Project design document form
(Version 10.1)

Complete this form in accordance with the instructions attached at the end of this form.

BASIC INFORMATION	
Title of the project activity	Poechos II hydroelectric plant project
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the PDD	8
Completion date of the PDD	20/08/2017
Project participants	Sindicato Energético SA VERT CONSERVATION PTE LTD
Host Party	Peru
Applied methodologies and standardized baselines	Applied methodology: Version 17.0 of: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources
Sectoral scopes linked to the applied methodologies	Sectoral scope: Number: 1 Energy industries (renewable - / non-renewable sources).
Estimated amount of annual average GHG emission reductions	19,582 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The purpose of the Poechos II hydroelectric power plant (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 49,530 MWh per year. The Project is estimated to displace 19,582 tCO_2e per year, which accounts for 134,666 tCO_2e for the second 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).

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

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

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

The Project 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;
e) Contributing to Peru's fiscal accounts through the payment of taxes;
f) Helping Peru improve its hydrocarbon trade balance through reduction of oil imports to be used for electricity generation; and,
g) Improving local education and technical training opportunities, which have been committed to by SINERSA.

A.2. Location of project activity

The Project is located in the Northwestern Peruvian Department of Piura, in the Sullana Province, Lancones District, and in the town of Lancones. The Project site is 1,100 Km North from the city of Lima, 40 Km from the Sullana City, and 30 km from the Peruvian-Ecuadorian border. The plant is located within the property of the Poechos dam, built over the Chira River[1] 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. In decimal point the coordinates are: Latitude 4.691308. Longitude 80.50308

Picture of the Power Plant

A.3. Technologies/measures

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

The technology employed is based on conventional Kaplan turbines (2) and generators (2) that are widely used all over the world. The penstock of the powerhouse is connected to the existing steel pipe of the intake of the diversion channel. The penstock is bifurcated into two penstock pipes of 30 m³/s, with each leading to a powerhouse with two generating units each of 5 MW capacity. The generating units consist of two Kaplan turbines coupled to synchronous generators (3-phase) each of 5.4 MVA nominal capacity. The part of the powerhouse housing the main equipment is an underground reinforced concrete structure, with other equipment in an above ground steel structure. The water is discharged into a tailrace channel (capacity 60 m³/s) connected to the existing energy dissipater of the diversion channel and fed back into the 'Daniel Escobar' irrigation diversion channel. The control building contains the control room, offices and auxiliary installations. The control room is equipped with a modern system for automatic and remote control (SCADA). Poechos II is connected to Poechos I through a transmission line of 10kV, of 1 km length. The power plant is connected to the national grid through an existing 60 kV overhead

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

transmission line. The transmission line is connected to the existing Sullana substation. The expected load factor is estimated in 57% according to historic energy production of the first crediting period of the plant. The Average lifetime of the equipment based on manufacturer's specifications and industry standards is 50 years. The efficiency is 90%. Peruvian technician of the plant have been trained by technology suppliers in how to operate and maintain the technology adequately.

GENERATION EQUIPMENT

TECHNICAL DATA - SUMMARY

Turbines

	DESCRIPTION	TURBINE 1	TURBINE 2
	Manufacturer	CKD	CKD
A	Type	Kaplan,Tipo S	Kaplan,Tipo S
B	Installed Power [MW]	5	5
C	Number of blades	18	18
D	Arrangement	Horizontal	Horizontal
F	Nominal speed [rpm]	275	275
G	Minimum discharge [m3/s]	15	15
H	Maximum discharge [m3/s]	30	30
I	Velocity for increase power [MW/min]	1	1
J	Velocity for decrease power [MW/min]	1	1
K	Minimum Power [MW]	2.5	2.5
L	Suspended solids limitations	no	no

Generators

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

A.4. Parties and project participants

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

A.5. Public funding of project activity

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

A.6. History of project activity

The proposed CDM project activity is neither registered as a CDM project activity nor included as a component project activity (CPA) in a registered CDM programme of activities (PoA).

This PDD corresponds to the second crediting period of the project activity.

A.7. Debundling

Not applicable

SECTION B. Application of selected methodologies and standardized baselines

B.1. Reference to methodologies and standardized baselines

According to the “Procedures for renewal of the crediting period of a registered CDM project activity”, (version 06.0, EB 63), paragraph 2(a), the latest approved version of a baseline and monitoring methodology, applied in the original CDM-PDD of the registered CDM project activity, shall be used whenever applicable.

