CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Poechos II hydroelectric plant project
Version 6
June 13, 2011
~~Version 5~~
~~September 10, 2008~~

A.2. Description of the project activity:

The proposed project Poechos II ("The Project") is a hydroelectric power plant located in Peru, in the North-western Department of Piura. The Project's purpose is to generate electricity, utilizing renewable energy sources, to be supplied to the Peruvian National Inter-connected Electric Grid (SEIN). The Project's installed capacity is 10 MW and the projected yearly average generation is 40,000 MWh per year. The expected load factor is 45.66%. The Project is estimated to displace 22,770.89 tCO_2e per year, which accounts for 159,396.40 tCO_2e for the first crediting period (7 years), generating the equivalent amount of Certified Emission Reductions (CERs). 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).

The Project 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 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 m^3/s for Poechos I and 60 m^3/s for Poechos II. The dam was constructed between 1971 and 1974 exclusively for the Chira-Piura[1] irrigation system. The Project's machine house will be built downstream at the intake of the diversion channel, named Daniel Escobar, which transports water for irrigation purposes. The Project will take 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 will not have facilities to discharge water for power generation because control of the discharges will be 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.

[1] The Chira-Piura dam is the largest in Peru.

The spatial extent of the project boundary is the National Electric Grid (SEIN). The Project will be 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 will be sold to the national grid~~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.

The Project contributes to sustainable development by:

a) Helping SEIN keep thermal power plants shut down and use them only for stand-by power generation, thus displacing expensive generation fired by heavy fuel, diesel, coal and natural gas, while reducing GHG emissions;

b) Employing local labor in construction and plant management;

c) Purifying and cleaning the water used for irrigation;

d) Facilitating electricity access by serving local demand;

g) Contributing to Peru's fiscal accounts through the payment of taxes;

h) Helping Peru improve its hydrocarbon trade balance through reduction of oil imports to be used for electricity generation; and,

i) Improving local education and technical training opportunities, which have been committed to by SINERSA.

A.3. 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.4. Technical description of the project activity:

A.4.1. Location of the project activity:

Department of Piura, Peru

A.4.1.1. Host Party(ies):

Republic of Peru

A.4.1.2. Region/State/Province etc.:

Department of Piura (Piura Region) / Sullana Province / Lancones District.

A.4.1.3. City/Town/Community etc:

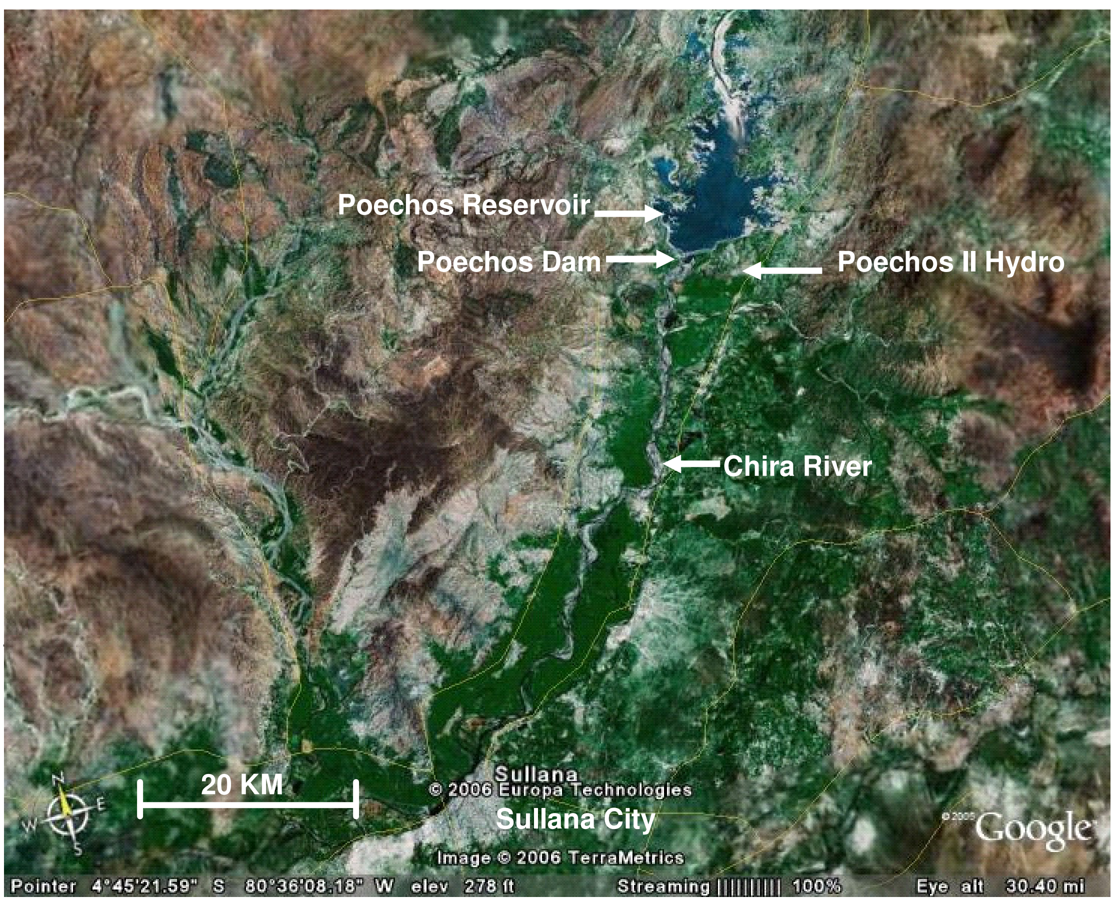
Town of Lancones (capital of the Lancones District)

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The Project will be 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 will be 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.

Figure 1: Map of the Project Site



A.4.2. Category(ies) of project activity:

According to Annex A of the Kyoto Protocol, the Project fits in:
Sectoral Scope Number: 1
Sectoral Scope: Energy Industries -Renewable Energy
Project Activity: Grid-connected renewable power generation; electricity capacity addition from a hydro power project with existing reservoir where the volume of the reservoir is not increased.

A.4.3. Technology to be employed by the project activity:

The technology employed is based on conventional Kaplan turbines (2) and generators (2) that are widely used all over the world. The penstock of the powerhouse will be connected to the existing steel pipe of the intake of the diversion channel. The penstock will be 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 will be an underground reinforced concrete structure, with other equipment in an above ground steel structure. The water will be 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 will be connected to Poechos I through a transmission line of 10kV, of 1 km length. The power plant will be 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.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Once implemented, the Project is estimated to reduce 22,770.89 tCO_2e annually, generating an expected total of 159,396.20 tCO_2e for the duration of the initial 7-year crediting period.

The Project's estimated annual ERs, over the 7-year crediting period, are as follows:

Table 1: Estimated Annual ERs

Year	Annual estimation of emissions reductions in tons of CO_2e
2009[3]	17,078.16

[3] For the Project "the year" would run from April 1st to March 31st, the first year of the first crediting period being April 2009-March 2010, and the last year of the first crediting period being April 2015-March 2016.

2010	22,770.89
2011	22,770.89
2012	22,770.89
2013	22,770.89
2014	22,770.89
2015	22,770.89
2016	5,692.72
Total estimated reductions (tons of CO_2e)	159,396.20
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tones of CO_2e)	22,770.89

A.4.5. Public funding of the project activity:

The Project has not received any type of public funding or public financial help.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved 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.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The Project is a grid-connected, zero-emission, renewable power generation activity and meets all the conditions stated in The Baseline Methodology (ACM0002). These conditions are:

- The Project supplies an electricity capacity addition of 10 MW from a hydropower source at an existing reservoir where the volume of the reservoir is not increased;
- The Project is not an activity that involves switching from fossil fuels to renewable energy at the Project site; and,
- The electricity grid (the SEIN) is clearly identified and information on the characteristics of this grid is available.

B.3. Description of the sources and gases included in the project boundary

The boundary of the Project includes the sources and gases contained in the table below:

Table 2: Sources and Gases Included in the Project Boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Power plants connected to the grid	CO_2	Yes	GHG in the baseline are due to carbon and fossil fuel fired plants
		CH_4	No	Power plants do not produce CH_4 or are negligible
		N_2O	No	Power plants do not produce N_2O or are negligible
Project Activity	Construction	CO_2	No	The emissions produced during construction due to vehicles and machinery are negligible in relation to the emission reductions that the hydroelectric plant will produce.
		CH_4	No	CH_4 is not produced
		N_2O	No	N_2O is not produced

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The baseline scenario is electricity that would have been otherwise generated by the operation of grid-connected power plants and by the addition of new generating sources. In accordance with the Baseline Methodology, the baseline emission factor is calculated using the combined margin (CM) method, which consists of the simple average of the operating margin emission factor (OM) and the build margin emission factor (BM). All margins are expressed in tCO_2/MWh.

CM= 0.5*OM + 0.5*BM

According to the Baseline Methodology, CM can be used to calculate the GHGs expressed in tCO_2/MWh that would have been emitted in the absence of the Project. GHG emission reductions will be claimed based on the total CO_2 emissions mitigated by The Project. The Project boundary considered is the SEIN electricity system. No leakages or indirect emissions were identified in the case of The Project.

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 is estimated to reduce 22,770.89 tCO_2e annually[4], with an expected total of just over 159,396.20 tCO_2e reduced for the duration of the initial 7-year crediting period.

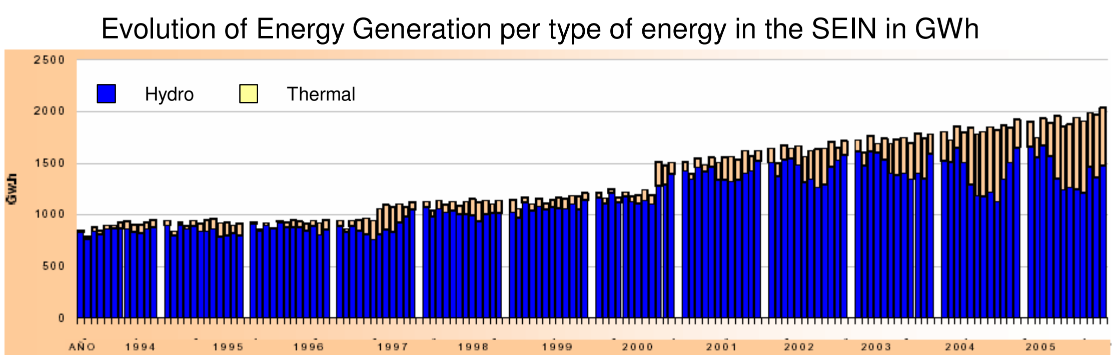
The installed capacity of the SEIN was 4,789 MW in 2005, of which 62% was hydroelectric power generation and 38% thermal. In 2005, the total national power generation was 23,001.49 GWh, of which 74.35% was hydroelectric power and 25.65% thermal.

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

Until 1992, all planning, investments and operation in the power sector were exclusively under the control and authority of the state. After the issuance of the Law of Electric Concessions in 1992, state-owned enterprises were privatized and currently investments in new power generation plants and transmission systems are the domain of private companies. The Law sets forth the norms of operation of the interconnected electric systems, for which an autonomous entity named Committee of Economic Operation of the Electric System (COES) was created. COES is made up of the shareholders of generation companies and of the main transmission system, and neither the State, nor the distribution companies nor consumers have any participation. The COES is responsible for the coordination of the SEIN system operation at minimum cost, guaranteeing the security of the electric power supply and the best use of energy resources.

Although the traditional energy source in Peru has been hydropower, the recent and on-going exploitation of the natural gas deposits of Camisea has started a new chapter in the Peruvian energy sector. Natural gas is expected to become the most economic resource for power generation over the coming decades.

Figure 2: Evolution of Energy Generation in the SEIN



Source: COES. Estadistica de Operaciones 2005

In the absence of the Project, GHG emissions are not likely to be reduced due to prohibitive barriers faced by hydropower plant developers in Peru, and to the existence of other conventional alternatives for power generation that are financially more attractive. Among the barriers are also national and sectoral policies, particularly those promoting the utilization of the Camisea natural gas deposits with special emphasis on gas-fired electricity generation and further exploration of deposits to be used by the Camisea Natural Gas project.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

The "Tools for the Demonstration and Assessment of Additionality" Version 3 is applied to the Project through the following steps:

Step 1: Identification of alternatives to the project activity consistent with mandatory laws and regulations
Step 2: Investment analysis

Step 3: Barriers analysis
Step 4: Common practice analysis

Step 1 - Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Three realistic and credible alternatives were identified as available to the Project participants, which **provide outputs or services comparable** with the proposed CDM project activity. These are:

1) Implement the Project as hydroelectric power generation, but **without** CDM assistance;

2) Implement the Project as a fossil fuel-fired thermal plant; or,

3) Provision of equivalent amount of annual power output by the grid that the proposed project is connected with (Do not implement any power generation project)

Since 2004, with the availability of the natural gas exploitation of Camisea and the subsequent promotional measures from the government for its development, fossil fuel-fired thermal plants have became the most competitive investment in the power market and start dominating the new generation in the Grid. This situation will not be changed in the near future since the natural gas reservoirs of the exploitation of Camisea are expected to last at least 30 years.

Sub-step 1b. Enforcement of applicable laws and regulations:

The identified alternatives are in compliance with all applicable legal and regulatory requirements, including Peru's Electric Concession Law of 1992 -Law 25844 (ECL). Several articles of Peru's ECL imply that the alternatives described above are valid and realistic options, including:

a) Article 1: Electricity generating activities can be developed by people or legal entities, whether they are nationals or foreigners. Legal entities (private companies) should be incorporated under Peruvian laws;

b) Article 3: A concession is required for the development of hydropower plants (or geothermal power plants[5]) if their installed capacity is greater than 20 MW;

c) Article 4: An authorization is required to develop fossil fuel-fired power plants with an installed capacity greater than 500 kW, and for hydropower and geothermal power plants if their installed capacity is less than or equal to 20 MW;

d) Article 6: The concessions and authorizations can be granted by Peru's Department of Energy and Mines (MINEM*)*;

e) Article 7: Electricity generating activities that do not require a concession or authorization can be developed freely provided they comply with technical standards and adhere to conservation of environmental quality and cultural heritage. The developer of such activities should inform the MINEM of the project activity and its technical characteristics;

[5] As of today, geothermal generation is non-existent in Peru. The Geothermal Law (Law 26848) was approved in July 1997.

f) Article 9: The Peruvian government seeks to preserve the environmental quality and cultural heritage of the country, as well as the rational use of natural resources in the development of activities related to generation, transmission and distribution of electricity.

