameter:	**Carbon Content**
Data unit:	tC/TJ
Description:	Carbon content for each type of fuel
Source of data used:	2006 IPCC Guidelines
Value(s) :	Default values. (see table below)
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Additional comment:	The carbon content is used to calculate the CO2 emission coefficients of the power plants in the grid.

	Type of Fuel			
	D2	**Residual**	**Natural Gas**	**Coal**
Carbon Content	20.20	21.10	15.30	25.80

<table>
<tr><td>Data / Parameter:</td><td>Oxidation Factor</td></tr>
<tr><td>Data unit:</td><td>%</td></tr>
<tr><td>Description:</td><td>Percentage of carbon that is oxidized or converted to carbon dioxide during the combustion of fossil fuels</td></tr>
<tr><td>Source of data used:</td><td>2006 IPCC Guidelines</td></tr>
<tr><td>Value(s) :</td><td>Default values.
<table>
<tr><td></td><td colspan="4">Type of Fuel</td></tr>
<tr><td></td><td>D2</td><td>Residual</td><td>Natural Gas</td><td>Coal</td></tr>
<tr><td>Oxidation Factor</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table></td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline emission calculations</td></tr>
<tr><td>Additional comment:</td><td>The oxidation factor is used to calculate the CO2 emission coefficients of the power plants in the grid.</td></tr>
</table>

D.2. Data and parameters monitored

<table>
<tr><td>Data / Parameter:</td><td>EG_h</td></tr>
<tr><td>Data unit:</td><td>MWh</td></tr>
<tr><td>Description:</td><td>Electricity supplied to the SEIN by the Project.</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured</td></tr>
<tr><td>Source of data:</td><td>COES records, electricity meters, final clients</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>See EGh Spreadsheet for the period 01 April 2010 - 31 March 2010</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline emission calculation</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>
<table>
<tr><td></td><td>Central Meter</td><td>Unit I</td><td>Unit II</td></tr>
<tr><td>Manufacturer</td><td>PM - ION 7650</td><td>General Electric</td><td>General Electric</td></tr>
<tr><td>Type</td><td>Digital</td><td>SR489-P5-LO-A20-E</td><td>SR489-P5-LO-A20-E</td></tr>
<tr><td>Accuracy class</td><td>0.2</td><td>0.5</td><td>0.5</td></tr>
<tr><td>Serial Number</td><td>PJ-1004A406-02</td><td>B3280435</td><td>B3280436</td></tr>
<tr><td>Calibration frequency</td><td>5 years</td><td>5 years</td><td>5 years</td></tr>
<tr><td>Date of last calibration</td><td>Aprl 22 -2010</td><td>Apr 3, 2008</td><td>Apr 3, 2008</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 every 5 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.
</td></tr>
</table>

	✓ The procedure of calibration is in document "CHP2-Procedimiento calibracion de medidores.docx"
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. Poechos II has a separate control and measuring system, distinct from that for Poechos I, and as per requirements by ENOSA and COES
Calculation method (if applicable):	
QA/QC procedures applied:	Electricity supplied by the project activity to the grid. Double check with receipt of sales.

Data / Parameter:	EFy.
Data unit:	tCO_2/MWh
Description:	CO2 emission factor of the grid
Measured /Calculated /Default:	Calculated
Source of data:	Project sponsor's own calculations based on COES data
Value(s) of monitored parameter:	0.63207 tCO_2/MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 will be 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 applied:	

Data / Parameter:	$EF_{OM,y}$
Data unit:	tCO2/MWh
Description:	CO2 Operating Margin Emission Factor of the grid
Measured /Calculated /Default:	Calculated
Source of data:	Project sponsor's own calculations based on COES data
Value(s) of monitored parameter:	0.63207 tCO_2/MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration	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

frequency, date of last calibration, validity)	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):	Calculated according to the Dispatch Data Analysis Operating Margin Emission Factor (DDA-OM) formulas established in Version 06 of ACM0002.
QA/QC procedures applied:	

Data / Parameter:	$EF_{BM,y}$
Data unit:	tCO2/MWh
Description:	CO2 Build Margin emission factor of the grid
Measured /Calculated /Default:	Calculated
Source of data:	Project sponsor's own calculations based on COES data
Value(s) of monitored parameter:	0.50466 tCO_2/MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 will be 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 applied:	

Data / Parameter:	F i
Data 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:	It is incorporated in COEF calculation in workbook "(WS-0) CEF calculation" of spreadsheet "Poechos II DDA-OM April 2009 – March 2010". In the column titled as "PFR per MWh(2)"
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 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*10^9/(NEC*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 is the annual statistics 2009 for this monitoring period.
QA/QC procedures applied:	

Data / Parameter:	COEFi
Data 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 spreadsheet "Poechos II DDA-OM April 2009 – March 2010". In the column titled as "CO2 Emissions Factor (tCO2/MWh)"
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 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 2009. COEFs per plant is calculated separately by the ERCP Manager, using actual NECs for each plant. The COEF formula to be used is: COEFs per plant = F i * [(44/12) x C x O] = [3.6 *10^9/(NEC*10^12)]* [(44/12) x C x O] = [3.6 x (44/12) x C x O] / [10^3 x NEC per plant].
QA/QC procedures applied:	

Data / Parameter:	GEN
Data unit:	MWh
Description:	Hourly electricity generation of all units of the grid
Measured /Calculated /Default:	Measured
Source of data:	COES
Value(s) of monitored parameter:	See Poechos II DDA-OM.xls Spreadsheet
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration	The information is provided by COES. No monitoring equipment is necessary for the project operator other than computers to down load the information.

frequency, date of last calibration, validity)	
Measuring/ Reading/ Recording frequency:	Directly Measured based on the information provided by COES. This data will be measured every 15 minutes and recorded hourly. 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 applied:	Data has been taken from COES official information

Data / Parameter:	Plant Name OM
Data unit:	Text
Description:	Identification of power plants for the OM
Measured /Calculated /Default:	
Source of data:	COES
Value(s) of monitored parameter:	See Poechos II DDA-OM.xls Spreadsheet
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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):	
QA/QC procedures applied:	

Data / Parameter:	Plant Name BM
Data unit:	Text
Description:	Identification of power plants for the BM
Measured /Calculated /Default:	
Source of data:	COES Annual statistics
Value(s) of monitored parameter:	See Poechos II BM2. xls Spreadsheet
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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):	
QA/QC procedures applied:	