In this case, Approved consolidated baseline and monitoring methodology ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” Version 17.0 is applied for this project.

This methodology also refers to the latest approved version of the following tools:

- Tool for the demonstration and assessment of additionality.
- Combined tool to identify the baseline scenario and demonstrate additionality.
- Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.
- Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation.
- Tool to calculate the emission factor for an electricity system.
- Tool to determine the remaining lifetime of equipment.
- Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.

However, the PDD for this renewal period uses only the following tools as it is explained in section B.2 of this PDD.

- Tool to calculate the emission factor for an electricity system (version 05.0).
- Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (Version 03.0.1.)

More information on the methodology and methodological tools listed above is available at the following website: https://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

B.2. Applicability of methodologies and standardized baselines

This Project satisfies the applicable conditions of ACM0002 because it is a grid-connected renewable generation project activity that installed a new power plant at a site where no renewable power plant was operated prior to the implementation of the Project activity (Green-field plant). The applicability conditions are described in the table below:

Table 2: Applicability Assessment of methodologies, standardized baselines and Tools

Applicability of ACM0002 (version 17.0)	
Description of ACM0002	**The Proposed Project**
This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	Applicable. • The proposed project activity was the installation of a Greenfield power plant.
The methodology is applicable under the following conditions: (a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; (b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	• Applicable. The proposed project activity was the installation of a hydro power plant .
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4),	Applicable. • The proposed project activity was implemented in existing single reservoir with no change in the volume of the reservoir.

is greater than 4 W/m2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	
In the case of integrated hydro power projects, project proponent shall: • Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or • Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	Not applicable. • The proposed project activity is not an integrated hydro power project.
The methodology is not applicable to: (e) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (f) Biomass fired power plants/units.	Not applicable. • The proposed project does not involve switching from fossil fuels to renewable energy sources at the site of the project activity. • The proposed project is not a biomass fired power plant
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.	Not applicable. • The proposed project does not involve switching from fossil fuels to renewable energy sources at the site of the project activity retrofits, rehabilitations, replacements, or capacity additions .
Therefore, the baseline methodology ACM0002 is applicable to the project activity.	
Applicability of tools referred in baseline methodology ACM0002 (version 17.0)	
Applicability of Tool for the demonstration and assessment of additionality (Version 07.0.0).	**The Proposed Project**
This tool was applied in the first crediting period. For the Renewal of the Crediting Period, according to the Procedures for renewal of the crediting period of a registered CDM project activity (version 06.0), it is not necessary a reassessment the additionality of the project but rather an assessment of the emissions which would have resulted from the baseline. Moreover, Project participants shall update only those sections of the project design document (CDM-PDD) relating to the baseline, estimated emission reductions and the monitoring plan.	Not Applicable. • The proposed project activity is applying for renewal of the crediting period and the additionality does not required a reassessment.
Applicability of Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0).	**The Proposed Project**
This tool was never applied in the project as it was selected the Tool for the demonstration and assessment	Not applicable.

of additionality in the first crediting period. In any case, as explained above, it is not necessary a reassessment the additionality for the Renewal of the Crediting Period.	• The proposed project activity is applying for renewal of the crediting period and the additionality does not required a reassessment. Even in the first crediting period of the project, this tool was not used as the Tool for the demonstration and assessment of additionality was selected.
Applicability of Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (Version 03.0).	**The Proposed Project**
This tool provides procedures to calculate project and/or leakage CO2 emissions from the combustion of fossil fuels. As the project does not use fossil fuels, this tool was not used.	Not applicable. • The proposed project activity does not use fossil fuels.
Applicability of Tool for Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0).	**The Proposed Project**
As the proposed project activity doesn't has project and/or leakage emissions, and the baseline emissions is estimated using the Tool to calculate the emission factor for an electricity system to estimate the baseline, this tool is not used.	Not applicable. The proposed project activity doesn't has project and/or leakage emissions and the baseline emission is estimated using other tool.
Applicability of Tool to calculate the emission factor for an electricity system (Version 05.0).	**The Proposed Project**
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power Plants. The proposed Project activity supplies electricity to a grid, so this tool is applicable.	Applicable.
Applicability of Tool to determine the remaining lifetime of equipment (Version 01).	**The Proposed Project**
As the project never involved the replacement of existing equipment with new equipment or retrofit of existing equipment, this tool is not applicable.	Not Applicable.
Applicability of Tool Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (Version 03.0.1)	**The Proposed Project**
According to the Procedures for renewal of the crediting period of a registered CDM project activity (version 06.0), which is it the case of this project activity, the Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period shall be used for the assessment of continued validity of the original baseline and its update.	Applicable.