None of the identified alternatives contravenes any legal or regulatory requirement, or poses a risk to do so in the future. Moreover, none of them breaches technical standards and dispositions of environmental and cultural conservation. Since they are all realistic and credible alternatives available to the project participants, the Project is considered additional under Step 1.

STEP 2 – Investment Analysis

Sub-step 2a – Determine appropriate analysis method

The CDM project activity generates financial and economic benefits other than CDM related income, thus the simple cost analysis does not apply. In order to determine whether the proposed project is economically or financially less attractive than the other alternatives without the revenue from the sale of CERs, Option III – "Apply benchmark analysis", is performed below.

Sub-step 2b – Option III – Apply benchmark analysis

The indicators that will be used are: (1) Project IRR, and (2) Project Investment Cost.

> **(1) Project IRR:** Project IRR is a suitable financial indicator for the Project and is compared to a calculated benchmark, which is the discount rate that represents the returns investors or borrowers would normally expect in Peru.
>
> **(2) Project Investment Cost:** The project investment cost is a suitable indicator to measure the attractiveness of a project. Here it was assessed as an indicator of whether the project developer has chosen the most efficient alternative, i.e. the least-cost option, to develop this electricity generation project.

The investment cost of the Project was compared to that of a natural gas-fired plant because the latter has become business-as-usual for energy generation in Peru since the arrival of natural gas to the coast and the on-going promotion by the Government for natural gas development. At the present time, natural gas-fired technology represents the most attractive option for both incumbent and newcoming Independent Power Producers (IPPs). This is evident not only from the number of latest natural gas-fired generation plants built, but also from those being planned.[6]

The indicator will be expressed in $US/MW.

Sub-step 2c – Calculation and comparison of financial indicators

(1) Project IRR Calculation

Project IRR: The table below presents the main data used in the IRR calculation of the Project. The calculation was based on conservative assumptions, all of which are listed below in order to maintain a transparent approach.

[6] See step 3: Barrier analysis: (c) Barrier due to prevailing practice

Table 3: Financial Details

Financial Details	
Costs of equipment and plant (initial investment cost)	9,000,000US$
Electricity tariff (generation)	0.029 US$/kWh
Electric tariff (capacity)	67,180 US$/MW-Year
Electricity sales/year (generation and capacity)	First year 635,100US$ Next years 1,495,847 US$ per year
Project life	40 years
Running costs/year	350,000 US$
Project IRR	**9.677%**

Source: SINERSA

Data assumptions:

- The costs of the plant and the equipment were supplied by the project developer based on market quotations.
- The price used in the financial model is the long term expected energy tariff.
- The running costs were estimated by the project developer including cost of trading, administration management insurance and water payment.

Discount Rate: A specific discount rate for the electric sector has been determined by MINEM within the ECL, and is used principally by the electric sector regulator to determine electricity tariffs, as well as by the private sector to evaluate investments. This discount rate is 12% and was established considering investment risk of a thermoelectric peaking unit.

It represents an official rate of discount for the Peruvian electric sector, and has been used widely for investment evaluations by both the private and the public sectors. It is considered to be a conservative discount rate since public investment is driven by social interests and often has access to attractive loan terms. In this analysis, the discount rate is used as a benchmark for the minimum rate of return expected by investors and borrowers in Peru.

Comparison of Project IRR to benchmark: The project IRR is compared to the benchmark to examine the financial attractiveness of the project, and, at **9.677%**, is lower than the benchmark of 12% discussed above. This low IRR compared to the hurdle rate indicates that the Project is not financially attractive without CDM assistance.

The low return does not justify the high risks (geological, social, environmental, regulatory, etc.) associated with implementing this new renewable energy project; therefore any investor should expect return higher than 12%.

(2) Project Investment Cost Calculation

The information contained in the table below shows the cost range of installing 1 MW of a natural gas-fired plant and compares it with the cost of installing 1 MW of the PoechosII hydropower plant.

Table 4: Cost Comparison by Technology

Technology/Cost Comparison					
	Simple Cycle Gas Turbine		**Diesel Engine**		**Small Hydro**
	Boyce[1]	World Bank[2]	Boyce[1]	World Bank[2]	Poechos II[4]
Size range (MW)	0.5 - 450	150	0.02-25	5	10 MW
Turnkey cost ($/MW)	300,000 to 650,000	380,000 to 520,000	200,000 to 500,000	470,000 to 650,000	900,000

1. *Source: Meherwan P. Boyce, Ph. D., P.E. (2002): Gas Turbine Engineering Handbook, p. 8*
2. *Source: The World Bank "Technical and Economic Assessment: Off Grid, Mini-Grid, and Grid Electrification Technologies Summary Report"; Discussion paper. World Bank; Energy Unit, Energy and Water Department. November 2005 p. 72*
3. *The project's feasibility study and the sponsor.*

Comparison of Project Investment Costs: Using a conservative approach, i.e. choosing the highest cost of thermal plants option, the investment cost of 1 MW of hydropower generation technology for Poechos II ($US 900,000) is 38% higher than that of 1 MW of thermal technology ($US 650,000). If the lowest cost among the thermal options is chosen (i.e. $US 300,000 for diesel engine), the investment cost for Poechos II would be 200% higher.

The above investment cost comparison makes it easier to structure financing for thermal generation than for hydropower generation.

Sub-step 2d –Sensitivity Analysis

The following assumptions are established to examine whether the above conclusion regarding the financial attractiveness of the Project is robust:

1) Project IRR: :

A sensitive analysis has been including in the IRR to see at what value for the sensitivity analysis each parameter, touches the benchmark. Three key parameters have been chosen to do the exercise. Investment costs, load factor and Tariff. The results are:

Table 5: Sensitivity Analysis: IRR

Sensitivity Analysis Project IRR

Turning point condition to overpass the benchmark of 12%		
-18.5% Investment	+26% Tariff	+28% Load Factor

The probability to reach this changes in the variables are practicable impossible. This is because: (i) the project investment cost was calculated taking into account quotations already budgeted which were the lowest available market quotes in order to make the project attractive for financing, more over, as the time passed on, the project cost has maintained as planned; (II) a tariff increase is not likely since energy generation in Peru is becoming cheaper as a result of lower cost of natural gas as fuel and the entry into operation in the medium term of various natural gas-fired thermoelectric plants (As it can be seen in the tariff forecast study "Electrical Referential Plan year 2006-2015" of the Ministry of Energy and Mines[7]), and the load factor is not expected to increase but reduce as it is explained below in section "(b)Barrier due to the low load factor"

Therefore, considering the impossibility to reach acceptable levels of IRR, it can be concluded that the Project is not financially attractive for private investors, and requires CDM revenues from the sale of CERs to become viable.

2) Project Investment Cost: The highest investment cost of a thermal plant (taken from Table 4) is compared to that of the Project. The result shows that it need a reduction of 28% of the turnkey cost of Poechos 2 to reach the highest cost of thermal plant and a reduction of 67% to reach the lowest cost of thermal plant , which is an impossible case since the project has been quoted with the lowest available market quotes as it was explained above.

Table 6: Sensitivity Analysis: Cost

	Turnkey Cost – Thermal Plant ($/MW)	Turnkey Cost reduction of Poechos II to reach thermal plant cost levels – %
Highest Cost	650,000	28%
Lowest Cost	300,000	67%
Turnkey cost Poechos II	900,000	

[7] Source: Ministerio de Energía y Minas. "PLAN REFERENCIAL DE ELECTRICIDAD 2006 – 2015". Page 133. http://www.minem.gob.pe/archivos/dge/publicaciones/plan2006/03-PRE-2006_CAPITULO_3_V5.pdf

Source: SINERSA.

Conclusion: The sensitivity analyses conducted above confirm that based on investment costs, the Project is not as financially attractive as other alternatives available in the market, and that successful implementation of the Project depends on CDM registration. As a result, the Project is considered additional under Step 2.

Step 3. Barrier Analysis

Sub-step 3 a. Identify barriers that would prevent the implementation of the type of the proposed project activity

The Project is additional because, in the absence of CDM, some or all of the following four barriers would have prevented its implementation (yet would not prevent the implementation of at least one of the alternatives).

(a) Investment Barriers: As it was mentioned before, Investment costs associated with hydroelectric power plants are much higher than those of fossil fuel-fired thermal power plants. Therefore, small fossil fuel-fired power generation is a more financially viable alternative in Peru than small hydroelectric power generation. This investment barrier is also accentuated by Peru's relatively high cost of capital, high financial risks, and an unsophisticated capital market[8]. Coupled with relatively limited access to international capital markets (which are in any case more attracted to investments in natural gas thermal projects), this situation makes it difficult for small hydroelectric projects to attract adequate capital. The sponsor of Poechos II has sought financing from several banks for a number of years, but none has been able to provide a financial solution.

The prospect of CDM revenues was the only mitigating factor against the above-mentioned investment barriers in front of the Project. CDM revenues helped the Project overcome these investment barriers by:

a. Reducing the plant turnkey cost of US$ 900,000/MW by 29%%[9]. The impact of CDM revenues on the Project's financial viability could be even greater, depending on the load factor achieved;
b. Improving the debt coverage ratio of the Project.
c. Strengthening cash flows with more liquid, international hard currency; and,
d. Making it an environmentally friendlier project than the alternatives, thus "greening" the investment portfolio of the financing entity.

[8] Recently, the Economist Intelligence Unit Limited (February 8, 2005), EIU Riskwire commented on Peru's financial risk and cost of capital as follows: "Corporate finance is widely available, but costly, with average commercial interest rates for dollar loans around 10%, and for local currency loans around 15-20%". It added that "Banks remain wary of lending to small and medium-sized businesses, and will do so until the economy shows strong signs of growth and the bad-debt ratio falls further."

[9] Taking the load factor of the Project as 45.66%, 10 MW will generate 40,000 MWh of electricity, which could reduce emissions by 40,000 times 0.56927, or 22,770.89 tCO_2 in ERs. The calculation of this baseline emission factor can be seen under B.6.3. Considering a price of US$ 15 per ER in 21 years (According to the World Bank market study "State and Trends of the Carbon Market 2007", page 32, brokers expected prices around 14.7 dollars per CER of a registered project.), the Project would receive US$ **2,582,802** in present value at 12% discount rate or US$. 258,280.2 per MW. Thus, with an average turnkey cost per MW of US$ 900,000/MW, CDM revenues reduce the turnkey cost by approximately 29%.

(b)Barrier due to the low load factor:

The Project faces the potential risk of a relatively low load factor (around 46%.) due to the following:

1. The river flow is highly variable, and ranges from 15 m^3/s to 60 m^3/s[10] because of hydrological conditions, operation rules, and demand from the user of the diversion channel and the Piura River.
2. The Poechos reservoir fluctuates, which means that the drop of the Project can vary between 7 and 22.7 m, impacting energy output accordingly.
3. Due to extreme velocities and dynamic forces at the channel intake, substantial losses occur at the intake of the diversion channel.
4. The priority of the project sponsor is to deliver water to another hydroelectric plant that it owns, named Curumuy, rather than to the Project. The reason for this is that Curumuy is located at the end of the diversion channel and, compared to the Project, Curumuy yields a higher energy output for the same flow of water. As a result, the Project's operation is subordinated to the operation of Curumuy, and it cannot use water for generation exclusively during peak hours.
5. Sediments have been accumulating in the Poechos reservoir that have gradually reduced its volume. Projections indicate that by 2026 the volume of the reservoir will be reduced to 216 MMC, which is below the minimum agricultural requirement of 360 MMC. The reduced reservoir volume will naturally reduce the Project's load factor further.

In this scenario, only the prospect of CDM revenues could lower this barrier faced by the Project.

(c) Barriers due to prevailing practice: As a result of the discovery of substantial gas fields in Peru, the regulatory and policy framework that has emerged over the last eight years has come to favor natural gas-fired electricity generation[11]. This trend is expected to continue as more fields are discovered and more pipelines are built.

After Shell's exit from Peru in mid-1998, the Government went on to aggressively promote thermal power generation technology fueled by natural gas. Beginning in that same year, it halted the definitive and temporal concessions for hydropower generation through Law 26980 issued in September 1998, Law 27133 issued in June 1999, and Law 27239 issued in December 1999[12]. No hydropower generation concessions were granted in 1999[13], demonstrating that the impact of this sectoral policy shift has

[10] River hydrology history is provided to the DOE.

[11] "The San Martin and Cashiriari fields, jointly known as Block-88 ("Camisea") are home to one of the most important non-associated natural gas reserves in Latin America. The Camisea reserves are ten times greater than all other existing natural gas reserves in Peru" – (Source: www.camisea.com.pe). Camisea was discovered between 1983 and 1987, but the Camisea project only became operational in August 2004. Since then concession rights for the block 56 (Pagoreni), which would enlarge the proven reserves of Natural Gas in Peru, have also been granted for exploration and development.

[12](1) September 27, 1998: Law 26980 – "Law that modified several articles and definitions annexed to ECL". On its third Transitory Disposition mandated the suspension for 9 months in the presentation of requests for temporal and definite concessions for hydropower plants. (2) June 4, 1999: Law 27133 – "Law of Promotion of the Natural Gas Industry" – On its Unique Complementary Disposition extended the suspension of hydropower plants for 12 additional months from June 1999. (3) December 22, 1999: Law 27239 – "Law that modified several articles of the ECL" - On its Unique Complementary Disposition mandated that priorities to admit new temporal and definitive concession in hydropower plants would be determined as a function of the national development.

[13] According to a list of definite concessions granted by Peru's Department Energy and Mines (MINEM) in the last 10 years.

curtailed new experience with hydropower development while adding to the risks associated with hydropower generation in Peru, perceived by local as well as foreign investors.

In the new millennium, the government continued to support the development of natural gas, issuing a license for the exploitation of the Camisea Field in February 2000 and a concession for natural gas and liquefied natural gas (LNG) transportation in October 2000. By the commissioning of the Camisea Project in August 2004, the government issued laws DS 019-2004 on June 25, 2004[14], DS 041-2004-EM on November 24, 2004[15]; and DS 107-2004-EF on August 5, 2004[16]; to promote natural gas-fired electricity generation and to exempt the selective consumption tax to natural gas. These 3 laws were aimed at making natural gas an even more competitive alternative for power generation.