Data / Parameter:	Merit Order
Data 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 "Poechos II DDA-OM.xls" spreadsheet for the period 01 April 2010 - 31 March 2010. The monthly merit order is calculated in workbook "(WS-2) MERIT ORDER BY MONTH"
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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. The proportion of data to be monitored is 100% of all plants in the merit order. The data will be archived electronically and in paper for original documents
Calculation method (if applicable):	
QA/QC procedures applied:	

Data / Parameter:	GEN imports
Data unit:	MWh
Description:	Electricity imports to the Project's electricity system
Measured /Calculated /Default:	Measured
Source of data:	COES
Value(s) of monitored parameter:	No imports were registered in COES as of date
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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% and the data will be archived electronically. Recording frequency: Once a year.
Calculation method (if applicable):	
QA/QC procedures applied:	

Data / Parameter:	COEF imports
Data unit:	tCO_2/MWh
Description:	CO2 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
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculations
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	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 tCO2/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 applied:	

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

The baseline emission factor (EFy) 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(s) ($EF_{OM,y}$)
STEP 2. Calculate the Build Margin emission factor ($EF_{BM,y}$)
STEP 3. Calculate the baseline emission factor EFy as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

In Annex I, is described the spreadsheets that calculated the results.

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

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

$$\mathbf{EF_{OM.y}\ Dispatch\ Data\ (tCO_2/MWh) = E_{OMy}/EG_y}$$

Where,

E_{OMy}: Sum of average tCO_2/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.

$E_{OM,y} = \sum_h EG_{h*.} EF_{DD.h}$.

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 (tCO_2/MWh) of the set of power plants (n) in the top 10% of grid system dispatch order during hour h:

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

Where:

$GEN_{,n,h}$: The hourly electricity generated within the period April 1,2009 – March 31,2010 by each unit of the SEIN of the set of power plants (n) in the top 10% of grid system dispatch order.

$COEF_{i,n}$[6]: The emission factors in tCO_2/MWh assigned to each plant in the SEIN based on its technology. For hydropower 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 per plant *10^3)= 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 2009 for this monitoring period. Based on the PFR, it is calculated the COEFn for each plant.
COEFs per plant = [3.6/ (10^3 x NEC per plant)] x (44/12) x C x O

EGy: 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 order[7]. 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 April 1,2009 – March 31,2010 :

$$E_{OMy}/ EG_y = 36{,}641/ 48{,}245 = \mathbf{0.75947\ tCO_2/MWh}$$

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

[6] COEFs assigned to each unit of the SEIN can be seen in Annex 3.
[7] 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.

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:

$$\mathbf{EF_{BMy}\ (tCO_2/MWh)} = [\sum_m GEN_{,m,y,} *COEF_{,m}] / [\sum_m GEN_{m,y}]$$

Where,

$GEN_{,m,y}$: The electricity generated in year 2009 by each unit of the SEIN of the set of power plants (m) in the BM selected Sample. It is considered year 2009 since it is the year of the most recently published Annual COES statistics.

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

Any additions to installed capacity in the SEIN were identified and considered. Table below shows the capacity additions to the SEIN, and their annual generation for the period . The annual generation of the additions included in this table is from 2009 (last year of public information – Annual statistics COES).

Capacity Additions in the SEIN (2006-2009)

Plant	Date	Technology	Installed Capacity Added (MW)	2009 total installed capacity	% of total installed capacity.	2009 total production in GWh	2009 Gen (GWh) of the new addition
Santa Rosa TG8	Ago-09	Gas turbine Natural Gas	199.83	199.83	100%	42.96	42.96
TG 3 Chilca	Jul-09	Gas turbine Natural Gas	194.19	194.19	100%	412.18	412.18
TG 2 Kallpa	Jun-09	Gas turbine Natural Gas	193.52	193.52	100%	503.69	503.69
Trujillo Norte	Jun-09	Diesel 2	62.13	62.13	100%	83.34	83.34
Oquendo	Ene-09	Gas turbine Natural Gas	29.38	29.38	100%	187.44	187.44
TG 2 Chilca	Jul-07	Gas turbine Natural Gas	174.53	174.53	100%	1,144.14	1144.14
TG 1 Kalpa	Jul-07	Gas turbine Natural Gas	174.41	174.41	100%	734.24	734.24
TG 1 Chilca	Dic-06	Gas turbine Natural Gas	175.96	175.96	100%	996.14	996.14
Ventanilla cc	Oct-06	Gas turbine Natural Gas	492.75	492.75	100%	3,256.21	3256.21
Santa Rosa UTI 5 y 6	Ago-06	Gas turbine Natural Gas	106.02	106.02	100%	158.14	158.14
Source: COES							

In Table above, it can be seen that the 5 most recently built plants up to year 2009 were: 1) Santa Rosa TG8, 2) TG3 Chilca, 3) TG 2 Kallpa, 4) Trujillo Norte, 5) Oquendo, with their total annual generation being 1,230 GWh. On the other hand, the total annual generation of the most recently built plants accounting for 20% of the grid was greater at 7,360GWh; therefore, this latter group was selected for the BM calculation. The most recently built power plants accounting for 20% of all power generation comprises the list of Table above until the enter of the Combined Cycle of Ventanilla in October 2006.

In Table below, the selected sample of most recently built plants was organized by their annual electricity generation output, their weights with respect to the total generation of the selected sample, and their emission factors. By multiplying the emission factor per plant with its assigned weight and then summing up the results, the weighted average of the selected sample was obtained. The resulting **BM2** equals **0.50466 tCO_2/MWh** for the year 2009.

BM Calculation following Option 2

Plant Name	Most Recent Year Gen (MWh)	% per plant	CO2 emission Factor tCO2/MWh
Santa Rosa TG8	43	0.58%	0.580
TG 3 Chilca	412	5.60%	0.580
TG 2 Kallpa	504	6.84%	0.601
Trujillo Norte	83	1.13%	0.600
Oquendo	187	2.55%	0.601
TG 2 Chilca	1,144	15.54%	0.580
TG 1 Kalpa	734	9.98%	0.601
TG 1 Chilca	996	13.53%	0.580
Ventanilla cc	3,256	44.24%	0.400
Total	7,360	100%	0.50466
			Weighted average emission factor
BM2=	0.50466	tCO2//MWh	

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

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

where the weights *wOM* and *wBM*, by default, are 50% (i.e., *wOM* = *wBM* = 0.5), and *EFOM,y* and *EFBM,y* are calculated as described in Steps 1 and 2 above and are expressed in tCO2/MWh.