B.3. Project boundary, sources and greenhouse gases (GHGs)

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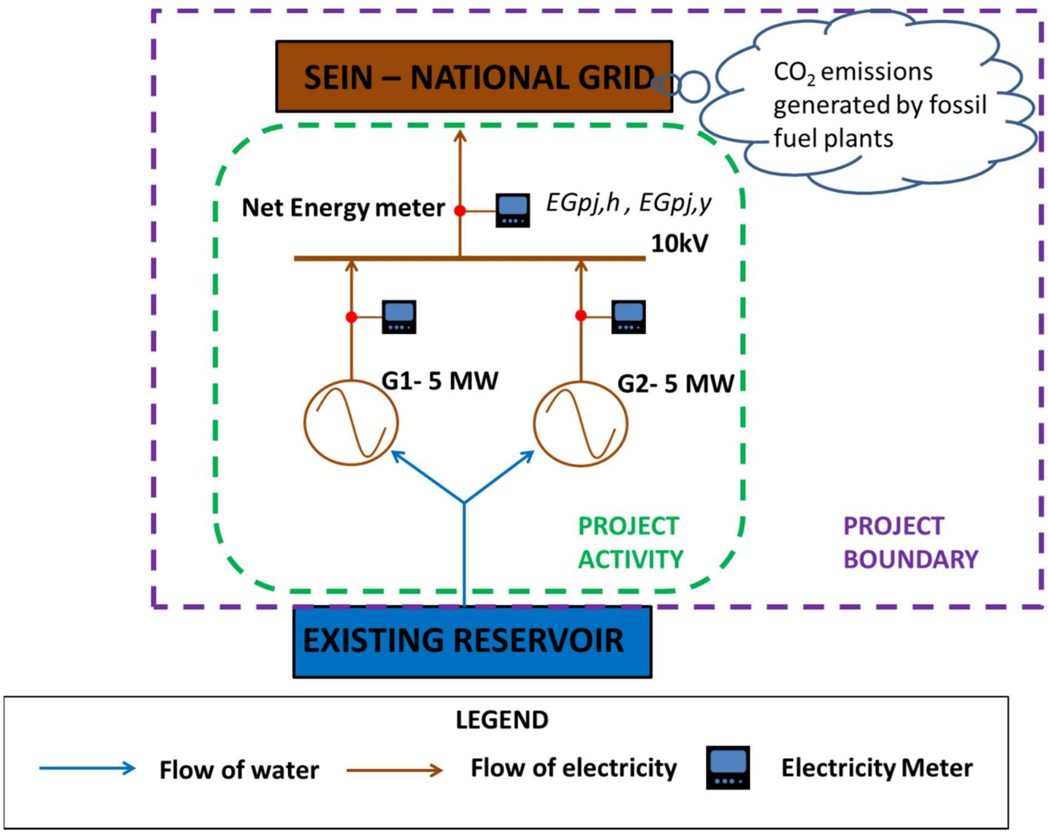
Source		GHG	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Main emission source
		CH_4	No	In the case of this project, the reservoir has not increased therefore no CH_4 emissions would occur.
		N_2O	No	Minor emission source

The flow diagram of the project boundary is illustrated below

Figure1: Flow diagram of the project boundary



B.4. Establishment and description of baseline scenario

According to the "**Procedures for renewal of the crediting period of a registered CDM project activity**, (version 06, EB 63), paragraph 1, it has been used the "Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period" (Version 03.0.1.)to assess validity of the original baseline and its update.

The tool consists of two steps. The first step provides an approach to evaluate whether the current baseline is still valid for the next crediting period without need to evaluate the baseline scenario. The second step provides an approach to update the baseline in case that the current baseline is not valid anymore for the next crediting period.

Given that the project activity was the installation of a new grid-connected renewable power plant/unit, the *baseline scenario* is the following:

According to the baseline methodology ACM0002 version 17.0 for a greenfield project as this one, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system" which is last version is 05.0.