Furthermore, the government has recently completed technical studies for the "National Gasification Project", which examines the installation of regional natural gas pipelines for transporting the Camisea gas to major Peruvian cities such as Ayacucho, Cuzco, Ica, and Junin. It has announced that the next step would be the selection of investors to build those pipelines. The government has also issued several decrees[17] that lay out the security measures and ownership requirements for gas pipeline installations, paving the way for new investments.

At a public declaration in August 2005[18], the Minister of Energy and Mines asserted the need to encourage the use of natural gas in all activities including electricity generation in order to offset the rising oil prices. For this purpose, the Council of Ministers created a commission to prepare a strategic plan proposing a series of measures to further promote the use of natural gas. As part of this strategy, on December 29, 2005, the government issued the decree on cogeneration, DS N° 064-2005-EM, encouraging simultaneous generation of heat and electricity using natural gas.

The impacts of these government efforts to promote natural gas development, distribution, electricity generation, and co-generation compound the challenges faced by hydropower developers, who must compete not only with a cheaper generation technology, that is, combined cycle plants[19], but also with a much cheaper fuel, natural gas, which is increasingly available locally.

According to MINEM[20], the two scenarios for Camisea's impact on the Peruvian electricity generation industry are:

1) Hydro-thermal Scenario: By the end of 2027, the SEIN will have an installed capacity of 66% thermal and 34% hydro, compared to the existing ratio of 48% thermal and 52% hydro.

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[14] Indicates that for the next 2 years after June 25, 2004, when the request for authorization is for natural gas-fired electricity generation, the guarantee required by article 66 of the ECL Rules will be reduced from 1% to 0.25% of total project budget , while the ceiling will be reduced from 500 UIT ("*Unidad Impositiva Tributaria*") to 200 UIT.

[15] Supreme Decree that promotes the installation of thermal plants that use natural gas as fuel.

[16] Clarifies that natural gas is not affected by the Selective Consumption Tax ("ISC").

[17] Supreme Decree 038-2004 on October 21, 2004; Supreme Decree 016-2004-EM on June 10, 2004; and Supreme Decree 018-2004-EM on June 16, 2004.

[18] Source: Ministerio de Energía y Minas. Dirección General de Electricidad "Informativo DGE n° 8" August 2005. page 5. http://www.minem.gob.pe/archivos/dge/estadisticas/informativo/InformativoDGE-8.pdf

[19] According to a study of the Word Bank in average the levelized cost of a Natural Gas combined cycle plant is US$4.47 cents/KWh and the levelized cost of a Small Hydro is US$6.77 cents/KWh. ; The World Bank: " Technical and Economic Assessment: Off Grid, Mini-Grid and Grid Electrification Technologies Summary Report" Discussion Paper; Word Bank, Energy Unit, Energy and Water Department. November 2005, p. 76-77.

[20] Source: Ministerio de Energía y Minas. Dirección General de Electricidad "Informativo DGE n° 8" agosto 2004. page. 1, http://www.minem.gob.pe/archivos/dge/estadisticas/informativo/informativo8.pdf

2) Thermal Scenario: If all capacity additions for generation continue to be in natural gas-fired thermal plants, by the end of 2027 the SEIN would have an installed capacity ratio of 75% thermal and 25% hydro.

Under the Hydro-thermal Scenario, demand by 2027 would be 800 million cubic feet of natural gas per day (mmcfpd) whereas under the Thermal Scenario, it would be 1000 mmcfpd. Under both scenarios, the power sector would be the main consumer of the Peruvian natural gas industry. These scenarios are in line with the Referential Plan of Electricity 2005 – 2014[21], where the MINEM performed forecasts of the future expansion of the SEIN. In the base scenario with a medium demand there are only 4 hydro plants representing 551 MW in power capacity (23% of the power capacity expansion) while 11 thermal plants represent 1820 MW of power capacity (77% of the power capacity expansion). In the other scenarios, the hydroelectric situation with regards to its low importance in the expansion plan does not change significantly.

As a result of the preference for natural gas in power sector policies and regulations, construction of small gas-fired power plants will also be facilitated through fuel switching from oil to natural gas, as more pipelines are built around the country and as new gas fields are discovered. For example, BPZ Energy Inc. [22] has recently discovered natural gas in the north of the country and is planning to build a 160 MW gas-fired power plant by using the gas on-site.

The fact that already there are 3 small natural gas-fired power plants in Peru, as reported by MINEM, demonstrates that this type of power generation is the preferred choice wherever natural gas is locally available and its supply is reliable. These gas-fired power plants are:

- CTGAS: 1 MW plant by Aguaytia Energy del Peru, located in Aguaytia, fuelled by locally extracted gas;
- Pavayacu: 7.85 MW plant by Pluspetrol, located in Loreto, fuelled by gas extracted in Lote 8; and,
- Corrientes: 13.41 MW plant by Pluspetrol, located in Loreto, fuelled by gas extracted in Lote 8.

The prevailing practice of natural gas-fired generation is spreading even faster to large power plants. As of today, there are 3 large plants that are fuelled by natural gas from the Camisea field:

- Ventanilla - Etevensa TG3: 164.1 MW plant, operating since September 2004;
- Ventanilla - Etenvesa TG4: 160.5 MW plant, operating since September 2004; and,
- Santa Rosa TG7: 121.3 MW plant operating since June 2005.

The conversion of the two Ventanilla plants to combined cycle will add to an installed capacity of 450 MW. TG3 has already been converted to combined cycle and entered into operation in June 2006, whereas TG4 will be commissioned at the end of 2006.

Two large natural gas-fired power plants to be fuelled by gas from Camisea are currently under construction:

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[21] Source: Plan Referencial de Electricidad 2005 – 2014. Ministerio de Energía y Minas. Page 86. http://www.minem.gob.pe/electricidad/pub_plananual2005.asp

[22] Source: http://www.bpzenergy.com/operational_update.html

- Chilca TG1: 174 MW plant to be commissioned in December 2006; and,
- Kallpa TG1: 168 MW plant to be commissioned in June 2007.

Both projects plan to double their power capacities in the medium term and then convert to combined cycle.

In summary, existing pro-Camisea policies, as well as the increased availability and widespread distribution of natural gas since 2004, have established the prevailing practice in the Peruvian power sector, which is based on natural gas-fired power generation.

(d) Geographical barriers: Options for cost-effective hydropower development in Peru are limited today because most sites have already been given in concession to private firms, and identification of new sites with appropriate geographical features is time consuming. Peru's geographic location in an active seismic area also increases the risks. In addition, the typical location of hydroelectric sources in remote rural areas complicates project infrastructure, and leaves facilities and workers more vulnerable to sociopolitical insurgency.

Geographical barriers can be further articulated as follows:

- Scarcity of locations: Options for hydropower development are limited in Peru today because almost all the best locations have been already given in concession to private firms. As a result, identifying appropriate geographical features takes a longer time nowadays.
- Seismology: Peru is located in in the circum-Pacific seismic belt, where more than two-thirds of the world's large-magnitude earthquakes occur. This geographic disadvantage makes hydroelectric projects high risk investments and increases their insurance premiums. Poechos II is especially vulnerable because is located at the bottom of a dam that could be destroyed by an earthquake.
- Social conflicts: Typically, hydroelectric plants are located in isolated rural areas, which makes the project infrastructure and workers vulnerable to social insurgency and instability from narcotics trafficking. In this regard, the most recent social conflicts report by the Peruvian Ombudsman's Office[23] registered 91 social conflicts, caused mainly by disputes with local authorities, environmental issues with companies that exploit natural resources as mines and hydroelectric power plants, and disputes among rural communities and special interest groups. In the hydroelectric sector, the latest well-known conflicts involved the hydroelectric power plants of Yuncan, San Gaban II, and Platanal. The possibility of social conflict surrounding the Poechos II plant arises from the poverty of the area's population.
- War zone: The Project is close to the border with Ecuador, a country with whom Peru has had three wars in the 1940s, 1980s, and 1990s. The issue that is relevant to the Project and could be a cause for potential conflict is that the river that feeds the Poechos reservoir originates in Ecuadorian territory.
- Droughts: Incidences of droughts in the Project area have been numerous and devastating. In its first year of operation in 2004, Poechos I suffered the worst drought in that river for the past 40 years. Its

[23] Defensonria del Pueblo. Reporte nº 30. Conflictos Sociales Conocidos por la Defensoría del Pueblo. Al 31 de agosto del 2006. Resumen Ejecutivo. http://www.ombudsman.gob.pe/modules/Downloads/conflictos/conflictos_sociales30.pdf

electricity production was 40% lower than the expected average.[24] Any future droughts affecting the same river would put Poechos II at high risk as well.

- El Niño: El Niño has affected the Piura area dramatically in the past. The last El Niño in 1997-1998 caused major damage to infrastructure, including to transmission lines and roads, valued at US$ 3.5 billion, which represented 4.54 % of Peru's GDP in 1997[25].

(e) Other Barriers.

While adequate technical capacity exists in Peru to build and operate small hydroelectric power plants, the technology nonetheless faces a range of technical challenges and performance risks related to the inherent limits on water resource availability. This is coupled with known risks of drought and earthquakes in Peru, as well as the priority given to irrigation over electricity generation. Also, because the particular hydrological and geological conditions and possible design failures can only be fully known *ex-post*, in terms of technology, hydropower plants constitute a much more challenging investment than fossil fuel-fired plants. Moreover, fossil fuel-fired plants, in addition to having lower up-front capital costs and higher emissions that are not reflected in their price, can also be built as close as necessary to the end-user, reducing -line investment costs considerably. Furthermore, the supply of hydroelectric power generation turbines is currently limited and subject to upward price pressures due to a rapidly growing demand, mainly originating in China. As a result, the delivery times for turbines can extend up to 16 months, with prices higher than ever.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

The identified barriers that the Project faces will not prevent the non-project alternative: "Provision of equivalent amount of annual power output by the grid that the proposed project is connected with (Do not implement any power generation project)" (alternative 3).

For alternative 2, "Implement the Project as a fossil fuel-fired thermal plant;" According to the identified barriers and the prevailing practice in Peru, the expansion of the electricity capacity is based mainly on natural gas thermal plants over 120 MWs developed by big Electricity Utilities companies as Suez Energy, Globeleq, ENDESA, etc. The scale of these projects as well as the nature of the investors (much important than Poechos II project sponsor) become natural gas thermal plants not an alternative to the proposed project. Few small thermal plants have been developed but only in cases that natural gas is available locally and the investor are the same entity the exploit the natural gas fields[26] that is not the case of Poechos II project sponsor. Thus, the identified barriers will prevent alternative 2 to be an alternative for the proposed project activity.

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[24] Source: The project sponsor.

[25] Source: **Lenkiza Angulo Villarreal "Análisis Ambiental en el Perú". Consultoría referida a Desastres Naturales .** CONAM. Diciembre de 2005

[26] Pluspetrol and Aguaytia

Therefore, according to methodology ACM0002, as the project activities does not modify or retrofit an existing electricity generation facility, the baseline scenario for the proposed project is the increased generation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations.

Having identified various barriers that prevented the implementation of this type of proposed project activity (hydropower plants) but did not prevent at least one of the alternatives identified, it can be concluded that the Project is additional under Step 3.

Step 4. Common Practice Analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity

As reviewed in Section 3 (c) above (**"barriers due to prevailing practice"),** newly constructed small hydro plants cannot be considered common practice in Peru. They are built sporadically, at best, as a result of special conditions met and various barriers overcome by the project developer, none of which would have likely been possible in the absence of CDM revenues.

The table below shows the new additions to the SEIN since 2004, the year in which the Camisea natural gas project was commissioned:

Table 7: Additions to the SEIN from 2004 to June 2006

Enterprise	Power plant	Unit	Type	Effective installed Capacity (MW)	Date of Commissioning	Comments
EDEGEL	VENTANILLA	TG3	Turbo Gas	164.1	08/09/2004	Natural Gas from Camisea
		TG4	Turbo Gas	160.5	29/09/2004	Natural Gas from Camisea
EDEGEL	SANTA ROSA	TG7	Turbo Gas	121.3	01/06/2005	Natural Gas from Camisea
EDEGEL	CALLAHUANCA	Gi, G2,G3	Hydro	7.5	04/07/2005 - 01/12/2005	Upgrade. Applying to the CDM
ENERSUR	YUNCAN		Hydro	130	Ago-05	Applying to the CDM
ETEVENSA	VENTANILLA	TG3	Gas Combined Cycle	235.5	Jun-06	Natural Gas from Camisea

Source: COES

There are only two hydroelectric power generation projects among the above additions to the SEIN, and they cannot be considered common practice because:

(1) Callahuanca

Callahuanca is a refurbishment project not a hydroelectric power plant, therefore is not comparable to Poechos II. On the other hand, from the beginning of the project, the project sponsor, EDEGEL, designed the project taking into account the CDM registration and a PDD has been submitted to the Executive Board. As a consequence, its CDM status prevents this project from being part of common practice in Peru.

(2) Yuncan

Yuncan is another project for which the sponsor, ENERSUR – Suez Energy, had planned to obtain CDM registration, which is in process. Its impending CDM status prevents Yuncan also from constituting common practice.

Sub-step 4b. Discuss any similar options that are occurring:

The following table provided by COES shows the power plants that were under construction or recently built as of August 2006.

Table 8: Power Plants Under Construction/ Recently Built

Enterprise	Power Plant	Unit	Type	Installed capacity (MW)	Expected Date of Commissioning
ETEVENSA	VENTANILLA	TG3	Natural Gas Combined Cycle	75.0	Jun-06
TERMOSELVA	AGUAYTIA	TG2	Turbo Gas-Natural Gas	6.0	Jun-06
EDEGEL	SANTAROSA	UTI 5 y UTI6	Turbo Gas-Natural Gas	105.8	Jul-06
ETEVENSA	VENTANILLA	TG4	Natural Gas Combined Cycle	75.0	Oct-06
ENERSUR	CHILCA	TG1	Turbo Gas-Natural Gas	174.0	Dec-06
CAHUA	PARIAC	CH1 y CH3	Hydro	0.8	Jan-07
GLOBELEQ	KALLPA	TG1	Turbo Gas-Natural Gas	160.0	Jun-07
MINERA MOCHICA GOLD	LA JOYA		Hydro	9.6	Aug-07
EGASA	MOLLENDO	TG1 y TG2	Turbo Gas-Natural Gas	71.0	Set- 07
EGENOR	CAÑA BRAVA	G4	Hydro	9.8	Set- 07
ELECTROANDES	YAUPI	G6 y G7	Hydro	30.0	Jan-08

Source: COES.