=

EFy = 0.5*(0.75947) + 0.5*(0.50466) = **0.632074 tCO_2/MWh**

E.2. Project emissions calculation

The Project does not lead to any GHG emissions. Hydropower plants built over existing reservoirs where the volume of the reservoir is not increased are classified as zero emission projects, for which there are no associated emissions in the Project boundary.

E.3. Leakage calculation

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

E.4. Emission reductions calculation / table

Total baseline emissions:

Estimated Baseline Emissions = EFy * (Estimated Annual Generation in MWh)
Estimated Baseline Emissions = 0.632074 tCO2/MWh * 48,245 MWh) = 30,494 tCO2

Total project emissions:

0

Total leakage:

0

Total emission reductions:

Baseline Emissions – Project Emissions – Leakage Emissions = 30,494 tCO_2 – 0 – 0 = 30,494 tCO_2

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

This section shall include a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	22,770	30,494

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

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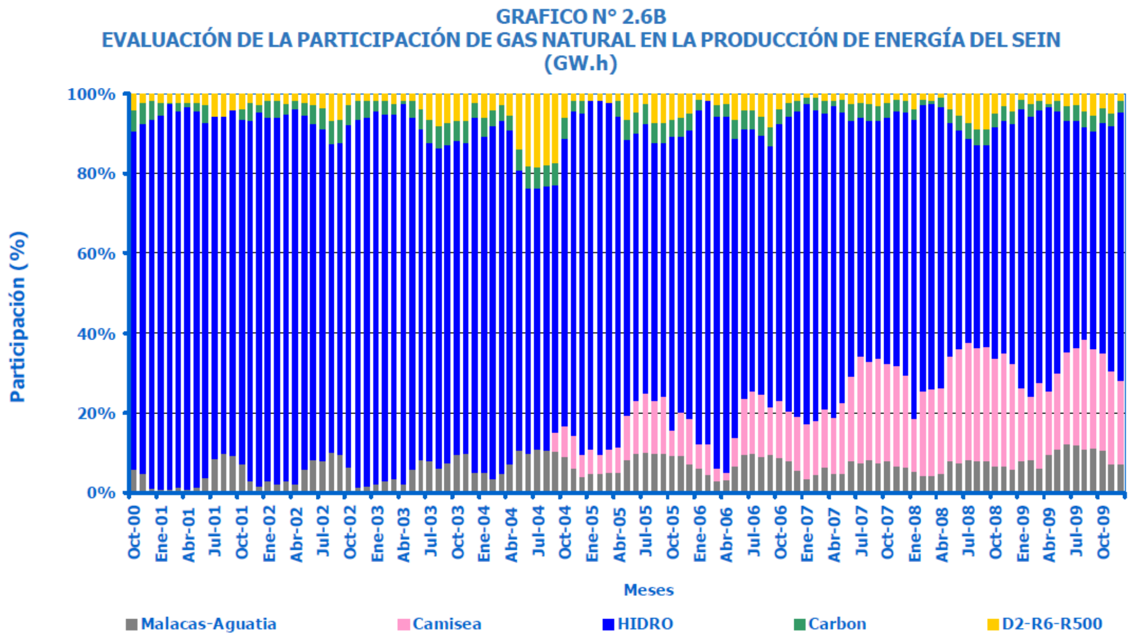
In the PDD it was estimated a yearly emission reduction of 22,770 tCO_2. In this monitoring period the emission reduction has been 30,494 tCO_2e, around 50% more. There are two reasons for this: The first is that the baseline emission factor has increased and the second is that the project energy production is a little more bigger that the one stated in the PDD.

The Baseline emission factor has grown from 0.56927 tCO_2/MWh to 0.632074 tCO_2/MWh. The main reason of that is that the Build Margin emission factor has grown in 23% due to the additions of new thermal plants that has left hydropower plants out of the sample plants of the build margin. In addition, the dispatch importance of thermal plants have been increasing from 25.65% of the total energy production of the grid in year 2006 to 37.09% in year 2009.Therefore, the Operating Margin emission factor also has increased.

Changes in the emission Factors

Emission Factor	PDD	Monitoring Period	Change %
$\mathbf{EF_y}$	0.56927 tCO_2/MWh	0.632074 tCO_2/MWh	+ 11%
$\mathbf{EF_{OM,y}}$	0.72756 tCO_2/MWh	0.75947 tCO_2/MWh	+ 4%
$\mathbf{EF_{BM,y}}$	0.41098 tCO_2/MWh	0.50466 tCO_2/MWh	+ 23%

Evolution of the energy production of the Peruvian Grid per type of generation(GWh)
The blue section is hydro , the other colours are thermal plants.



Source: COES Annual statistics 2009. Chapter 2. Page 15

The energy production for the period April 1,2009 – March 31,2010 has been 48,245 MWh, while the estimated energy production in the PDD was 40,000 MWh. This means an increment of 20%.

For the project, the main parameter that defines annual energy production and consequently reduction of the emission of CO2, is hydrology. HPP Poechos 1 could produce up to 87.6 GWh/year, 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 estimated an annual production close to 40 GWh/year. It is noticeable that each year for the hydrology of the Chira River varies widely. Therefore, the total energy production for the verification period April 1st, 2009 – March 31st, 2010 was more than average, which directly resulted in increase of the corresponding reduction of CO2 emissions.

Anyhow, even under these real operational conditions, .power plant operational factor (relation between really produced energy and maximum possible energy production) is only 55,07% (48,245 / 87,600 GWh), which indicates that HPP Poechos II operated during the analyzed period within expected ranges of possible energy production.

ANNEX I: Emissions Reductions Calculation Procedure and Required Spreadsheets

The ERCP is the basic instrument for gathering, recording and processing information that result in the measured ERs. The ERCP should contain: i) data gathered from the Project's final client: ENOSA[8], ii) data gathered from COES information system, and iii) data processed by the Operator. All data processing should be done in Excel. The ERCP is designed for monthly calculation, based on final monthly COES reports and the final client monthly recording.