In accordance with this tool, the baseline emission factor is calculated using the combined margin ($EF_{grid,CM,y}$) method, which consists of the weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$). All margins are expressed in tCO_2/MWh. The formula is as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

The Weightings of operating margin emissions factor (w_{OM}) and build margin emissions factor (w_{BM}) would change for this second crediting period to w_{OM} = 0.25 and w_{BM} = 0.75 margin emissions factor (in the first crediting period was w_{OM} = 0.5 and w_{BM} = 0.5)

According to the tool, $EF_{grid,CM,y}$ can be used to calculate GHG emissions expressed in tCO_2/MWh that would have been generated 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.

As per paragraph 3 of the procedures for renewal of the crediting period of a registered CDM project activity, it does not require a reassessment of the baseline scenario and hence the above mentioned baseline scenario is still applicable for the project activity for the second crediting period.

<u>Application of the Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period</u>

Step 1: Assess the validity of the current baseline for the next crediting period

The "Procedures for the renewal of the crediting period of a registered CDM project activity" approved by the CDM Executive Board require assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps:

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

As explained in the original PDD, the baseline, and the alternatives to the project, continue to be ruled by the Electric Concession law – ECL (law 25844) released in 1992. This law regulates all activities related to the generation, transmission and distribution of electric energy.

Following the issuance of this law, state-owned enterprises were privatized and investments in new power generation plants and transmission systems became 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 the state, the distribution companies or consumers do have any participation. COES is responsible for the coordination of the National Grid (It is called SEIN that is the abbreviation of Sistema Electrico Interconectado Nacional) system operation at minimum cost, guaranteeing the security of the electric power supply and the best use of energy resources. The new regulatory model proposes private initiatives of new investment in power generation.

Electric Concession Law (ECL) is still in force and its relevant articles cited in the original PDD remain the same with a few minor changes, e.g., related to EIA requirements, that do not affect the baseline.

The chart below provides an analysis of the articles under the ECL:

Electric Concession Law – ECL Selected articles and analysis

	Description in the first crediting period PDD	Changes after the submission of the first crediting period PDD	Comments
Article 1	Electricity generating activities can be developed by natural or juridical persons, whether they are national or foreigners. The juridical persons (private companies) should be incorporated under Peruvian laws;	None	
Article 3	A Concession is required for the development of hydro power plants (or geothermic plants13) if their installed capacity is greater than 10 MW	Now all renewable projects with installed capacity greater than 500 KW required a concession	Concession is required for projects that take advantage of public goods as renewable resources. The impact over the baseline is neutral since the changes have relaxed the same requisites for thermal and hydro projects. Before these changes, both thermal and hydro projects, need and environmental Impact Assessment if the power capacity was greater than 10 MW, now it has to be greater than 20 MW (See article 25). In addition, the change does not affect the baseline since the changes were issued in year 2008 and are not retroactive. Besides these changes would not prevent the alternatives presented in the original PDD.
Article 4	An Authorization is required to develop fossil-fuel thermal plants if their installed capacity is greater than 500 KW, and hydropower plants and geothermic plants if their installed capacity is less than or equal to 10 MW	Fossil-fuel thermal plants with installed capacity greater than 500 KW still required authorization. Hydropower plants and geothermic plants have been erased from this article due to the change in article 3.	
Article 6	The Concessions and Authorizations can be granted by the MINEM, who would establish for that a Registration of the Electric Concessions.	None	
Article 7	Electricity generating activities that do not required Concession or Authorization could be developed freely upon compliance with technical norms and dispositions of environmental conservation and Cultural Patrimony conservation - the owner of the title of these activities should inform the MINEM the initiation of activities and the technical characteristics of the project and installations.	None	
Article 9	The Peruvian Government preserve the environmental conservation and the Cultural Patrimony of the Nation, as well as the rational use of the natural resources in the development of activities related to generation, transmission and distribution of electricity	None	