As Table 8 above illustrates, 7% of installed capacity under construction is hydroelectric power generation, whereas the remaining 93% is natural gas-fired thermal generation. All of the hydropower projects are seeking CDM registration, which can be attributed to the barriers explained above, preventing hydropower projects from being developed without CDM.

Based on these circumstances, the Project is not common practice, but rather, an unusual occurrence that would have limited prospects for completion without CDM revenues. Thus, the Project is deemed additional under Step 4.

The Project's sponsor, SINERSA, decided to aim for CDM registration in order to offset some of the risks and barriers associated with hydropower in Peru, as discussed above. With the experience gained from its first registered CDM project, Poechos I, SINERSA saw a good opportunity in Poechos II with the expected impact of CDM revenues and the corresponding risk mitigation, coupled with better prospects for attracting investment.

Poechos I had encountered difficulties in securing financing, which made it imperative to obtain CDM registration in order to reach financial closure. At that time, the idea of a second phase project, Poechos II, was abandoned due to lack of financing. After two years of negotiations with the same entity that provided financing for Poechos I, SINERSA was finally able to secure the financing for Poechos II, which will include CDM revenues as part of the approved financial scheme. At the same time, the SINERSA Board of Directors established a strict requirement that the Project must include additional CDM revenues in order to be feasible and executable. For the international financing entity, registration of the Project as a CDM project provides a better debt service coverage ratio, international currency liquidity, and higher environmental integrity. Table 9 below summarizes the impact of CDM registration in the project.

Table 9: Impact of CDM Registration

Assumptions		**Impact of CDM Registration**	
Operating Life:	40 years	Annual Revenues US$ (for the next 21 years):	Growth of 22.8%
Discount Rate	12%	Debt Service Coverage Ratio (EBIT/ Interest Expense):	Growth of 72%
Power:	10MW	IRR:	Add 2.6% to IRR
Load Factor:	45.66%	Turnkey cost US$/MW:	Reduction of 29%
CER Price:	US$15		
CER payment Period:	21 years		

Source: SINERSA

When CDM revenues are taken into account, annual revenues for the Project increase by 22.8%, and the economic IRR gains an additional 2.6%. More importantly, the debt service coverage ratio improves by 72%, which is a critical factor since Poechos II is highly leveraged. Finally, CDM revenues reduce the turnkey cost of the project by 29%, significantly improving the prospects for the financing of the Project.

Thanks to the economic benefits from the sale of the CERs, the CDM registration will help the Project overcome the following barriers:

- Investment barriers: With CDM, the perception of the Project with respect to other alternatives improves since it would receive an additional income that makes the Project financially more attractive. The impact of CDM registration can be measured as a reduction in 29% of the turnkey cost by calculating the present value of the CDM revenue[27]. In addition, CDM registration will make the Project a more suitable candidate for loan financing from various international entities.
- Technological barriers: The additional revenue resulting from CDM registration of the Project will help the Project better meet the extra costs and potential risks associated with hydroelectric power technology.
- Barriers due to prevailing practice: CDM revenues will, to some extent, compensate the Project in lieu of the economic incentives that thermal plants receive in the form of sectoral policies that favor thermal generation, as well as the relatively lower cost of natural gas as their main source of fuel.
- Geographical barriers: Geographical barriers that face the Project constitute additional costs and risks. CDM revenues will help pay such risk premium and additional costs caused by these barriers.

As all of the above steps were satisfied, the proposed CDM Project activity is demonstrated to be not a part of the baseline scenario, and therefore, additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The Baseline Methodology stipulates that the baseline of the Project is the Combined Margin emission factor (CM), which is the average of the Operating Margin emission factor (OM) and the Build Margin emission factor (BM). Estimated anthropogenic emissions were calculated for the Project following a 4-step-process:

Step 1 – Calculation of the Operating Margin emission factor (OM)
Step 2 – Calculation of the Build Margin emission factor (BM)
Step 3 – Calculation of the Combined Margin emission factor (CM)
Step 4 – Calculation of the Project's Emission Reductions Prior to Validation

Step 1 – Calculation of the Operating Margin emission factor

Out of four options for the calculation of the OM, the Dispatch Data Analysis Operating Margin Emission Factor (DDA-OM) was chosen since it constitutes the first methodological choice where data is available, according to the Baseline Methodology. The formula for the DDA-OM used was provided by the Baseline Methodology as follows:

Dispatch Data Analysis OM. The Dispatch Data OM emission factor ($EF_{OM,Dispatch\ Data,y}$) is summarized as follows:

[27] Calculations are explained in the Investment Barrier analysis section.

$\mathbf{EF}_{\text{OM, DispatchData, y}} = E_{OM,y} / EG_y$

Where EG_y is the generation of the project (in MWh) in year *y*, and $E_{OM,y}$ are the emissions (tCO_2) associated with the operating margin calculated as:

$\mathbf{EF}_{\mathbf{OM,y}} = \sum_h EG_h * EF_{DD,h}$

where EG_h is the generation of the project (in MWh) 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*:

$\mathbf{EF}_{\mathbf{DD,h}}\ \mathbf{(tCO_2/MWh)} = [\sum_{n} GEN_{n,h,} * COEF_n] / [\sum_n GEN_{n,h}]$

Where,

$GEN_{n,h}$: Is the Hourly Generation of each plant for the set of plants *(n)* falling within the top 10% of the system dispatch.

$COEF_n$: Emission factor of each plant in the selected sample, expressed in tCO2/MWh; The COEF formula to be used is: COEF per plant = $\mathbf{F}_{\mathbf{i,n}}$ * [(44/12) x C x O]. Where $\mathbf{F}_{\mathbf{in}}$ is the amount of each fossil fuel in TJ consumed by each power plant per MWh = [3.6 *10^9/(NEC*10^12)] . The COEF reduced formula is [3.6 * (44/12) *C*O]/ [10^3 * NEC] Where C = Carbon Content of the fuels used by relevant power source and O = the percent oxidation of the fuel of the plant

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 has to be calculated indirectly by calculating it from electricity produced and real Net Efficiency Conversion (NECs) per power plant using Plant Fuel Requirement per MWh[28] (PFR per MWh) Formula ([3.6 *10^9/(NEC*10^12)]) . The NECs are obtained from COES annual statistics.

To determine the set of plants (*n*), obtain from a national dispatch center: a) the grid system dispatch order of operation for each power plant of the system; and b) the amount of power (MWh) that is dispatched from all plants in the system during each hour that the project activity is operating (GEN_h). At each hour *h*, stack each plant's generation (GEN_h) using the merit order. The set of plants (*n*) consists of those plants at the top of the stack (i.e., having the least merit), whose combined generation ($\Sigma\ GEN_h$) comprises 10% of total generation from all plants during that hour (including imports to the extent they are dispatched)

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 (BM1), or (2) the most recently built power plants accounting for 20% of all power generation (BM2), 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. It is selected *Option 2*. For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually *ex-post* for the year in which actual project generation and associated emissions reductions occur.

The formula applied to the selected sample was:

[28] The PFR Formula has been taken from The Green House Assessment Handbook (September, 1998) – a World Bank document.

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

Where,

$GEN_{m,y}$: Is the yearly Generation of each plant in the selected sample *(m)*

$COEF_m$: Emission factor of each plant in the selected sample, expressed in tCO_2/MWh; and its calculation is analogue to the variables described in the OM analysis.

Step 3 – Calculation of the Baseline emission factor

The Baseline Emission Factor was calculated as a CM, consisting of the simple average[29] of the OM and the BM. All margins are expressed in tCO_2/MWh.

$$\mathbf{CM = 0.5*OM + 0.5*BM}$$

Step 4 – Calculation of the Project's Emission Reductions Prior to Validation

The Project itself does not lead to any GHG emissions, therefore, no leakage was factored into the calculation of estimated ERs, and hence, the baseline emissions were estimated to be equal to the Project ERs.

B.6.2. Data and parameters that are available at validation:

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 applied:	0
Justification of the choice of data or description of measurement methods and procedures actually applied :	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.
Any comment:	

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 applied:	0
Justification of the choice of data or description of measurement methods	According to the Baseline Methodology, project participants do not need to consider leakage.

[29] The default weights (50%,50%) were kept.

and procedures actually applied :	
Any comment:	

Data / Parameter:	**Carbon Content**
Data unit:	tC/TJ
Description:	Carbon content for each type of fuel
Source of data used:	2006 IPCC Guidelines
Value applied:	Default values. Please see Table #2, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The carbon content is used to calculate the CO2 emission coefficients of the power plants in the grid.
Any comment:	

Data / Parameter:	**Oxidation Factor**
Data unit:	%
Description:	Percentage of carbon that is oxidized or converted to carbon dioxide during the combustion of fossil fuels
Source of data used:	2006 IPCC Guidelines
Value applied:	Default values. Please see Table #2, Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Oxidation factor is used to calculate the CO2 emission coefficients of the power plants in the grid.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Step 1 – Calculation of the Operating Margin emission factor

The formula for the DDA-OM used was provided by the Baseline Methodology as follows:

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

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]

EG_y: Annual generation of the Project

For this calculation the hourly generation in 2005 was used, which was the most recent statistic data available. At the time the Project's Baseline Study was completed, the hourly generation data did not yet exist for one entire year. Therefore, it was assumed that the Project operated at full capacity and dispatched equally during all hours of the year. Considering this assumption, the variables were defined as follows:

- EG_y: An "approximation" of the total electricity generated by the Project in 2005. It was calculated by multiplying Installed Capacity (MWh) of the Project times 8760.
- EG_h: An "approximation" of the total electricity generated by the Project in each hour of 2005. It was assumed the Project generated at its full installed capacity of 10 MWh in each hour.
- GEN_{nh}: The hourly electricity generated in 2005 by each unit of the SEIN that falls within the top 10% of grid dispatch.
- $COEF_{i,n}$[30]: 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.

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[31]. 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:

$$E_{OMy} / EG_y = 63{,}735 / 87{,}600 = \mathbf{0.72756\ tCO_2/MWh}$$

Step 2 – Calculation of the Build Margin emission factor

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:

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

Where,

$GEN_{m,y}$: Is the yearly Generation of each plant in the selected sample *(m)*

$COEF_m$: Emission factor of each plant in the selected sample, expressed in tCO_2/MWh; and its calculation is analogue to the variables described in the OM analysis.

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

[31] 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.

Any additions to installed capacity in the SEIN were identified and considered. Table 10 below shows the capacity additions to the SEIN, and their annual generation. Since the Project has not yet generated electricity, the annual generation of the additions included in this table is from 2005 (last year of public information).

Table 10: Capacity Additions in the SEIN (1999-2005)

Plant	Date	Technology	Installed Capacity Added (MW)	2005 total installed capacity	% of total installed capacity.	2005 total production in GWh	2005 Gen (GWh) of the new addition
Callahuanca	Dic-05	Hydro	5.374	80.43	7%	546.71	36.53
YUNCAN	Ago-05	Hydro	136.76	136.76	100%	250.48	250.48
Santa Rosa	Jun-05	Gas turbine Natural Gas	123.299	123.299	100%	403.51	403.51
Ventanilla	Ago-04	Gas turbine Natural Gas	315.32	315.32	100%	1861.37	1861.37
Cañon del Pato	Jun-04	Hydro	2.761	263.49	1%	1539.79	16.13
Yarinacocha	Mar-03	Diesel 2 / Residual	25.6	25.60	100%	72.45	72.45
Arcata	Abr-03	Hydro	5.278	5.28	100%	29.77	29.77
Huanchor	Nov-02	Hydro	19.6	19.60	100%	22.50	22.50
Cañon del Pato	Jun-02	Hydro	4.18	263.49	2%	1539.79	24.43
Machupichu	Oct-01	Hydro	85.8	85.80	100%	748.18	748.18
San Nicolas Cummins	Jun-01	Diesel 2 / Residual	1.25	1.25	100%	0.77	0.77
Tumbes	Jun-01	Diesel 2 / Residual	18.339	18.34	100%	50.58	50.58
Cañon del Pato	Jun-01	Hydro	9.968	263.49	4%	1539.79	58.25
Chimay	Oct-00	Hydro	150.9	150.90	100%	799.35	799.35
Ilo2	Ago-00	Steam Turbine / Coal	141.1	141.10	100%	830.88	830.88
San Gaban II	Feb-00	Hydro	113.1	113.10	100%	754.32	754.32
Yanango	Feb-00	Hydro	42.6	42.60	100%	177.57	177.57
Cañon del Pato	Nov-99	Hydro	92.682	263.49	35%	1539.79	541.62

Source: COES

Source: COES

In Table 10, it can be seen that the 5 most recently built plants up to year 2005 were: 1) Callahuanca 2) Yuncan, 3) Santa Rosa, 4) Ventanilla, 5) Cañon del Pato, with their total annual generation being 2,568 GWh. On the other hand, the total annual generation of the most recently built plants accounting for 20% of the grid was greater at 5,205GWh; 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 3 until the enter of Ilo 2 in August 2000.

In Table 11 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 **0.41098 tCO_2/MWh** for the year 2005.

Table 11: BM Calculation following Option 2

Plant Name	Most Recent Year Gen (MWh)	% per plant	CO2 emission Factor tCO2/MWh
Callahuanca	37	0.70%	0.000
YUNCAN	250	4.81%	0.000
Santa Rosa	404	7.75%	0.641
Ventanilla	1,861	35.76%	0.600
Cañon del Pato	16	0.31%	0.000
Yarinacocha	72	1.39%	0.652
Arcata	30	0.57%	0.000
Huanchor	23	0.43%	0.000
Cañon del Pato	24	0.47%	0.000
Machupichu	748	14.37%	0.000
San Nicolas Cummins	1	0.01%	0.655
Tumbes	51	0.97%	0.637
Cañon del Pato	58	1.12%	0.000
Chimay	799	15.36%	0.000
Ilo2	831	15.96%	0.823
Total	5,205	100%	0.41098 Weighted average emission factor

BM2=	0.41098	tCO2//MWh

Step 3 – Calculation of the Baseline emission factor

Baseline Emission Factor is the simple average of the OM and the BM and is calculated as follows:

CM = 0.5*OM + 0.5*BM
CM = 0.5*(0.72756) + 0.5*(0.41098) = 0.56927 tCO_2/MWh

The resulting Baseline Emission Factor is **0.56927 tCO_2/MWh.**

Step 4 – Calculation of the Project's Emissions Reductions Prior to Validation

The estimated annual ERs for the Project were calculated as follows:

Estimated Baseline Emissions = CM* (Estimated Annual Generation in MWh)
Estimated Annual ERs = CM* (Estimated Annual Generation in MWh)
Estimated Annual ERs = 0.56927 tCO_2/MWh * 40,000 MWh = **22,770.89 tCO_2**
Estimated ERs for the first crediting period = 22,770.89 tCO_2/yr* 7 yrs = **159,396.20 tCO_2**

B.6.4 Summary of the ex-ante estimation of emission reductions:

A summary of the *ex-ante* estimation of ERs can be found in Table 12 below.