There are only 2 required spreadsheets that are updated with new data: Poechos II DDA-OM.xls and Poechos II BM2.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. In this case the date is April 1st,2009 -March 31st ,2010.

DDA-OM Spreadsheet :

This Excel file contains all data and formulas necessary to calculate the Dispatch Data Analysis Operating Margin (DDA-OM). The data's year is the year of project generation (April 1st,2009-March 31st,2010). 17 worksheets compose the DDA-OM Spreadsheet:

- Worksheet #0: COEFs (tCO_2/MWh) calculation for each plant in the SEIN. The COEF will be calculated *ex- post* annually along the first crediting period.
- Worksheet #1: COEFs (tCO_2/MWh) to assign to each plant in the SEIN .
- Worksheet #2: Calculation of monthly grid dispatch merit order for all thermal plants in the SEIN.
- Worksheet #3 to Worksheet #14: One worksheet per month of the year. These worksheets contain the hourly generation of the plants in the SEIN.

Worksheet #0

Table 1 below shows COEF Calculations and is already filled with actual 2009 NECs from COES Annual Statistics 2009[9] which is the most recent annual statistics published.

[8] When the Project Operator becomes an active member of COES, all data will come from COES.

[9] COES: Estadística de Operaciones. In year 2009, NEC appears as "Eficiencia Térmica %" in the chart No 4.7

Table 1: COEF Calculation

Thermal Plants Emission Factors 2009

Thermal Plants		Technology	Fuel	Real NECs (1)	PFR per MWh (2)	C (3)	O (4)	44/12	CO2 Emissions Factor (tCO2/MWh)
aguaytia1	AGUAYTIA 1	Gas Turbine Natural Gas	Natural Gas	30.70%	0.01173	15.30	1.000	3.67	0.658
aguaytia2	AGUAYTIA 2	Gas Turbine Natural Gas	Natural Gas	30.10%	0.01196	15.30	1.000	3.67	0.671
bellavista 1	BELLAVISTA	Diesel 2 / Residual	Diesel 2	38.00%	0.00947	20.20	1.000	3.67	0.702
bellavistaalco	BELLAVISTA alco	Diesel 2 / Residual	Diesel 2	31.40%	0.01146	20.20	1.000	3.67	0.849
calana 123	CALANA 123	Diesel 2 / Residual	Residual 6	41.80%	0.00861	21.10	1.000	3.67	0.666
chiclayo	DS CHICLAYO OESTE-D	Diesel 2 / Residual	Diesel 2	35.00%	0.01029	21.10	1.000	3.67	0.796
chilca 1	CHILCA	Gas Turbine Natural Gas	Natural Gas	34.80%	0.01034	15.30	1.000	3.67	0.580
chilina comb	C. COMBINADO	Combined Cycle Gas-Steam	Diesel 2	29.30%	0.01229	20.20	1.000	3.67	0.910
chilina tv2	TV2 CHILINA	Steam Turbine / Residual	R500	21.00%	0.01714	21.10	1.000	3.67	1.326
chilina tv3	TV3 CHILINA	Steam Turbine / Residual	R500	22.90%	0.01572	21.10	1.000	3.67	1.216
chilina_slz12	SULZER CHILINA	Diesel 2 / Residual	Diesel 2	42.30%	0.00851	20.20	1.000	3.67	0.630
chimbote	TG CHIMBOTE	Gas Turbine Diesel	Diesel 2	23.50%	0.01532	20.20	1.000	3.67	1.135
ctoquendo	OQUENDO	Gas Turbine Natural Gas	Natural Gas	33.60%	0.01071	15.30	1.000	3.67	0.601
dolores2	DOL ALCO 1-2 GM 1-2-3	Diesel 2 / Residual	Diesel 2	33.90%	0.01062	20.20	1.000	3.67	0.787
dolorespata	DOL ALCO 1-2 GM 1-2-3	Diesel 2 / Residual	Diesel 2	34.00%	0.01059	20.20	1.000	3.67	0.784
ilo1katcato	KATCATO (ENERSUR)	Diesel 2 / Residual	Diesel 2	41.70%	0.00863	20.20	1.000	3.67	0.639
ilo1tg1	TG1 ILO	Gas Turbine Diesel	Diesel 2	30.30%	0.01188	20.20	1.000	3.67	0.880
ilo1tg2	TG2 ILO	Gas Turbine Diesel	Diesel 2	32.70%	0.01101	20.20	1.000	3.67	0.815
ilo1tv2	ILO TV2	Steam Turbine / Residual	R500	34.90%	0.01032	21.10	1.000	3.67	0.798
ilo1tv3	ILO TV3	Steam Turbine / Residual	R500	33.60%	0.01071	21.10	1.000	3.67	0.829
ilo1tv4	ILO TV4	Steam Turbine / Residual	R500	34.50%	0.01043	21.10	1.000	3.67	0.807
ilo2_carb	TV CARBON ILO II	Steam Turbine / Coal	Coal	40.20%	0.00896	25.80	1.000	3.67	0.847
kallpa	KALPA	Gas Turbine Natural Gas	Natural Gas	33.60%	0.01071	15.30	1.000	3.67	0.601
mal_tg3	TG3	Gas Turbine Natural Gas	Natural Gas	22.00%	0.01636	15.30	1.000	3.67	0.918
malacas_tg1	TG1	Gas Turbine Natural Gas	Natural Gas	21.20%	0.01698	15.30	1.000	3.67	0.953
malacas_tg2	TG2	Gas Turbine Natural Gas	Natural Gas	21.60%	0.01667	15.30	1.000	3.67	0.935
malacas_tgN4	TGN4	Gas Turbine Natural Gas	Natural Gas	27.50%	0.01309	15.30	1.000	3.67	0.734
mollendo 123	MOLLENDO 1,2,3	Diesel 2 / Residual	R500	43.20%	0.00833	21.10	1.000	3.67	0.645
mollendo tg1	MOLLENDO TG1	Gas Turbine Diesel	Diesel 2	30.30%	0.01188	20.20	1.000	3.67	0.880
mollendo tg2	MOLLENDO TG2	Gas Turbine Diesel	Diesel 2	31.60%	0.01139	20.20	1.000	3.67	0.844
Paramonga	PARAMONGA	Cogenration Bagase/Diesel	Bagase						0.000
paita1	DS PAITA1	Diesel 2 / Residual	Diesel 2	34.40%	0.01047	20.20	1.000	3.67	0.775
paita2	DS PAITA2	Diesel 2 / Residual	Diesel 2	32.20%	0.01118	20.20	1.000	3.67	0.828
piura1	DS PIURA1	Diesel 2 / Residual	Diesel 2	37.00%	0.00973	20.20	1.000	3.67	0.721
piura2	DS PIURA2	Diesel 2 / Residual	Diesel 2	37.30%	0.00965	20.20	1.000	3.67	0.715
sanbta rosa uti_5	TG S.ROSA UTI5	Gas Turbine Diesel	Diesel 2	29.50%	0.01220	20.20	1.000	3.67	0.904
santa rosa uti_6	TG S.ROSA UTI6	Gas Turbine Diesel	Diesel 2	30.30%	0.01188	20.20	1.000	3.67	0.880
santa rosa westin	TG WESTINGHOUSE	Gas Turbine Natural Gas	Natural Gas	33.10%	0.01088	15.30	1.000	3.67	0.610
santa rosa tg8	TG 8 S.Rosa	Gas Turbine Natural Gas	Natural Gas	34.80%	0.01034	15.30	1.000	3.67	0.580
shcummins	CUMMINS	Diesel 2 / Residual	Diesel 2	37.90%	0.00950	20.20	1.000	3.67	0.704
shouesa_tv1	TV1 SHOUGESA	Steam Turbine / Residual	R500	28.80%	0.01250	21.10	1.000	3.67	0.967
shouesa_tv2	TV2 SHOUGESA	Steam Turbine / Residual	R500	28.50%	0.01263	21.10	1.000	3.67	0.977
shouesa_tv3	TV3 SHOUGESA	Steam Turbine / Residual	R500	30.70%	0.01173	21.10	1.000	3.67	0.907
sullana	DS SULLANA	Diesel 2 / Residual	Diesel 2	34.00%	0.01059	20.20	1.000	3.67	0.784
taparachi	TAPARACHI	Diesel 2 / Residual	Diesel 2	35.90%	0.01003	20.20	1.000	3.67	0.743
tg_piura	TG PIURA	Gas Turbine Diesel	Diesel 2	21.30%	0.01690	21.10	1.000	3.67	1.308
emergen	Trujillo norte	Diesel 2	Diesel 2	37.90%	0.00950	20.20	1.000	3.67	0.704
trujillo	TG TRUJILLO	Gas Turbine Diesel	Diesel 2	24.40%	0.01475	20.20	1.000	3.67	1.093
tumbes	TUMBES	Diesel 2 / Residual	Residual 6	42.00%	0.00857	21.10	1.000	3.67	0.663
VENTANILLA CC	VENTANILLA CC	Gas Turbine Natural Gas	Natural Gas	50.50%	0.00713	15.30	1.000	3.67	0.400
yarinacocha (5)	Yarinacocha (5)	Diesel 2 / Residual	Residual 6	39.20%	0.00918	21.10	1.000	3.67	0.711