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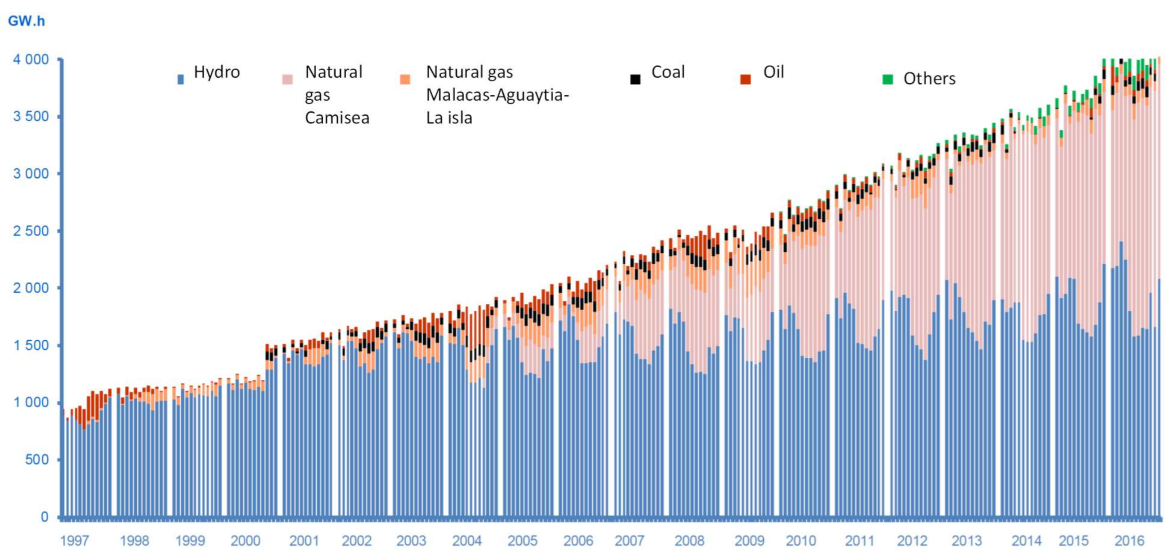
Regarding the policies and circumstances that promote the support of the realistic and credible alternative of natural gas power plants have been effective and confirmed. The natural gas of

Camisea has been operational since August 2004 and most of the new additions have been natural gas thermal plants.

The table below shows the new power capacity to the SEIN since 1997. It is clear that since year 2004, the year in which the Camisea natural gas project was commissioned, the new additions to the grid has been dominated by Natural Gas Thermal Plants.

Evolution of Energy Generation per type of energy in the SEIN in GWh. 1997 - 2016



Source: COES. Annual Operating Statistics of the Peruvian National Grid 2016. Figure 5.6 A

Therefore, the project baseline on the second crediting period remains the same. This baseline is the most plausible and it doesn't need to be actualized

Since the current baseline complies with all relevant mandatory national and/or sectoral policies which have come into effect after the submission of the project activity for validation and are applicable at the time of requesting the renewal of the crediting period, go to Step 1.2.

Step 1.2: Assess the impact of circumstances

As seen previously, the baseline is in compliance with the law and actual circumstances ensure the continuity of the baseline i.e. generation of power from grid mix.

It is important to mention that after the submission of the PDD of the first crediting period, a law for the promotion of renewable energy was issued in May 2008. This law allows renewable projects under 20 MW of power capacity built after the issuance of this law, to apply to a special tariff through bidding. The first bidding was made in February 2010 and 161.71 MW of power capacity were awarded to 17 hydro power plants. Some of these power plants have entered in operation after May 2008 and other have to be built before

year 2012. The impact in the baseline is small relatively to the size of the national grid[2] even considering the objective of the government to reach 500 MW of power capacity through this law until year 2012.

Since this first bidding was launched in February 2010, close to one year after the commission of Poechos II, the project did not consider any of its incentives during its construction stage and commercial operation.

There is sufficient market information to calculate the parameters needed to update the baseline.

Any changes to circumstances that affect the grid mix are reflected in the grid emission factor and hence the baseline emission.

The plant still has the same technical characteristics and energy sources and its energy production has been sold to the grid These circumstances continue during the second crediting period.

Financing from the Clean Development Mechanism, sale of CERs, as was mentioned in the original PDD has been alleviating financial constraints faced by the project and the continued availability of CER revenue the impact of the CDM over the project performance and social investments is expected to be strengthened in the second crediting period.

Therefore, based on the "Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period", continued validity of the original baseline is established for the second crediting period.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) is technically possible

The project activity involves a hydro power plant where in the absence of the project activity, the project participants would not have constructed the plant but where the electricity would have been generated in other existing plants and/or in new plants constructed by third parties elsewhere. At the beginning of the first crediting period, it was stated in the PDD that the expected minimum plant operating life is 40 years. After 7 years, it can be established that the remaining technical lifetime of the equipment is still beyond the end of the second crediting period (7 years) for which renewal is requested. Therefore, it is established that the continuation of the current baseline equipment is technically possible.