Table 12: Ex-ante Estimation of the Project's ERs

year[32]	Estimation of project activity emissions (tones of CO_2e)	Estimation of baseline emissions (tones of CO_2e)	Estimation of leakage (tones of CO_2e)	Estimation of overall emission reductions(tones of CO_2e)
2009	0	17,078.16	0	17,078.16
2010	0	22,770.89	0	22,770.89
2011	0	22,770.89	0	22,770.89
2012	0	22,770.89	0	22,770.89
2013	0	22,770.89	0	22,770.89
2014	0	22,770.89	0	22,770.89
2015	0	22,770.89	0	22,770.89
2016	0	5,692.72	0	5,692.72
Total	**0**	**159,396.20**	**0**	**159,396.20**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

The numeration of "Data / Parameter" is the same as the "ID Numbers" indicated in the Baseline Methodology (ACM0002 Version 6). Parameters 8 (surface area at full reservoir level) and 11(fraction of time during which lowcost/ must-run sources are on the margin) of the ACM0002 are not applicable since the Project will not build a reservoir, and parameter 11 is used only for Simple Adjusted Operating Margin, which is not the case of the project.

Data / Parameter:	**1. EG_h**
Data unit:	MWh
Description:	Electricity supplied to the SEIN by the Project
Source of data to be used:	COES
Value of data applied for the purpose of calculating expected emission reductions in section B.5	40,000 MWh
Description of measurement methods and procedures to be applied:	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 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 will have a separate control and measuring system, distinct from that for Poechos I, and as per requirements by ~~ENOSA and~~ COES. The electricity meters will be calibrated at least every three years. This separate measuring system is composed by one meter that measures

[32] For the Project "the year" will run from April 1 to March 31, the first year of the first crediting period being 1 April 2009 – 31 March 2010 and the last year of the first crediting period being 1 April 2015 – 31 March 2016.

	electricity after electricity auxiliary consumption. After that meter, the electricity is transformed from 10 kv to 60 kv and is transmitted through a transmission line to the national grid (SEIN). In order to be more accurate in measuring net energy to the grid considering not only auxiliary electricity consumption but also transformation and transmission loses, the project developer use the electricity meter of Sullana which is located after transformer. 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.. 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 ($MWh_{Sullana}$ - $MWh_{Poechos\ II}$). Therefore, transformation and transmission loses will be absorbed by Poechos I Therefore, the net electricity to the grid for Poechos II is the electricity metered in the electricity meter of Poechos II and reported to COES.(Transformation and transmission loses will not affect the supply of electricity of Poechos II since the electricity calculation of Poechos I absorbed it).
QA/QC procedures to be applied:	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 (SEIN) or to the final client ~~(ENOSA)~~, as well as other records are used to ensure consistency.
Any comment:	Electricity supplied by the project activity to the grid. Double check with receipt of sales

Data / Parameter:	**2. EF_y.**
Data unit:	**tCO_2**/MWh
Description:	**CO_2** emission factor of the grid
Source of data to be used:	Project sponsor's own calculations based on COES data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.56927 tCO_2/MWh
Description of measurement methods and procedures to be applied:	Calculated yearly. The proportion of data to be monitored is 100% and the data will be archived electronically. 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.
QA/QC procedures to be applied:	
Any comment:	Calculated as a weighted sum of the OM and BM emission factors

Data / Parameter:	**3. $EF_{OM,y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 Operating Margin Emission Factor of the grid

Source of data to be used:	Project sponsor's own calculations based on COES hourly generation data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.72756 tCO_2/MWh
Description of measurement methods and procedures to be applied:	Calculated yearly. The proportion of data to be monitored is 100% and the data will be archived electronically. 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
QA/QC procedures to be applied:	
Any comment:	Calculated as indicated in the relevant OM baseline method (DDA-OM)

Data / Parameter:	**4. $EF_{BM,y}$**
Data unit:	tCO_2/MWh
Description:	CO_2 Build Margin emission factor of the grid
Source of data to be used:	Project sponsor's own calculations from COES data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.41098 tCO_2/MWh
Description of measurement methods and procedures to be applied:	Calculated yearly. The proportion of data to be monitored is 100% and the data will be archived electronically. 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.
QA/QC procedures to be applied:	
Any comment:	Calculated as $[\sum_{m,y} GEN_{,m,y,} *COEF_{m}] / [\sum_{m} GEN_{my}]$ for the recently built power plants defined in the Baseline Methodology (BM2)

Data / Parameter:	**5. F_i**
Data unit:	TJ
Description:	Amount of each fossil fuel consumed by each power plant per MWh
Source of data to be used:	Project sponsor's own calculation using COES net efficiency conversions (NECs) annual data.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	It is incorporated in COEF calculation
Description of measurement methods and procedures to be applied:	Estimated yearly. The proportion of data to be monitored is 100% and the data will be archived electronically. 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.

QA/QC procedures to be applied:	
Any comment:	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. Parameter 5 should be monitored using the most recent information published by the NEC. This parameter is included in the calculation of COEF calculation.

Data / Parameter:	**6. COEFi**
Data unit:	tCO_2/MWh
Description:	CO_2 emission coefficient of each power plant
Source of data to be used:	Project sponsor's own calculations.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Annex 3, Table #1.
Description of measurement methods and procedures to be applied:	Calculated yearly. The proportion of data to be monitored is 100% and the data will be archived electronically. 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.
QA/QC procedures to be applied:	
Any comment:	COEFs need to be updated annually with actual NECs that are published annually by COES. COEFs per plant will need to be 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].

Data / Parameter:	**7. GEN**
Data unit:	MWh
Description:	Hourly electricity generation of all units of the grid
Source of data to be used:	COES
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Information is available to the DOE in Excel spreadsheets based on information provided by COES.
Description of measurement methods and procedures to be applied:	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. 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.
QA/QC procedures to be applied:	
Any comment:	Data should be taken from COES.

Data / Parameter:	9. Plant Name
Data unit:	Text
Description:	Identification of power plants for the OM
Source of data to be used:	COES
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Annex 3, Table #1.
Description of measurement methods and procedures to be applied:	Estimated yearly. The proportion of data to be monitored is 100% of set of plants and the data will be archived electronically. 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
QA/QC procedures to be applied:	
Any comment:	Identification of plants to calculate OM

Data / Parameter:	10. Plant Name
Data unit:	Text
Description:	Identification of power plants for the BM
Source of data to be used:	COES
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See Annex 4 in the "The BM2 Spreadsheet" description.
Description of measurement methods and procedures to be applied:	Estimated yearly. The proportion of data to be monitored is 100% of set of plants and the data will be archived electronically. 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.
QA/QC procedures to be applied:	
Any comment:	Identification of plants to calculate BM

Data / Parameter:	12. Merit Order
Data unit:	Text
Description:	The merit order in which power plants are dispatched by documented evidence
Source of data to be used:	COES
Value of data applied for the purpose of calculating expected	Information is available to the DOE in Excel spreadsheets based on information provided by COES.

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	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.~~. 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.
QA/QC procedures to be applied:	
Any comment:	The plants should be stacked in the dispatch data analysis.

Data / Parameter:	**12 a. GEN imports**
Data unit:	KWh
Description:	Electricity imports to the Project's electricity system
Source of data to be used:	COES
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No imports were registered in COES as of date
Description of measurement methods and procedures to be applied:	Calculated yearly. The proportion of data to be monitored is 100% and the data will be archived electronically. 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.
QA/QC procedures to be applied:	
Any comment:	Obtained from latest local statistics. If local statistics are not available, IEA statistics are used to determine imports. Imports are not expected but will be monitored if any.

Data / Parameter:	**12 b. COEF imports**
Data unit:	tCO_2/MWh
Description:	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur)
Source of data to be used:	COES
Value of data applied for the purpose of calculating expected emission reductions in section B.5	No imports on the date.
Description of measurement methods and procedures to be applied:	Calculated yearly. The proportion of data to be monitored is 100% and the data will be archived electronically. 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.
QA/QC procedures to be applied:	
Any comment:	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).

B.7.2 Description of the monitoring plan:

No especial monitoring equipment is needed. AHLCARBONO will provide SINERSA with a Monitoring Plan and pre-programmed spreadsheets such that the Project sponsor will only need to collect the information as described and apply the formulas as instructed in the Monitoring Plan. COES, the dispatch center will be the only data provider for the annual *ex-post* calculation of the Project's ERs. The designated project staff will confirm these data with their own records, which they will cross check with sales receipts. Further details of the MP are available in Annex 4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

The Baseline Study and the Monitoring methodology were completed on September 12, 2006 by:

Francisco Fernández-Asín
AHLCARBONO
Virginia,
USA.
E-mail: francisco.asin@ahlcarbono.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

12/02/2007

C.1.2. Expected operational lifetime of the project activity:

The Project is expected to have a minimum operating life of 40 years.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/04/2009

C.2.1.2. Length of the first crediting period:

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

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

Numerous environmental assessment documents were completed during the preparation of the Project. An Environmental Impact Assessment (EIA) was completed for both Poechos I and II, which analyzed impacts during construction and operation. No major impacts were identified, in part because the area had already been altered from its natural state due to previous infrastructure projects (the dam and irrigation system). Impacts of construction were managed well through proper environmental practices laid out in an Environmental Management Plan submitted to and approved by the Inter-American Development Bank (IDB), the German development bank, DEG, and the World Bank, which are all financiers involved in the Project. A separate EIA covering both projects was completed for the transmission line alone, with, again, no major impacts identified.

Communities along the transmission line were given the opportunity to connect to the SEIN through the generation of Poechos I, the 60 kV transmission line and the 10/60 kV switchyard. Therefore, at the present time about 20,000 families have access to electricity thanks to the implementation of Poechos I. Poechos II will provide additional supply, as well as guarantee of safe and adequate operation for these new consumers Their consumption will be partly subsidized by the Peruvian Government in accordance with MINEM initiatives regarding social development and rural electrification.[33]

Other direct benefits resulting from the Project include:

- Supply of a clean source of energy;
- Training for locals on the productive uses of electricity;
- Tax collections in the Project area at an estimated annual average of 500,000 USD, which will boost the development of local communities;
- Creation of more than 200 jobs during the construction phase, employing locals exclusively and thus impacting more than 200 families positively;
- Economic development of the poorest areas of the country through access to electricity, which will spur productive activities. Initially such activities will be promoted through the maximum use of local supplies;

[33] One such initiative is the *Fondo de Compensacion Social Electrica (*FOSE*),* which was created by Law 27510 in 2001to favor electricity access and reliability to all clients that consume less than 1000 KWh by offering them discounts. Currently FOSE’s operational lifetime is set until December 2006.

- Creation of the second project on the Ecuadorian - Peruvian border, which will serve as a good reference for future initiatives for the sustainable development of this area with low human development indexes (HDI);
- Mitigation of migration of peasants to the coastal cities of Peru;
- Commitment expressed by SINERSA to education and local technical training;
- Reduction of operating costs of the Poechos dam, such as the elimination of diesel-based generators currently supplying electricity to the dam;
- An increase of nearly $10 Million USD in investment in Peru, including approximately $3 Million USD in direct investment in the Project's area.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Approval of the EIA report by the Environmental Agency: March 31, 2003 (EIA by MINEM)
Other Permits: Water concession

The potential impacts of the Project, as identified in the EIA, are summarized in Table 13 below.

Table 13: Potential Environmental Impacts of the Project

Environmental	Magnitude (High, Medium, Low)	Comments
Increased erosion	Low	No destruction of the local forest was caused, therefore this impact was minor.
Deterioration of the landscape	Low	All Project works are minimal compared to the existing civil works of the dam; therefore no deterioration of the landscape is expected.
Air emissions	Low High (+)	No impact; hydropower energy from HPP Poechos I will be used during construction (instead of diesel generators). The Project will result in the reduction of local pollution and of carbon emissions to the atmosphere, which will have a positive effect both locally and globally.
Loss of vegetation and biodiversity	Low	No impact, because the density within the Project area is low, and the river has already been reduced to a concrete diversion channel.
Loss of agricultural area	Low	The Project will not cause any loss of agricultural areas.
Lack of water for biological functions in the river	Low	Sponsor is working with authorities to ensure that the minimum ecological flow of 10 m3/s is maintained at all times.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

As part of EIA guidelines and procedures by the Government of Peru, and in full compliance with World Bank Safeguard Policies, several workshops with the local communities took place. The EIAs for the power plant as well as for the transmission line, were discussed with affected groups, and were made available for comment by NGOs through the Environmental Agency. The consultation on the EIA for the Project took place in 1997 during the process of obtaining concessions. Announcements of the consultations were posted in local newspapers. The public consultation on the EIA for the transmission line took place on July 23, 2003 in Sullana.

E.2. Summary of the comments received:

Local stakeholders were consulted as part of the EIA process. The summary EIA reports include a section on the public consultation process, wherein the groups consulted and their comments are detailed. The EIAs are available for public review at MINEM, and are also available locally. Local stakeholders' questions revolved around concerns from surrounding municipalities about the timing for the electrification of their villages.

E.3. Report on how due account was taken of any comments received:

Because no negative comments were received, the Project sponsor outlined its own initiatives to continue with the Project, given the support of the community. The following social priorities were addressed during the Project's design and construction, and will continue to be addressed during its operation:

- Reinforce the good rapport with the locals and continue the dialogue with the community of Lancones;
- Hire and train local workers for construction and operation;
- Develop local technical capabilities;
- Maximize the use of local products, supplies and materials for the Project;
- Contract Peruvian companies to perform the planned activities;
- Prioritize the target of the social investment with the community;
- Promote the improvement of education;
- Meet the World Bank's Safeguard Policies.

In addition, as a response to local stakeholders' comments, the Project has cooperated with an ambitious MINEM-initiated Rural Electrification Plan by creating three new "small electric systems" or sub-grids from SINERSA's transmission lines. The impact of electricity supply in this underdeveloped area close to the border with Ecuador (and once considered a security zone) is instrumental for the area's development. The Governmental plan was made possible by the Project's cooperation, and the Project's consideration of local stakeholders' concerns regarding local electrification.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	
Title:	President
Salutation:	Mr.
Last Name:	Fernández-Asín
Middle Name:	
First Name:	Francisco
Department:	
Mobile:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

N/A; the Project has not received any type of public funding or public financial help.