1. Source: COES. Estadistica de Operaciones 2009. Cuadro No 4.7. Eficiencia Termica %
2. PFR per MWh = Plant Fuel Requirement formula per MWh = MWh*3.6*10^9/(NEC*10^12)

Table 1 contains pre-established formulas to calculate the emission factors. Data on actual NECs, technology has been updated according the the most recent annual statistics published which is year 2009. New thermal plants have to be included in the year they appear. All these variables should be updated yearly according to the information in the Annual Statistics publicly available on the COES website, therefore, the emission factors of each year depends on the latest Annual Statistics published on the COES website. The specific information source for all these data is the chart entitled “Costos Variables de las Centrales Termoeléctricas del SINAC”, of the COES Annual Statistics, appeared in chart number 4.7., “Estadística anual de Operaciones 2009”.

The formula to use to calculate the COEFs per plant for Table A4-1 is:

COEFs per plant = [PFR per MWh) x C x O x 44/12]

Where:

PFR per MWh = Plant Fuel Requirement (TJ) per MWh = 3.6*10^9/(NEC*10^12)

C= Carbon Content (tC/TJ)

O=Oxidation Factor;

44/12= Mass Conversion (tCO_2/tC).

The C and O factors should be extracted accordingly from Table 2 below in Worksheet #0.

Table 2: Carbon and Oxidation Factors of Various Fuels

	Type of Fuel			
	D2	**Residual**	**Natural Gas**	**Coal**
(3) Carbon Content	20.20	21.10	15.30	25.80
(4) Oxidation Factor	1	1	1	1

Worksheet #1

The following Table 3 assigns a COEF to each plant in the SEIN according to its COEF established in Worksheet #0, Table 1.

Table 3 holds up to 100 plants, of which 34 are hydropower plants and 66 are thermal plants. 64 of the 100 plants already exist, 30 of which are hydropower plants and 34 are thermal, while 36 are future plants, of which 4 will be hydropower plants and 32 thermal plants. Data on future plants should be filled as the arrows in Table A4-3 indicate, as they enter the SEIN. Plants that did not dispatch in any hour of the year in question should not be considered for the DDA-OM calculation at all, so that they do not occupy extra-space unnecessarily.