Step 1.4: Assessment of the validity of the data and parameters

The IPCC 1996 defaults value used for emission factor calculations were determined at the start of the crediting period and not monitored during the first crediting period. IPCC released new Guidelines for National Greenhouse Gas Inventories in 2006. Default values are still the same however the Tool to calculate the emission factor for an electricity system asks to use IPCC default values at the lower limit of the uncertainty at a 95% confidence interval. The IPCC default values have been updated accordingly for the second crediting period.

Step 2 "Update the current baseline and the data and parameters" .
Step 2.1: Update the current baseline

[2] According to COES annual statistics 2009, in year 2009 the power effective capacity of the national grid was 5,848 MW which 48.88% is hydro and the remaining 51.12% is thermal.

By applying steps 1.1, 1.2 and 1.3 of the Tool, it has been confirmed that the current baseline continues to be valid for the second crediting period.

Step 2.2: Update the data and parameters
Step 1.4 showed that IPCC default values have to be updated in the current baseline. In the current PDD the IPCC default values have been updated accordingly following the guidance in Step 1.4.

According to the "Procedures for renewal of the crediting period of a registered CDM project activity", it is necessary to update the original CDM-PDD with the latest approved version of a baseline and monitoring methodology applied.

In this case, the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version 17.0 is applied. This methodology also refers to the latest approved version of the following tool: "Tool to calculate the emission factor for an electricity system (version 05.0.)" which defines the baseline emission factor for the project activity and has been applied accordingly.

B.5. Demonstration of additionality

As per paragraph 2 of the procedures for renewal of the crediting period of a registered CDM project activity, for the preparation of a revised PDD "Project participants shall update those sections of the project design document (CDM PDD) relating to the baseline, estimated emission reductions and the monitoring plan using an approved baseline and monitoring methodology"; therefore section B.5 on assessment and demonstration of additionality remains to be the same as that for the registered PDD.

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 plants5) 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;
f) 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.[3]

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

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.

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[4]), 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	

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

[4] 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

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[5]. 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%%[6]. 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.

(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[7] 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.

[5] 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."

[6] 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%.

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

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[8]. 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[9]. No hydropower generation concessions were granted in 1999[10], demonstrating that the impact of this sectoral policy shift has 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[11], DS 041-2004-EM on November 24, 2004[12]; and DS 107-2004-EF on August 5, 2004[13]; 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

[8] "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.

[9](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.

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

[11] 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.

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

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

government has also issued several decrees[14] 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[15], 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[16], but also with a much cheaper fuel, natural gas, which is increasingly available locally.

According to MINEM[17], 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.

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[18], 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.[19] 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.

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[14] 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.

[15] 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

[16] 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.

[17] 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

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

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

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:

- 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[20] 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 electricity production was 40% lower than the expected average.[21] 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[22].

(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

[20] 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

[21] Source: The project sponsor.

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

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[23] 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.

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

[23] Pluspetrol and Aguaytia

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[24]. 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.

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

B.6. Estimation of emission reductions

B.6.1. Explanation of methodological choices

According to the “Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period”, data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period should be updated.
As is seen as follows, the application of steps 1.1, 1.2 and 1.4 of the Tool, confirmed that the baseline, data and parameters can be used for the renewal crediting period.

Emissions reductions are calculated according to the Approved consolidated baseline and monitoring methodology ACM0002 *“Consolidated baseline methodology for grid-connected electricity generation from renewable sources”*, version 17.0, as follow:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2e/yr)
BE_y	=	Baseline emissions in year *y* (t CO_2/yr)
PE_y	=	Project emissions in year *y* (t CO_2e/yr)

Project Emissions (PEy)

For most renewable power generation project activities, $PE_y = 0$. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

For the hydropower project activity, the value of $PE_{FF,y}$ and $PE_{GP,y}$ are zero. As this project did not result in new single or multiple reservoirs nor increase of single or multiple existing reservoirs, $PE_{HP,y}$ is also zero.