Annex 3

BASELINE INFORMATION

Table A3-1 below shows COEF calculations with actual 2005 NECs from the *Annual Statistics* published by COES. In the monitoring, COEFs should be updated using the latest *Annual Statistics*.

Table A3-1 COEF Calculations

Table # 1: COEF Calculation
Thermal Plants Emission Factors 2005

Thermal Plants		Technology	Fuel	Real NECs[1]	PFR per MWh[2]	C[3]	O[4]	44/12	CO2 Emissions Factor (tCO2/MWh)
ag_tg1	AGUAYTIA 1	Gas Turbine Natural Gas	Dry	29.80%	0.01208	15.30	1.000	3.67	0.678
ag_tg2	AGUAYTIA 2	Gas Turbine Natural Gas	Dry	29.30%	0.01229	15.30	1.000	3.67	0.689
bvista1	BELL MAN 1,2	Diesel 2 / Residual	Diesel 2	37.30%	0.00965	20.20	1.000	3.67	0.715
bvista2	BELL MAN 1,2	Diesel 2 / Residual	Diesel 2	30.90%	0.01165	20.20	1.000	3.67	0.863
calana123	CALANA 123	Diesel 2 / Residual	Residual 6	41.80%	0.00861	21.10	1.000	3.67	0.666
calana4	CALANA 4	Diesel 2 / Residual	Residual 6	38.80%	0.00928	21.10	1.000	3.67	0.718
ccomb	C. COMBINADO	Combined Cycle Gas-Steam	Diesel 2	31.10%	0.01158	20.20	1.000	3.67	0.857
chi_slz12	SULZER CHILINA	Diesel 2 / Residual	Diesel 2	42.10%	0.00855	20.20	1.000	3.67	0.633
chicl_o	DS CHICLAYO OESTE-D	Diesel 2 / Residual	Residual 6	34.60%	0.01040	21.10	1.000	3.67	0.805
chiltv1	chiltv1	R500	R500						
chiltv2	TV2 CHILINA	Steam Turbine / Residual	R500	21.40%	0.01682	21.10	1.000	3.67	1.301
chiltv3	TV3 CHILINA	Steam Turbine / Residual	R500	22.20%	0.01622	21.10	1.000	3.67	1.255
chimb	TG1 CHIMBOTE	Gas Turbine Diesel	Diesel 2	24.40%	0.01475	20.20	1.000	3.67	1.093
cnp_mann	DS PACAS-MAN	Diesel 2 / Residual	Diesel 2	30.90%	0.01165	20.20	1.000	3.67	0.863
cnp_slz	DS PACAS-SULZER	Diesel 2 / Residual	Diesel 2	33.60%	0.01071	20.20	1.000	3.67	0.794
dolores1	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
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
ilo1catk	KATCATO (ENERSUR)	Diesel 2 / Residual	Diesel 2	37.80%	0.00952	20.20	1.000	3.67	0.705
ilo1tg1	TG1 ILO	Gas Turbine Diesel	Diesel 2	29.70%	0.01212	20.20	1.000	3.67	0.898
ilo1tg2	TG2 ILO	Gas Turbine Diesel	Diesel 2	31.70%	0.01136	20.20	1.000	3.67	0.841
ilo1tv1	ILO TV1	Steam Turbine / Residual	R500	34.90%	0.01032	20.20	1.000	3.67	0.764
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	41.40%	0.00870	25.80	1.000	3.67	0.823
mal_tg1	TG1	Gas Turbine Natural Gas	Pure Methane	21.20%	0.01698	14.50	1.000	3.67	0.903
mal_tg2	TG2	Gas Turbine Natural Gas	Pure Methane	21.80%	0.01651	14.50	1.000	3.67	0.878
mal_tg3	TG3	Gas Turbine Natural Gas	Pure Methane	22.00%	0.01636	14.50	1.000	3.67	0.870
mal_tg4	TGN4	Gas Turbine Natural Gas	Pure Methane	28.00%	0.01286	14.50	1.000	3.67	0.684
moll123	MOLLENDO 1,2,3	Diesel 2 / Residual	R500	42.40%	0.00849	21.10	1.000	3.67	0.657
molltg1	TGM1 MOLLENDO	Gas Turbine Diesel	Diesel 2	28.40%	0.01268	20.20	1.000	3.67	0.939
molltg2	TGM2 MOLLENDO	Gas Turbine Diesel	Diesel 2	29.40%	0.01224	20.20	1.000	3.67	0.907
moq12	MOQUEGUA	Diesel 2	Diesel 2						
paita1	DS PAITA1	Diesel 2 / Residual	Diesel 2	35.50%	0.01014	20.20	1.000	3.67	0.751
paita2	DS PAITA2	Diesel 2 / Residual	Diesel 2	32.00%	0.01125	20.20	1.000	3.67	0.833
piura1	DS PIURA1	Diesel 2 / Residual	Residual 6	37.20%	0.00968	21.10	1.000	3.67	0.749
piura2	DS PIURA2	Diesel 2 / Residual	Residual 6	34.50%	0.01043	21.10	1.000	3.67	0.807
shcummins	CUMMINS	Diesel 2 / Residual	Diesel 2	40.70%	0.00885	20.20	1.000	3.67	0.655
shou_tv1	TV1 SHOUGESA	Steam Turbine / Residual	R500	28.60%	0.01259	21.10	1.000	3.67	0.974
shou_tv2	TV2 SHOUGESA	Steam Turbine / Residual	R500	28.30%	0.01272	21.10	1.000	3.67	0.984
shou_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	36.10%	0.00997	20.20	1.000	3.67	0.739
tg_piu	TG PIURA	Gas Turbine Diesel	Residual 6	26.00%	0.01385	21.10	1.000	3.67	1.071
tintaya	TINTAYA	Diesel 2	Diesel 2						
truji	TG TRUJILLO	Gas Turbine Diesel	Diesel 2	23.30%	0.01545	20.20	1.000	3.67	1.144
trupal	TRUPAL	Residual 6	Residual 6						
tumbes	TUMBES	Diesel 2 / Residual	Residual 6	43.70%	0.00824	21.10	1.000	3.67	0.637
uti_5	TG S.ROSA UTI5	Gas Turbine Diesel	Diesel 2	28.30%	0.01272	20.20	1.000	3.67	0.942
uti_6	TG S.ROSA UTI6	Gas Turbine Diesel	Diesel 2	31.30%	0.01150	20.20	1.000	3.67	0.852
vent3	TG VENTANILLA-3	Gas Turbine Natural Gas	Dry	33.60%	0.01071	15.30	1.000	3.67	0.601
vent4	TG VENTANILLA-4	Gas Turbine Natural Gas	Dry	33.70%	0.01068	15.30	1.000	3.67	0.599
westin	TG WESTINGHOUSE	Gas Turbine Natural Gas	Dry	31.50%	0.01143	15.30	1.000	3.67	0.641
	TG WESTINGHOUSE	Gas Turbine Diesel	Diesel 2	32.90%	0.01094	20.20	1.000	3.67	0.810
yarinac	Yarinacocha (5)	Diesel 2 / Residual	Residual 6	42.70%	0.00843	21.10	1.000	3.67	0.652

1. Source: COES. Estadistica de Operaciones 2005. Cuadro No 4.7. Eficiencia Termica %
2. PFR per MWh = Plant Fuel Requirement formula per MWh = "3.6*10^9/(NEC*10^12)

Table A3-1above has the emission factor formulas inserted in it. Actual NECs, as well as data on technology and fuel were obtained from COES. All this data was publicly available at the COES website in its annual statistics. The specific information source is the chart entitled "Costos Variables de las Centrales Termoeléctricas del SINAC", which appeared in the COES Annual Statistics (*Estadística anual de Operaciones*) for the years 2004 and 2005 as chart number 4.7.

The formula to use to calculate the COEFs per plant for Table A3-1 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 were extracted from IPCC 2006.

Table A3-2: Carbon Content and Oxidation Factors for Various Fuels

Table #2	Type of Fuel				
	D2	Residual	Gas Dry	Gas PM	Coal
(3) C Content	20.20	21.10	15.30	14.50	25.80
(4) Oxidation Factor	1	1	1	1	1

Source: IPCC 2006.

Justification of the usage of COES information system data for baseline calculation:

The baseline calculation disregarded the data that is not registered by COES and deemed COES data to be the best approximation of total SEIN data on both generation and installed capacity additions. It was also deemed to be the best data to allow a good monitoring practice because of three reasons:

1. There is not as good quality data of the SEIN production as what COES registers. The information of plants connected to the SEIN but not registered in COES regarding generation and installed capacity additions is provided by the plants' management periodically to the MINEM. However, this data does not pass through a verification or validation process, nor is it required to comply with technical standards as rigorously as COES requires from their power plant members;
2. The limitation of MINEM's final annual reports and data availability would not allow good monitoring practice;
3. The generation of these other plants connected to the SEIN but not registered by COES, is irrelevant as it comprised only 2% of total SEIN electricity generation in 2005, as Table A-3 below shows.

Table A3-3: Generation in SEIN and COES

	SEIN (GWh)	COES (GWh)	COES/SEIN	Not recorded by COES
2005	23,434	23,001	0.98	0.02
2004	22,288	21,903	0.98	0.02
2003	20,999	20,689	0.99	0.01
2002	20,018	19,658	0.98	0.02
2001	18,755	18,463	0.98	0.02

Source: Anuario Estadistico MINEM 2001 -2005 and Estadistica de operaciones COES 2001-2005

Annex 4

MONITORING INFORMATION

TABLE OF CONTENTS

I. Background Information

The baseline methodology and monitoring methodology for Poechos II are in accordance with the approved consolidated baseline methodology (ACM0002): Consolidated baseline methodology for zero-emissions grid-connected electricity generation from renewable sources (The Baseline Methodology). This Baseline Methodology was released on September 3 2004 by the CDM Executive Board and revised on May 19, 2006.

The Project is a hydroelectric power plant located in Peru, in the Northwestern Department of Piura. It installed capacity is 10 MW and projected yearly average generation is 40 GWh/yr. The Project will displace approximately 22,770.89 tCO_2 per year, which totals 159,396.20 tCO_2 for the first crediting period (7 years). Methane and carbon dioxide emissions from the Project are negligible, and per the Methodology, there is no need to monitor leakage and leakage will not be taken into account when calculating ERs.

The spatial extent of the Project boundary is the SEIN. The Project is connected to the SEIN through the Sullana Substation, which belongs to ENOSA, a state-owned enterprise. The 40 GWh of electricity generated per year will be sold to ~~ENOSA~~ the grid. Until now, neither electricity exports from the SEIN nor electricity imports to the SEIN have taken place.

II. Purpose of the Monitoring Plan

This report presents the Monitoring Plan (MP) for the Project. The MP defines a standard against which the performance in terms of the Project's ERs will be monitored and verified, in conformance with all relevant requirements of the CDM of the Kyoto Protocol. As of today, the Project's sponsor is the same enterprise as the Project's operator: SINERSA (the Operator). The CDM defines monitoring as the systematic surveillance of a project's performance by measuring and recording performance-related indicators relevant to the project activity. Both the Baseline and the MP are subject to verification procedures.

III. Use of the Monitoring Plan by the Operator

The MP identifies key performance indicators of the Project and sets out the procedures for metering, monitoring, calculating and verifying the ERs generated by the Project annually. Adherence to the instructions in the MP is necessary for the Operator to successfully measure and track the impact of the Project, and to prepare all data required for the periodic audit and verification process that must be undertaken to confirm the attainment of the corresponding ERs.

The MP assists the Operator in establishing a credible, transparent, and adequate data measurement, collection, recording and management system to successfully develop and maintain the proper information; required for an audit and for the verification and certification of the achieved ERs and other Project outcomes. Specifically, the MP provides the requirements and instructions for: (i) establishing and maintaining the appropriate monitoring system, including spreadsheets for the calculation of ERs, (ii) checking whether the Project meets key sustainable development indicators, (iii) implementing the necessary measurement and management operations, and (iv) preparing for the requirements of independent third party verifications and audits.

The MP ensures environmental integrity and accuracy of crediting ERs by allowing actual ERs to be accounted for only after they have been generated. The MP must therefore be used throughout the period in which the Project has committed to, or desires to sell and track ERs. It must be adopted as a key input into the detailed planning of the Project, and included as one of its operational manuals.

The MP can be updated and adjusted to meet operational requirements. The Verifier approves such modifications during the process of initial or periodic verification. In particular, any shifts in the baseline scenario may lead to such amendments, which may be mandated by the Verifier. Amendments may also be necessary as a consequence of new circumstances that affect the ability to monitor ERs, as described here, or to accommodate new or modified CDM rules.

I.V. Organizational, Operational and Monitoring Obligations

A. Obligations of the Operator

Monitoring performance of the Project requires the fulfillment of operational data collection and processing obligations from the Operator. The Operator has the primary obligation of ensuring that sufficient and accurate information is available to calculate ERs in a transparent manner and of allowing for a successful verification of accounted ERs.