Table 3: Plants in the SEIN by Technology and Assigned COEF

Table#1: Name Plant / Technology/Assigned COEF

Name	Plant	Technology	COEF(tCO2/MWh)
hp1		Hydro	0.000
hp2		Hydro	0.000
hp3		Hydro	0.000
hp4		Hydro	0.000
Aricota	Aricota	Hydro	0.000
Cahua	Cahua	Hydro	0.000
Callahuanca	Callahuanca	Hydro	0.000
Carhuaquero	Carhuaquero	Hydro	0.000
Charcani 1-3	Charcani 1-3	Hydro	0.000
Charcani 4	Charcani 4	Hydro	0.000
Charcani 5	Charcani 5	Hydro	0.000
Charcani 6	Charcani 6	Hydro	0.000
Chimay	Chimay	Hydro	0.000
Gallito Ciego	Gallito Ciego	Hydro	0.000
Huampani	Huampani	Hydro	0.000
Huanchor	Huanchor	Hydro	0.000
Huayllacho	Huayllacho	Hydro	0.000
Huinco	Huinco	Hydro	0.000
Machupicchu	Machupicchu	Hydro	0.000
Malpaso	Malpaso	Hydro	0.000
Mantaro	Mantaro	Hydro	0.000
Matucana	Matucana	Hydro	0.000
Misapuquio	Misapuquio	Hydro	0.000
Moyopampa	Moyopampa	Hydro	0.000
Orocha-Pachachaca	Orocha-Pachachaca	Hydro	0.000
Pariac	Pariac	Hydro	0.000
Restitución	Restitución	Hydro	0.000
San Antonio	San Antonio	Hydro	0.000
San Gaban 2	San Gaban 2	Hydro	0.000
San Ignacio	San Ignacio	Hydro	0.000
Yanango	Yanango	Hydro	0.000
Yaupi	Yaupi	Hydro	0.000
Yuncan	Yuncan	Hydro	0.000
Caño Pato	Caño Pato	Hydro	0.000
aguaytia1	AGUAYTIA 1	Gas Turbine Natural Gas	0.658
bellavista 1	BELLAVISTA	Diesel 2 / Residual	0.702
calana 123	CALANA 123	Diesel 2 / Residual	0.666
chiclayo	DS CHICLAYO OESTE-D	Diesel 2 / Residual	0.796
chilca 1	CHILCA	Gas Turbine Natural Gas	0.580
chilina comb	C. COMBINADO	Combined Cycle Gas-Steam	0.910
chilina tv3	TV3 CHILINA	Steam Turbine / Residual	1.216
chilina_slz12	SULZER CHILINA	Diesel 2 / Residual	0.630
chimbote	TG CHIMBOTE	Gas Turbine Diesel	1.135
ctoquendo	OQUENDO	Gas Turbine Natural Gas	0.601
dolorespata	DOL ALCO 1-2 GM 1-2-3	Diesel 2 / Residual	0.784
ilo1katcato	KATCATO (ENERSUR)	Diesel 2 / Residual	0.639
ilo1tg2	TG2 ILO	Gas Turbine Diesel	0.815
ilo1tv2	ILO TV2	Steam Turbine / Residual	0.798
ilo2_carb	TV CARBON ILO II	Steam Turbine / Coal	0.847
kallpa	KALPA	Gas Turbine Natural Gas	0.601
malacas_tgN4	TGN4	Gas Turbine Natural Gas	0.734
mollendo 123	MOLLENDO 1,2,3	Diesel 2 / Residual	0.645
Paramonga	PARAMONGA	Cogenration Bagase/Diesel	0.000
paita1	DS PAITA1	Diesel 2 / Residual	0.775
piura2	DS PIURA2	Diesel 2 / Residual	0.715
santa rosa uti_6	TG S.ROSA UTI6	Gas Turbine Diesel	0.880
santa rosa westin	TG WESTINGHOUSE	Gas Turbine Natural Gas	0.610
santa rosa tg8	TG 8 S.Rosa	Gas Turbine Natural Gas	0.580
shcummins	CUMMINS	Diesel 2 / Residual	0.704
shouesa_tv3	TV3 SHOUGESA	Steam Turbine / Residual	0.907
sullana	DS SULLANA	Diesel 2 / Residual	0.784
taparachi	TAPARACHI	Diesel 2 / Residual	0.743
tg_piura	TG PIURA	Gas Turbine Diesel	1.308
emergen	Trujillo norte	Diesel 2	0.704
trujillo	TG TRUJILLO	Gas Turbine Diesel	1.093
tumbes	TUMBES	Diesel 2 / Residual	0.663
VENTANILLA CC	VENTANILLA CC	Gas Turbine Natural Gas	0.400
yarinacocha (5)	Yarinacocha (5)	Diesel 2 / Residual	0.711
tp30			0.000
tp31			0.000
tp32			0.000
tp33			0.000
tp34			0.000
tp35			0.000
tp36			0.000
tp37			0.000
tp38			0.000
tp39			0.000
tp40			0.000
tp41			0.000
tp42			0.000
tp43			0.000
tp44			0.000
tp45			0.000
tp46			0.000
tp47			0.000
tp48			0.000
tp49			0.000
tp50			0.000
tp51			0.000
tp52			0.000
tp53			0.000
tp54			0.000
tp55			0.000
tp56			0.000
tp57			0.000
tp58			0.000
tp59			0.000
tp60			0.000
tp61			0.000

Worksheet #2: Monthly Merit Order Calculation

The 52 weekly merit orders[10] for "hours of maximum demand" should be averaged in Worksheet #2:

April - 1st Week most recent year

Unit Name	Sta Rosa Eq-C (S/KWh)
Sorted by name	x

April - 2nd Week most recent year

Unit Name	Sta Rosa Eq-C (S/KWh)
Sorted by name	x

April - 3rd Week most recent year

Unit Name	Sta Rosa Eq-C (S/KWh)
Sorted by name	x

April - 4rd Week most recent year

Unit Name	Sta Rosa Eq-C (S/KWh)
Sorted by name	x

April-most recent year

Unit Name	Sta Rosa EC (S/KWh)
Sorted by name	Monthly Average Merit Order

Visible Average Function

April-most recent year

Unit Name	Sta Rosa EC (S/KWh)
Name	Sorted by Monthly Average Merit Order

12 monthly merit orders need to be obtained from April through March.

Worksheet #3 to Worksheet #14: Hourly Generation by the Plants in the SEIN

12 monthly worksheets that contain the hourly generation of each plant in the SEIN each month of the most recent year (September-August) should be identical in # of columns, formulas, and general organization, but not in data. Worksheets #3 – Worksheet #14 columns C to CY should be organized as follows:

COEFs:	0	0	0	0	0	0.34	0.62	...	0	0
TECHNOLOGY:	Hydro	Hydro	Hydro	Hydro	Hydro	r-500	Dry Gas	……	Unknown	Unknown
Hours of the month	HP1…..	….HP6	CH Yuncan	…..	Cañon del Pato	ILO TV2	AGUAYTIA 1 (2)	………	TP55….	TP66
1										
.	Future HPs		Existing HPs			Existing HPs			Future HPs	
.										
.										
.	There is an unchangeable pre-defined order for existing and					Existing TPs should be placed according to grid dispatch merit order				
744	future HPs - fro all the crediting period					as well as Future TPs				

Hourly generation of hydropower plants (both existing and future) should occupy columns D to AK only. Hourly generation of thermal plants (both existing and future) should occupy columns AL to CY only. The predefined order for hydropower plants is shown below (Where the "-1 position" =D column and "30th position" =AK column). Thermal plants should be sorted according to their calculated monthly merit order in the grid dispatch. Future hydropower plants (maximum 4) are reserved a columns to the very left of columns D to AK. Future thermal plants (maximum 32) should be reserved a column to the very right of columns AL to CY, as if they were the last in the monthly merit order of the grid system dispatch. Finally, the associated COEFs of SEIN plants should be entered in the first row of the corresponding plant's column. For future plants COEF = 0.