Baseline emissions (BEy)

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

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

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

As the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y}$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Calculation of $EF_{grid,CM,y}$

The Baseline emission factor is calculated as a combined margin ($EF_{grid,CM,y}$) , following the guidance in the "Tool to calculate the emission factor for an electricity system" (Version 05.0). According to the Tool, the baseline emission factor is calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$) where the weights W_{OM} and W_{BM}, by default for the second crediting period , are W_{OM} = 25% and W_{BM} = 0.75%). This is presented below:

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

Step 1: Identify the relevant electricity systems.

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

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

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

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

Step 6: Calculate the combined margin (CM) emissions factor

Step 1: Identify the relevant electricity systems

Poechos II is connected to the SEIN through the Sullana Substation, which belongs to Electronoroeste S.A. (ENOSA), a state-owned enterprise, using a 60 kV transmission line of 34 km from Poechos I to Sullana, which was already constructed for Poechos I and is the property of Sindicato Energetico SA (SINERSA). The project is connected to Poechos I through a 10 kV transmission line of 1 km.

Electricity imports from other grids have not been reported, either by the SEIN or the MINEM. Even if there were imports, for the purpose of determining the OM emission factor, the assumed emission factor for net electricity imports is 0.

Electricity exports to other grids have reported by the SEIN ; therefore, exports should not be subtracted from electricity generation data used in calculating and monitoring the electricity emission factors.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Since project participants considered only grid power plants for the calculation of the operating margin and build margin emission factor, option 1 is selected.

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

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

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

Out of four options for the OM, the *Dispatch Data Analysis OM* (option c) was selected. The Simple OM method cannot be used since low cost, must-run resources constitute more than 50 % of total grid generation in Peru. Also, it was not necessary to use either the Simple Adjusted OM approach or the Average OM approach because detailed dispatch data is available.

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

The dispatch data analysis OM emission factor ($EF_{grid,OM-DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour h where the project is displacing grid electricity. This approach is not applicable to historical data and, thus, requires annual monitoring of $EF_{grid,OM-DD,y}$.

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

$$EF_{grid,OM-DD,y} = \frac{\sum_{h} EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where,

$EF_{grid,OM-DD,y}$	**=**	Dispatch data analysis operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{PJ,h}$	**=**	Electricity displaced by the project activity in hour *h* of year *y* (MWh)
$EF_{EL,DD,h}$	**=**	CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh)
$EG_{PJ,y}$	=	Total electricity displaced by the project activity in year *y* (MWh)
h	=	Hours in year *y* in which the project activity is displacing grid electricity
y	=	Year in which the project activity is displacing grid electricity

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

$$EF_{EL,DD,h} = \frac{\sum_{n} EG_{n,h} \cdot EF_{EL,n,y}}{\sum_{n} EG_{n,h}}$$

Where:

$EF_{EL,DD,h}$	=	CO_2 emission factor for grid power units in the top of the dispatch order in hour *h* in year *y* (tCO_2/MWh)
$EG_{n,h}$	=	Net quantity of electricity generated and delivered to the grid by grid power unit n in hour *h* (MWh)
$EF_{EL,n,y}$	=	CO_2 emission factor of grid power unit *n* in year *y* (tCO_2/MWh)
n	=	Grid Power units in the top of the dispatch. At each hour, *h*, stack each grid power unit's generation using the merit order. The group of power units n in the dispatch margin includes the units in the top x% of total electricity dispatched in the hour h, where x% is equal to the greater of either: (a) 10%; or (b) The quantity of electricity displaced by the project activity during hour h divided by the total electricity generation by the grid power plants during that hour *h*.
h	=	Hours in year y in which the project activity is displacing grid electricity

The CO_2 emission factor of the grid power units n ($EF_{EL,n,y}$) is determined as per the guidance for the simple OM, using the option A2: if for a power unit m only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (t CO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All power units serving the grid in year y except low-cost/must-run power Units
y	=	applicable year during monitoring (*ex-post* option)

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

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

In terms of vintage of data, project participants have chosen Option 2**:** For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1[25]. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

According to the *Tool*, the sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

   Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).

Otherwise:

d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

   If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

e) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

[25] Option 1 - calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation

f) The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample-CDM}$->10yrs).

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which electricity generation data is available, calculated as follows:

$$EF_{grid\ BMy} = [\Sigma m\ EG_{,m,y},\ x\ EF_{EL,m,y}] / [\Sigma m\ _{EGmy}]$$

Where:

$EF_{grid,BM,y}$	= Build margin CO2 emission factor in year, *y* (tCO_2/MWh)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit m in year, *y* (MWh)
$EF_{EL,m,y}$	= CO2 emission factor of power unit m in year, *y* (tCO_2/MWh)
m	= Power units included in the build margin
y	= Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM, using option,A2, using for *y* the most recent historical year for which electricity generation data is available, and using for *m* the power units included in the build margin.