"**Data Collection and Integration:** 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[34] ~~and from the Project's final client, ENOSA~~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:

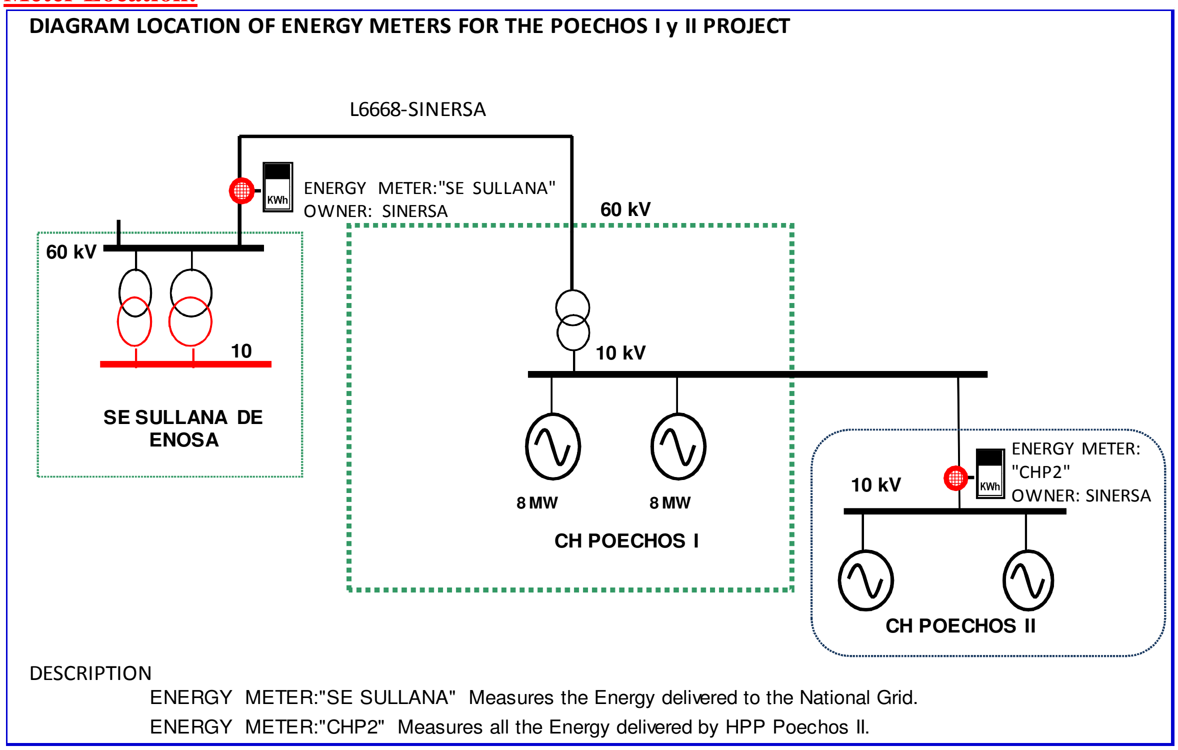
	At the end of each month:
COES **(Data Provider)**	-Report of hourly generation of the plants in the SEIN (measurement: 15' or 30' [35]) -Report of weekly dispatch merit orders for "hours of maximum demand [36]" -Report of net energy sold to the grid.
~~**ENOSA**~~ ~~**(Data Provider)**~~	~~-Report of the Project hourly generation purchased by ENOSA.~~

[34] As long as the Project Operator is not an active member of COES. When it is, all data will come from COES.
[35] 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.
[36] (6pm to 11 pm) to set a standard - weekly merit orders for hours of maximum, minimum and medium demand are similar.

Operator (Data processor)	- Report of the Project hourly generation measured by the electric meter of Poechos II Verification of COES and final clients 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 the substation of Sullana. ~~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 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.

Meter Location:



The electricity of Poechos II is metered after electricity auxiliary consumptions. From the 10 kv busbar of Poechos I, electricity from Poechos I and Poechos II are transformed to 60 kv and is transmitted through a transmission line to the substation of Sullana, which is connected to the national grid. In the end of this transmission line there is an electricity meter "Sullana Meter" that measures net electricity to the grid from the projects of Poechos II and Poechos I.

Net electricity to the Grid of Poechos II:

The electric meter of Poechos II measures electricity after electricity auxiliary consumption. In order to be more accurate in measuring net energy to the grid considering not only auxiliary electricity consumption but also transformation loses, the project developer use the electricity meter of Sullana which is located after transformer.

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 ($MWh_{Sullana}$ - $MWh_{Poechos\ II}$). Therefore, transformation and transmission loses will be absorbed by Poechos I

So, the net electricity to the grid for Poechos II is the electricity metered in the electricity meter of Poechos II and reported to COES. (Transformation and transmission loses will not affect the supply of electricity of Poechos II since the electricity calculation of Poechos I absorbed it).

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 Sullana.

B. Emissions Reductions Calculation Procedure and Required Spreadsheets

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 should contain: i) data gathered from the Project's ~~final client: ENOSA~~[37] ~~,~~meters 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 will only be possible to know the ERs at the end of each year (March 31st for the Project), filling data monthly in the required spreadsheets will 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~~ 3 required spreadsheets to update with new data: *Poechos II EGh net electricity check.xls*, *Poechos II DDA-OM.xls* and *PoechosII BM2.xls* ~~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.

Poechos II EGh net electricity check.xls

This spread sheet will verify that the sum of electricity reported of Poechos II and Poechos I in each hour is equal to the net electricity metered in Sullana.

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

The Excel spread sheet will be composed by 12 worksheets. One worksheet per month of the year. These worksheets contain (a) the hourly generation measured in the electricity meter of Sullana ($EGh_{Sullana}$)which is the net electricity to the grid of Poechos I and Poechos II, (b) hourly generation of Poechos II metered in the meter of Poechos II (c) and hourly generation assigned to Poechos I ($EGh_{PoechosI}$). Also there is a colum that sum the electricity reported of Poechos I and II and other column which is the Net electricity consistency test. This consistency test is used to prove that net electricity to the grid for both projects (metered is Sullana) is equal to the sum of the reported electricity of both projects.

day/month/year/ hour	$EGh_{Sullana}$ Sullana Meter (electricity reported from the electricity meter of Sullana)	$EGh_{Poechos\ II}$ Poechos II EGh (Electricity metered in Poechos II)	$EGh_{Poechos\ I}$ Poechos I EGh (Electricity Assigned to Poechso I)	$EGh_{Poechos\ II} + EGh_{Poechos\ I}$ Sum of $EGh_{Poechos\ II}$ and $EGh_{Poechos\ I}$	$EGh_{Sullana} - (EGh_{Poechos\ II} + EGh_{Poechos\ I}) = 0$ **Consistency test:** The sum of the EGh of both projects must be the same as the electricity metered in Sullana.

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-March 31st). ~~17~~ 15 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 A4-1 below shows COEF Calculations and is already filled with actual 2005 NECs from COES Annual Statistics 2005[38] . These are only examples in order to derive a reference baseline estimation. In the monitoring, COEFs would vary according to the information published by COES each year.

[38] COES: Estadística de Operaciones. In year 2005, NEC appears as "Eficiencia Térmica %" in the chart No 4.7

Table A4-1: COEF Calculation

Table # 1: COEF Calculation
Thermal Plants Emission Factors 2005

Thermal Plants		Technology	Fuel	Real NECs(1)	PFR per MWh(2)	C(3)	O(4)	44/12	CO2 Emissions Factor (tCO2/MWh)
ag_tg1	AGUAYTIA 1	Gas Turbine Natural Gas	Dry	29.80%	0.01208	15.30	1.000	3.67	0.678
ag_tg2	AGUAYTIA 2	Gas Turbine Natural Gas	Dry	29.30%	0.01229	15.30	1.000	3.67	0.689
bvista1	BELL MAN 1,2	Diesel 2 / Residual	Diesel 2	37.30%	0.00965	20.20	1.000	3.67	0.715
bvista2	BELL MAN 1,2	Diesel 2 / Residual	Diesel 2	30.90%	0.01165	20.20	1.000	3.67	0.863
calana123	CALANA 123	Diesel 2 / Residual	Residual 6	41.80%	0.00861	21.10	1.000	3.67	0.666
calana4	CALANA 4	Diesel 2 / Residual	Residual 6	38.80%	0.00928	21.10	1.000	3.67	0.718
ccomb	C. COMBINADO	Combined Cycle Gas-Steam	Diesel 2	31.10%	0.01158	20.20	1.000	3.67	0.857
chi_slz12	SULZER CHILINA	Diesel 2 / Residual	Diesel 2	42.10%	0.00855	20.20	1.000	3.67	0.633
chicl_o	DS CHICLAYO OESTE-D	Diesel 2 / Residual	Residual 6	34.60%	0.01040	21.10	1.000	3.67	0.805
chiltv1	chiltv1	R500	R500						
chiltv2	TV2 CHILINA	Steam Turbine / Residual	R500	21.40%	0.01682	21.10	1.000	3.67	1.301
chiltv3	TV3 CHILINA	Steam Turbine / Residual	R500	22.20%	0.01622	21.10	1.000	3.67	1.255
chimb	TG1 CHIMBOTE	Gas Turbine Diesel	Diesel 2	24.40%	0.01475	20.20	1.000	3.67	1.093
cnp_mann	DS PACAS-MAN	Diesel 2 / Residual	Diesel 2	30.90%	0.01165	20.20	1.000	3.67	0.863
cnp_slz	DS PACAS-SULZER	Diesel 2 / Residual	Diesel 2	33.60%	0.01071	20.20	1.000	3.67	0.794
dolores1	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
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
ilo1catk	KATCATO (ENERSUR)	Diesel 2 / Residual	Diesel 2	37.80%	0.00952	20.20	1.000	3.67	0.705
ilo1tg1	TG1 ILO	Gas Turbine Diesel	Diesel 2	29.70%	0.01212	20.20	1.000	3.67	0.898
ilo1tg2	TG2 ILO	Gas Turbine Diesel	Diesel 2	31.70%	0.01136	20.20	1.000	3.67	0.841
ilo1tv1	ILO TV1	Steam Turbine / Residual	R500	34.90%	0.01032	20.20	1.000	3.67	0.764
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	41.40%	0.00870	25.80	1.000	3.67	0.823
mal_tg1	TG1	Gas Turbine Natural Gas	Pure Methane	21.20%	0.01698	14.50	1.000	3.67	0.903
mal_tg2	TG2	Gas Turbine Natural Gas	Pure Methane	21.80%	0.01651	14.50	1.000	3.67	0.878
mal_tg3	TG3	Gas Turbine Natural Gas	Pure Methane	22.00%	0.01636	14.50	1.000	3.67	0.870
mal_tg4	TGN4	Gas Turbine Natural Gas	Pure Methane	28.00%	0.01286	14.50	1.000	3.67	0.684
moll123	MOLLENDO 1,2,3	Diesel 2 / Residual	R500	42.40%	0.00849	21.10	1.000	3.67	0.657
molltg1	TGM1 MOLLENDO	Gas Turbine Diesel	Diesel 2	28.40%	0.01268	20.20	1.000	3.67	0.939
molltg2	TGM2 MOLLENDO	Gas Turbine Diesel	Diesel 2	29.40%	0.01224	20.20	1.000	3.67	0.907
moq12	MOQUEGUA	Diesel 2	Diesel 2						
paita1	DS PAITA1	Diesel 2 / Residual	Diesel 2	35.50%	0.01014	20.20	1.000	3.67	0.751
paita2	DS PAITA2	Diesel 2 / Residual	Diesel 2	32.00%	0.01125	20.20	1.000	3.67	0.833
piura1	DS PIURA1	Diesel 2 / Residual	Residual 6	37.20%	0.00968	21.10	1.000	3.67	0.749
piura2	DS PIURA2	Diesel 2 / Residual	Residual 6	34.50%	0.01043	21.10	1.000	3.67	0.807
shcummins	CUMMINS	Diesel 2 / Residual	Diesel 2	40.70%	0.00885	20.20	1.000	3.67	0.655
shou_tv1	TV1 SHOUGESA	Steam Turbine / Residual	R500	28.60%	0.01259	21.10	1.000	3.67	0.974
shou_tv2	TV2 SHOUGESA	Steam Turbine / Residual	R500	28.30%	0.01272	21.10	1.000	3.67	0.984
shou_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	36.10%	0.00997	20.20	1.000	3.67	0.739
tg_piu	TG PIURA	Gas Turbine Diesel	Residual 6	26.00%	0.01385	21.10	1.000	3.67	1.071
tintaya	TINTAYA	Diesel 2	Diesel 2						
truji	TG TRUJILLO	Gas Turbine Diesel	Diesel 2	23.30%	0.01545	20.20	1.000	3.67	1.144
trupal	TRUPAL	Residual 6	Residual 6						
tumbes	TUMBES	Diesel 2 / Residual	Residual 6	43.70%	0.00824	21.10	1.000	3.67	0.637
uti_5	TG S.ROSA UTI5	Gas Turbine Diesel	Diesel 2	28.30%	0.01272	20.20	1.000	3.67	0.942
uti_6	TG S.ROSA UTI6	Gas Turbine Diesel	Diesel 2	31.30%	0.01150	20.20	1.000	3.67	0.852
vent3	TG VENTANILLA-3	Gas Turbine Natural Gas	Dry	33.60%	0.01071	15.30	1.000	3.67	0.601
vent4	TG VENTANILLA-4	Gas Turbine Natural Gas	Dry	33.70%	0.01068	15.30	1.000	3.67	0.599
westin	TG WESTINGHOUSE	Gas Turbine Natural Gas	Dry	31.50%	0.01143	15.30	1.000	3.67	0.641
	TG WESTINGHOUSE	Gas Turbine Diesel	Diesel 2	32.90%	0.01094	20.20	1.000	3.67	0.810
yarinac	Yarinacocha (5)	Diesel 2 / Residual	Residual 6	42.70%	0.00843	21.10	1.000	3.67	0.652

1. Source: COES. Estadistica de Operaciones 2005. Cuadro No 4.7. Eficiencia Termica %
2. PFR per MWh = Plant Fuel Requirement formula per MWh = *3.6*10^9/(NEC*10^12)

Table A4-1 contains pre-established formulas to calculate the emission factors. Data on actual NECs, technology and fuel has to be updated each year. 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", which in the years 2004 and 2005 of the COES Annual Statistics, appeared in chart number 4.7., "Estadística anual de Operaciones".

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 A4-2 below in Worksheet #0.

Table A4-2: Carbon and Oxidation Factors of Various Fuels

Table #2	Type of Fuel				
	D2	Residual	Gas Dry	Gas PM	Coal
(3) C Content	20.20	21.10	15.30	14.50	25.80
(4) Oxidation Factor	1	1	1	1	1

Source: IPCC 2006.

<u>Worksheet #1</u>

The following Table A4-3 assigns a COEF to each plant in the SEIN according to its COEF established in Worksheet #0, Table A4-1.