Predefined order from left to right (D to AK) for all hydropower plants[11]

[10] The merit order is given by the Santa Rosa Equivalent Cost (Soles/MWh) assigned to a plant according to its efficiency

[11] The only difference between negative and positive positions is that negatives are for inexistent plants up to December 2005. Even when they start to exist they should keep that position. Note that future hydropower plants are reserved a column to the very left of Worksheet #3-Worksheet #14

-4		hp1
-3		hp2
-2		hp3
-1		hp4
1		C.H. Aricota
2		C.H. Cahua
3		C.H. Callahuanca
4		C.H. Carhuaquero
5		C.H. Charcani 1-3
6		C.H. Charcani 4
7		C.H. Charcani 5
8		C.H. Charcani 6
9		C.H. Chimay
10		C.H. Gallito Ciego
11		C.H. Huampani
12		C.H. Huanchor
13		C.H. Huayllacho
14		C.H. Huinco
15		C.H. Machupicchu
16		C.H. Malpaso
17		C.H. Mantaro
18		C.H. Matucana
19		C.H. Misapuquio
20		C.H. Moyopampa
21		C.H. Orocha-Pachachaca
22		C.H. Pariac
23		C.H. Restitución
24		C.H. San Antonio
25		C.H. San Gaban 2
26		C.H. San Ignacio
27		C.H. Yanango
28		C.H. Yaupi
29		C.H. Yucan
30		C.H. Caño Pato

The formula component of each monthly worksheet (W#3–W#14) is provided in columns CZ to FD (not shown in this PDD). Formulas will use the data entered in columns D to CY and will bring a resulting DDA-OM. The only data column in this set is EE, which should be filled with the Project's hourly generation. The resulting DDA-OM will show up at the low end of column EE in W# January..

The BM2 Spreadsheet:
This Excel file, composed of three worksheets, contains all the calculations necessary to update the BM2. The data's year is the year of the Project generation.

- Worksheet #15: Additions to the SEIN according to COES
- Worksheet #16: The BM2 Calculation in the year the Project's generation started.
- Worksheet #17: The Baseline Emission Factor and ERs in the year the Project's generation started.

Worksheet #15: Additions to the SEIN

Table 4: Additions to the SEIN

Plant	Date	Technology	Installed Capacity Added (MW)	2009 total installed capacity	% of total installed capacity.	2009 total production in GWh	2009 Gen (GWh) of the new addition
Santa Rosa TG8	Ago-09	Gas turbine Natural Gas	199.83	199.83	100%	42.96	42.96
TG 3 Chilca	Jul-09	Gas turbine Natural Gas	194.19	194.19	100%	412.18	412.18
TG 2 Kallpa	Jun-09	Gas turbine Natural Gas	193.52	193.52	100%	503.69	503.69
Trujillo Norte	Jun-09	Diesel 2	62.13	62.13	100%	83.34	83.34
Oquendo	Ene-09	Gas turbine Natural Gas	29.38	29.38	100%	187.44	187.44
TG 2 Chilca	Jul-07	Gas turbine Natural Gas	174.53	174.53	100%	1,144.14	1144.14
TG 1 Kalpa	Jul-07	Gas turbine Natural Gas	174.41	174.41	100%	734.24	734.24
TG 1 Chilca	Dic-06	Gas turbine Natural Gas	175.96	175.96	100%	996.14	996.14
Ventanilla cc	Oct-06	Gas turbine Natural Gas	492.75	492.75	100%	3,256.21	3256.21
Santa Rosa UTI 5 y 6	Ago-06	Gas turbine Natural Gas	106.02	106.02	100%	158.14	158.14
Source: COES							

Worksheet #16: Build MarginCalculation

Table 5: Selection of the sample group

Year	Plant Name	Plant Type	Most recent year generation(GWh)	Filter most recent 20%	Most recent 20% units generation	Filter 5 most recent units	5 Most recent units generation
Ago-09	Santa Rosa TG8	Gas turbine Natural Gas	42.96	1	42.96	1	43
Jul-09	TG 3 Chilca	Gas turbine Natural Gas	412.18	1	412.18	1	412
Jun-09	TG 2 Kallpa	Gas turbine Natural Gas	503.69	1	503.69	1	504
Jun-09	Trujillo Norte	Diesel 2	83.34	1	83.34	1	83
Ene-09	Oquendo	Gas turbine Natural Gas	187.44	1	187.44	1	187
Jul-07	TG 2 Chilca	Gas turbine Natural Gas	1,144.14	1	1,144.14		
Jul-07	TG 1 Kalpa	Gas turbine Natural Gas	734.24	1	734.24		
Dic-06	TG 1 Chilca	Gas turbine Natural Gas	996.14	1	996.14		
Oct-06	Ventanilla cc	Gas turbine Natural Gas	3,256.21	1	3,256.21		
					-		
			-		-		
			-		-		
			-		-		
			-		-		
			-		-		
			-		-		
			-		-		
			-		-		
T/.			7,360	9	7,360	5	
					24.69%		1230
				SEIN Annual Gen=	29,807		
				20% of SEIN Gen=	5,961		
	Most recent 20% units generation		5 Most recent units generation				
	7,360	>	1,230				

Any new plant recorded in Worsheet#15 will require an additional row in Worksheet #16. In this worksheet, columns whose titles are highlighted in blue should be updated. New plants should be added on new rows, as the arrow above indicates. The first filter (5th column composed by 1s and 0s) ensures that the sample's annual generation comprises the most recent 20% of capacity additions to the SEIN. The second filter (7th column) counts up to 5 most recent plants. An automatic check is included in this table, which checks whether the generation of the 5 most recent plants built is greater than the generation of the sample (latest 20% of capacity additions) and indicates which of the two should be selected for the BM2 calculation.