Table A4-3 holds up to 100 plants, of which 34 are hydropower plants and 66 are thermal plants. 83 of the 100 plants already exist, 28 of which are hydropower plants and 54 are thermal, while 19 are future plants, of which 6 will be hydropower plants and 12 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 A4-3: Plants in the SEIN by Technology and Assigned COEF

Table#1: Name Plant / Technology/Assigned COEF

Name	Plant	Technology	COEF(tCO2/MWh)
ag_tg1	AGUAYTIA 1 (2)	Gas Turbine Natural Gas	0.678
ag_tg2	AGUAYTIA 2 (2)	Gas Turbine Natural Gas	0.689
arcata	Arcata	Hydro	0.000
aricota	CH ARICOTA	Hydro	0.000
bvista1	BELL MAN 1,2	Diesel 2 / Residual	0.715
bvista2	BELL MAN 1,2	Diesel 2 / Residual	0.863
cahua	Cahua	Hydro	0.000
calana123	CALANA 123	Diesel 2 / Residual	0.666
calana4	CALANA 4	Diesel 2 / Residual	0.718
call	CH Callahuanca	Hydro	0.000
ccomb	C. COMBINADO	Combined Cycle Gas-Steam	0.857
chariii	CH CHARCANI	Hydro	0.000
chariv	CH CHARCANI	Hydro	0.000
charv	CH CHARCANI	Hydro	0.000
charvi	CH CHARCANI	Hydro	0.000
chi_slz12	SULZER CHILINA	Diesel 2 / Residual	0.633
chicl_o	DS CHICLAYO OESTE-D	Diesel 2 / Residual	0.805
chiltv1	chiltv1	R500	
chiltv2	TV2 CHILINA	Steam Turbine / Residual	1.301
chiltv3	TV3 CHILINA	Steam Turbine / Residual	1.255
chimay	CH Chimay	Hydro	0.000
chimb	TG1 CHIMBOTE	Gas Turbine Diesel	1.093
cnp_mann	DS PACAS-MAN	Diesel 2 / Residual	0.863
cnp_slz	DS PACAS-SULZER	Diesel 2 / Residual	0.794
cpato	CH Cañón del Pato	Hydro	0.000
cqro	CH Carhuaquero	Hydro	0.000
dolores1	DOL ALCO 1-2 GM 1-2-3	Diesel 2 / Residual	0.784
dolores2	DOL ALCO 1-2 GM 1-2-3	Diesel 2 / Residual	0.787
gciego	CH Gallito Ciego	Hydro	0.000
herc	CH HERCA	Hydro	0.000
hp1	HP1	Hydro	0.000
hp2	HP2	Hydro	0.000
hp3	HP3	Hydro	0.000
hp4	HP4	Hydro	0.000
hp5	HP5	Hydro	0.000
hp6	HP6	Hydro	0.000
hp7	CH Yuncan	Hydro	0.000
hpni	CH Huampaní	Hydro	0.000
huanchor	CH Huanchor	Hydro	0.000
huin	CH Huinco	Hydro	0.000
ilo1catk	KATCATO (ENERSUR)	Diesel 2 / Residual	0.705
ilo1tg1	TG1 ILO	Gas Turbine Diesel	0.898
ilo1tg2	TG2 ILO	Gas Turbine Diesel	0.841
ilo1tv1	ILO TV1	Steam Turbine / Residual	0.764
ilo1tv2	ILO TV2	Steam Turbine / Residual	0.798
ilo1tv3	ILO TV3	Steam Turbine / Residual	0.829
ilo1tv4	ILO TV4	Steam Turbine / Residual	0.807
ilo2_carb	TV CARBON ILO II	Steam Turbine / Coal	0.823
machup	CH MACHUPICCHU	Hydro	0.000
mal_tg1	TG1	Gas Turbine Natural Gas	0.903
mal_tg2	TG2	Gas Turbine Natural Gas	0.878
mal_tg3	TG3	Gas Turbine Natural Gas	0.870
mal_tg4	TGN4	Gas Turbine Natural Gas	0.684
malp	CH Malpaso	Hydro	0.000
man	CH MANTARO	Hydro	0.000
mat	CH Matucana	Hydro	0.000
moll123	MOLLENDO 1,2,3	Diesel 2 / Residual	0.657
molltg1	TGM1 MOLLENDO	Gas Turbine Diesel	0.939
molltg2	TGM2 MOLLENDO	Gas Turbine Diesel	0.907
moq12	MOQUEGUA	Diesel 2	0.000
moy	CH Moyopampa	Hydro	0.000
oro_p	CH Oroya-Pachac.	Hydro	0.000
paita1	DS PAITA1	Diesel 2 / Residual	0.751
paita2	DS PAITA2	Diesel 2 / Residual	0.833
pariac	Pariac	Hydro	0.000
piura1	DS PIURA1	Diesel 2 / Residual	0.749
piura2	DS PIURA2	Diesel 2 / Residual	0.807
ron	CH RESTITUCION	Hydro	0.000
sgab2	CH SAN GABAN	Hydro	0.000
shcummins	CUMMINS	Diesel 2 / Residual	0.655
shou_tv1	TV1 SHOUGESA	Steam Turbine / Residual	0.974
shou_tv2	TV2 SHOUGESA	Steam Turbine / Residual	0.984
shou_tv3	TV3 SHOUGESA	Steam Turbine / Residual	0.907
sullana	DS SULLANA	Diesel 2 / Residual	0.784
taparachi	TAPARACHI	Diesel 2 / Residual	0.739
tg_piu	TG PIURA	Gas Turbine Diesel	1.071
tintaya	TINTAYA	Diesel 2	0.000
tp55	TP55	Unknown	0.000
tp56	TP56	Unknown	0.000
tp57	TP57	Unknown	0.000
tp58	TP58	Unknown	0.000
tp59	TP59	Unknown	0.000
tp60	TP60	Unknown	0.000
tp61	TP61	Unknown	0.000
tp62	TP62	Unknown	0.000
tp63	TP63	Unknown	0.000
tp64	TP64	Unknown	0.000
tp65	TP65	Unknown	0.000
tp66	TP66	Unknown	0.000
truji	TG TRUJILLO	Gas Turbine Diesel	1.144
trupal	TRUPAL	Residual 6	0.000
tumbes	TUMBES	Diesel 2 / Residual	0.637
uti_5	TG S.ROSA UTI5	Gas Turbine Diesel	0.942
uti_6	TG S.ROSA UTI6	Gas Turbine Diesel	0.852
vent3	TG VENTANILLA-3	Gas Turbine Natural Gas	0.601
vent4	TG VENTANILLA-4	Gas Turbine Natural Gas	0.599
westin	TG WESTINGHOUSE	Gas Turbine Natural Gas	0.641
yanan	CH Yanango	Hydro	0.000
yarinac	Yarinacocha (5)	Diesel 2 / Residual	0.652
yaupi	CH Yaupi	Hydro	0.000

Worksheet #2: Monthly Merit Order Calculation

The 52 weekly merit orders[39] 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
1 744	Future HPs		Existing HPs There is an unchangeable pre-defined order for existing and future HPs - fro all the crediting period			Existing HPs Existing TPs should be placed according to grid dispatch merit order as well as Future TPs			Future HPs	

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 "28th position" =AK column). This order should hold for the first crediting period. Thermal plants should be sorted according to their calculated monthly merit order in the grid dispatch. Future hydropower plants (maximum 6) are reserved a columns to the very left of columns D to AK. Future thermal plants (maximum 12) 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.

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

Predefined order from left to right (D to AK) for all hydropower plants[40]

-6	hp1	HP1
-5	hp2	HP2
-4	hp3	HP3
-3	hp4	HP4
-2	hp5	HP5
-1	hp6	HP6
1	Hydro	CH Yuncan
2	Hydro	CH MANTARO
3	Hydro	CH RESTITUCION
4	Hydro	CH Huinco
5	Hydro	CH Matucana
6	Hydro	CH Yaupi
7	Hydro	CH Oroya-Pachac.
8	Hydro	CH Malpaso
9	Hydro	CH Cahua
10	Hydro	CH Pariac
11	Hydro	CH Arcata
12	Hydro	CH Gallito Ciego
13	Hydro	CH Callahuanca
14	Hydro	CH Moyopampa
15	Hydro	CH Huampaní
16	Hydro	CH Chimay
17	Hydro	CH Yanango
18	Hydro	CH Huanchor
19	Hydro	CH Carhuaquero
20	Hydro	CH ARICOTA
21	Hydro	CH CHARCANI
22	Hydro	CH CHARCANI
23	Hydro	CH CHARCANI
24	Hydro	CH MACHUPICCHU
25	Hydro	CH HERCA
26	Hydro	CH SAN GABAN
27	Hydro	CH CHARCANI
28	Hydro	CH Cañón del 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# April..

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.

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[40] 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

- 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 A4-4: Additions to the SEIN

Plant	Date	Technology	Installed Capacity Added (MW)	2005 total installed capacity	% of total installed capacity.	2005 total production in GWh	2005 Gen (GWh) of the new addition
Callahuanca	Dic-05	Hydro	5.374	80.43	7%	546.71	36.53
YUNCAN	Ago-05	Hydro	136.76	136.76	100%	250.48	250.48
Santa Rosa	Jun-05	Gas turbine Natural Gas	123.299	123.299	100%	403.51	403.51
Ventanilla	Ago-04	Gas turbine Natural Gas	315.32	315.32	100%	1861.37	1861.37
Cañon del Pato	Jun-04	Hydro	2.761	263.49	1%	1539.79	16.13
Yarinacocha	Mar-03	Diesel 2 / Residual	25.6	25.60	100%	72.45	72.45
Arcata	Abr-03	Hydro	5.278	5.28	100%	29.77	29.77
Huanchor	Nov-02	Hydro	19.6	19.60	100%	22.50	22.50
Cañon del Pato	Jun-02	Hydro	4.18	263.49	2%	1539.79	24.43
Machupichu	Oct-01	Hydro	85.8	85.80	100%	748.18	748.18
San Nicolas Cummins	Jun-01	Diesel 2 / Residual	1.25	1.25	100%	0.77	0.77
Tumbes	Jun-01	Diesel 2 / Residual	18.339	18.34	100%	50.58	50.58
Cañon del Pato	Jun-01	Hydro	9.968	263.49	4%	1539.79	58.25
Chimay	Oct-00	Hydro	150.9	150.90	100%	799.35	799.35
Ilo2	Ago-00	Steam Turbine / Coal	141.1	141.10	100%	830.88	830.88
San Gaban II	Feb-00	Hydro	113.1	113.10	100%	754.32	754.32
Yanango	Feb-00	Hydro	42.6	42.60	100%	177.57	177.57
Cañon del Pato	Nov-99	Hydro	92.682	263.49	35%	1539.79	541.62

Source: COES

Worksheet #16: Build MarginCalculation

Table A4--5: Selection of the sample group

BUILD MARGIN2 (BM2):

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
Dic-05	Callahuanca	Hydro	36.53	1	36.53	1	37
Ago-05	YUNCAN	Hydro	250.48	1	250.48	1	250
Jun-05	Santa Rosa	Gas turbine Natural Gas	403.51	1	403.51	1	404
Ago-04	Ventanilla	Gas turbine Natural Gas	1,861.37	1	1,861.37	1	1861
Jun-04	Cañon del Pato	Hydro	16.13	1	16.13	1	16
Mar-03	Yarinacocha	Diesel 2 / Residual	72.45	1	72.45		
Abr-03	Arcata	Hydro	29.77	1	29.77		
Nov-02	Huanchor	Hydro	22.50	1	22.50		
Jun-02	Cañon del Pato	Hydro	24.43	1	24.43		
Oct-01	Machupichu	Hydro	748.18	1	748.18		
Jun-01	San Nicolas Cummins	Diesel 2 / Residual	0.77	1	0.77		
Jun-01	Tumbes	Diesel 2 / Residual	50.58	1	50.58		
Jun-01	Cañon del Pato	Hydro	58.25	1	58.25		
Oct-00	Chimay	Hydro	799.35	1	799.35		
Ago-00	Ilo2	Steam Turbine / Coal	830.88	1	830.88		
Feb-00	San Gaban II	Hydro	754.32		-		
Feb-00	Yanango	Hydro	177.57		-		
Nov-99	Cañon del Pato	Hydro	541.62		-		
T/.			6,679	15	5,205	5	
					22.63%		2568
				SEIN Annual Gen=	23,001		
				20% of SEIN Gen=	4,600		

Most recent 20% units generation		5 Most recent units generation
5,205	>	2,568

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 0.41098 tCO_2/MWh for the year 2005.

Table A4-6: BM2 Calculation

Plant Name	Most Recent Year Gen (MWh)	% per plant	CO2 emission Factor tCO2/MWh
Callahuanca	37	0.70%	0.000
YUNCAN	250	4.81%	0.000
Santa Rosa	404	7.75%	0.641
Ventanilla	1,861	35.76%	0.600
Cañon del Pato	16	0.31%	0.000
Yarinacocha	72	1.39%	0.652
Arcata	30	0.57%	0.000
Huanchor	23	0.43%	0.000
Cañon del Pato	24	0.47%	0.000
Machupichu	748	14.37%	0.000
San Nicolas Cummins	1	0.01%	0.655
Tumbes	51	0.97%	0.637
Cañon del Pato	58	1.12%	0.000
Chimay	799	15.36%	0.000
Ilo2	831	15.96%	0.823
Total	**5,205**	**100%**	**0.41098 Weighted average emission factor**

BM2=	0.41098	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).

Project	MWh in the year
Poechos II	40,000.00

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

Project	MWh in the year*Combined Margin
Poechos II	22,770.89

DDA – OM = 0.72756

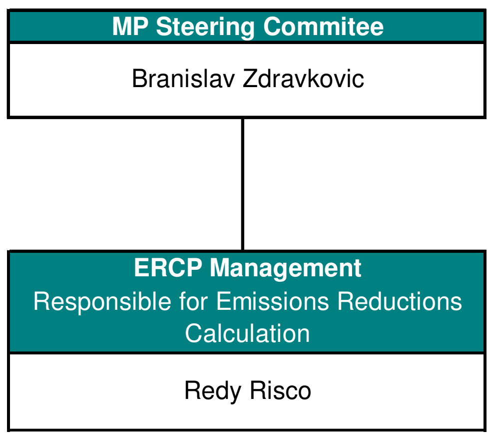
BM2 =	0.41098
CM =	0.56927

VI. Annexes

The ERCP Organizational Structure and Quality Assurance and Control Procedure

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

ERCP Organizational Structure



Monitoring Plan (MP) – Emissions Reductions Calculation Procedure

ERCP Quality Control

Operating 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*

Build Margin Calculation

Data

Operating Margin Calculation:

- The Project hourly generation data:
- *SEIN* units hourly generation data:
- Weekly Merit order for hours of maximum demand:
- Real NECs

Build Margin Calculation:

- *COES* most recent year operations statistics
- New units that enter the *SEIN* annually
- Real NECs

Quality of Data Collection

Operating Margin Calculation:

- 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*
- To whom does it comes? ERCP Manager

Build Margin Calculation:

- 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*
- To whom does it comes? ERCP Manager

Quality of Data Processing

Operating Margin Calculation:

- 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

Build Margin Calculation:

- 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