The selected sample of most recently built plants is organized by their annual electricity generation output, their weights with respect to the total generation of the selected sample, and their emission factors. By multiplying the emission factor per plant with its weight and then adding the results, the weighted average of the selected sample was obtained in tCO_2/MWh. Sometimes, a new plant is composed of more than the generating unit, in which case the emission factor is going to be the average weighted by the annual energy of each unit. This result is the BM2 and was calculated as 0.50466 tCO_2/MWh for the year 2009.

Table 6: BM2 Calculation

Plant Name	Most Recent Year Gen (MWh)	% per plant	CO2 emission Factor tCO2/MWh
Santa Rosa TG8	43	0.58%	0.580
TG 3 Chilca	412	5.60%	0.580
TG 2 Kallpa	504	6.84%	0.601
Trujillo Norte	83	1.13%	0.600
Oquendo	187	2.55%	0.601
TG 2 Chilca	1,144	15.54%	0.580
TG 1 Kalpa	734	9.98%	0.601
TG 1 Chilca	996	13.53%	0.580
Ventanilla cc	3,256	44.24%	0.400
Total	7,360	100%	0.50466
			Weighted average emission factor
BM2=	0.50466	tCO2//MWh	

The Emission factors should be extracted accordingly from Worksheet O that would be updated yearly according to data Published by COES from this year forward.

Worksheet #17: Combined Margin and ERs of the year

Worksheet #17 shows the ERs of the year calculated with the 2 spreadsheets' results for DDA-OM and BM2. Cells which have highlighted titles in blue should be updated at the end of the year (March 31).The result for the period April 1st,2009 – March 31st,2010 are:

Project	MWh in the year
Poechos II	48,245

ERs of the Year (DDA-OM-BM2):

Project	MWh in the year*Combined Margin
Poechos II	30,494

DDA – OM =	0.75947
BM2 =	0.50466
CM =	0.63207

ANNEX II: Calibration Certificates

PowerLogic™

70052-0225-05

Certificate of Compliance and Calibration

Schneider Electric certifies that the PowerLogic product listed below meets the published specifications and has been calibrated and tested using equipment and standards traceable to the National Institute of Standards and Technology (NIST) in the US or the National Research Council of Canada (*NRC*).

Model	Part #	Serial #	Calibration Date
ION7650	**P7650A0E0C6E0A0E**	**PJ-1004A406-02**	**22-Apr-2010**

AUTOMATED TESTING

- Power supply levels tested and adjusted on variable power supply units
- Communications verified
- Unit ID and serial number programmed
- Voltage and current inputs calibrated
- Aux I/O calibrated and tested (if applicable)
- Required software options programmed
- Calibration constants saved to external file

FINAL TESTING AND INSPECTION

- Serial number verified
- Firmware version verified
- LCD/Keypad functionality checked (if applicable)
- Memory checked
- Calibration verified
- Software options downloaded and verified (if applicable)
- Applicable counters and registers cleared
- Dielectric Withstand Test Passed

TEST EQUIPMENT USED TO CALIBRATE METER	Model	S/N	Test Equipment Calibration Due Date
	Rotek 8000 BC	**112BC**	**21-Sep-2010**
	Rotek 8000 A	**112**	**21-Sep-2010**

Quality Manager

Production Manager

Quality System
Certified to
ISO 9001:2008

Schneider Electric

Certificate of Compliance and Verification

Model **ION7650**

Part # **P7650A0E0C6E0A0E**

Serial # **PJ-1004A406-02**

The following data contains the energy test results verifying the accuracy of the above meter at the time this test was performed.

The meter has been factory tested in accordance with ***Schneider Electric's*** verification procedures on equipment that is traceable to either ***N.I.S.T.*** (US) or ***N.R.C.*** (Canadian) standards.

Accuracy Data

Step	acc	volt_a	volt_b	volt_c	pab	pac	amp_a	amp_b	amp_c	ph_a	ph_b	ph_c
1	99.994	120.00	120.00	120.00	120	240	0.010	0.010	0.010	0	120	240
2	100.000	120.00	120.00	120.00	120	240	0.020	0.020	0.020	0	120	240
3	99.992	120.00	120.00	120.00	120	240	0.250	0.250	0.250	0	120	240
4	100.001	120.00	120.00	120.00	120	240	0.250	0.250	0.250	60	180	300
5	100.016	120.00	120.00	120.00	120	240	1.000	1.000	1.000	0	120	240
6	100.025	120.00	120.00	120.00	120	240	1.000	1.000	1.000	60	180	300
7	100.002	120.00	120.00	120.00	120	240	2.500	2.500	2.500	0	120	240
8	100.012	120.00	120.00	120.00	120	240	2.500	2.500	2.500	60	180	300
9	100.009	120.00	120.00	120.00	120	240	5.000	5.000	5.000	60	180	300
10	99.984	120.00	120.00	120.00	120	240	10.000	10.000	10.000	60	180	300

Quality System
Certified to
ISO 9001:2008

Schneider Electric

GE Consumer & Industrial
Multilin
215 Anderson Markham, ON, Canada L6E 1B3
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www.Gemultilin.com

CERTIFICATE OF CALIBRATION

Serial No: B3280435
Model No: 489-P5-LO-A20-E
Date: Apr 3 2008 16:52:10

Thank you for purchasing a GE Multilin product. We are committed to producing the highest quality products in the industry backed by exceptional technical service and customer support.

Our products are manufactured, calibrated and tested in accordance with our quality system to meet GE Multilin's product specifications. Instruments used to calibrate and test our products are calibrated to nationally recognized standards.

All products are backed by a full two-year warranty on material and workmanship from the date of shipment from the factory. In the event of a failure under warranty, GE Multilin will repair or replace the product, provided the warrantor determines that it is defective and it is returned to an authorized service center or the factory. Repairs or replacement of product under this warranty will be made without charge.
For complete text of Warranty (including limitations and disclaimers) refer to GE Multilin's Standard Terms & Conditions of Sales.

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Technical Specialist

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