If the power units included in the build margin *m* correspond to the sample group SETsample-CDM->10yrs, then, as a conservative approach, only option A2 from guidance in Step 4 (a) can be used and the default values provided in Annex 1 of the Tool to Calculate the Emission Factor for an Electricity System (version 05.0) shall be used to determine the parameter ηm,y.

Step 6: Calculate the combined margin (CM) emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option a) has been selected. The combined margin emission factor is calculated as follows:

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

Where:

$EF_{grid,BM,y}$	= Build margin CO2 emission factor in year, *y* (tCO_2/MWh)
$EF_{\ grid,OM,y}$	= Operating margin CO2emission factor in year, *y* (tCO_2/MWh)
W_{OM}	= Weighting of operating margin emissions factor (%)
W_{BM}	= Weighting of build margin emissions factor (%)

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

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

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**PE_y**
Unit	tCO_2
Description	GHG emissions produced by the project activity
Source of data	N/A (as suggested in The Methodology)
Value(s) applied	0
Choice of data or Measurement methods and procedures	The Project does not lead to any GHG emissions. Hydropower plants 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.
Purpose of data	Calculation of project emissions
Additional comment	-

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

Data / Parameter:	**$EG_{m,y}$**
Unit	MWh
Description	Net electricity generated and delivered to the grid by power plant / unit m in year *y*
Source of data	COES data from 2015 http://www.coes.org.pe
Value(s) applied	The value is in workbook (WS-1) BM of the spreadsheet Poechos II BM 2015.xls
Choice of data or Measurement methods and procedures	According to the "Tool to Calculate the Emission Factor for an Electricity System" (Version 05.0), for ex ante validation calculation, the latest publicly available information is used, which is the COES annual statistics of 2015. Directly measured based on the information provided by COES.
Purpose of data	Baseline emission calculation
Any comment:	Monitoring frequency: BM: For the second crediting period only once ex-ante . For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

Data / Parameter:	**ηm,y**
Unit	-
Description	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data	Data from the dispatch centre, COES Annual statistics http://www.coes.org.pe/wcoes/coes/estadistica/estadanual.aspx.

Value(s) applied	Net Energy Conversion Efficiencies (NECs) for all thermal plants are available in the annual statistics of COES. For the *ex-ante* calculation, the latest publicly available information is used, which is the COES annual statistics of 2015.
Choice of data or Measurement methods and procedures	According to the "Tool to Calculate the Emission Factor for an Electricity System" (Version 05.0), for ex ante validation calculation, the latest publicly available information is used, which is the COES annual statistics of 2015.
Purpose of data	Baseline emission calculation
Any comment	In the first monitoring report, the latest publicly available annual report of COES is used. This information will be monitored once during the crediting period. The data from COES is reliable since efficiency is calculated according to the COES procedure Number 17 for the determination of effective power and efficiency of thermal power plants. (http://www.coes.org.pe/coes/Procedimientos/procedimiento_n17.pdf). This procedure established that the efficiency of the plants have to be calculated according to international standards. For diesel engines ISO-3046-1 or its updated versions, for gas turbines: section 8 of ISO 2314: 1989 or its updated versions, for steam turbines: DIN1943, Sections 6 to 8, February 1975, or it updated version. Etc. These calculations and measurements is performed by COES accredited consultants and the result are reviewed and supervised by COES experts.

Data / Parameter:	**EFCO2,i,y and EFCO2,m,i,y**
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type i used in power unit m in year y
Source of data	The following data sources may be used if the relevant conditions apply: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	IPCC default values: Diesel Oil = 72,600 kg/TJ Residual Fuel Oil = 75 500 kg/TJ Natural Gas = 54,300 kg/TJ Coal = 87,300 kg/TJ Landfill = 46,200 kg/TJ
Choice of data or Measurement methods and procedures	As there are not local data regarding emission factors, IPCC default values are used.
Purpose of data	Baseline emission calculation
Any comment	Monitored for the second crediting period, only once ex -ante, following the guidance included in Step 5 of the "Tool to calculate the emission factor for an electricity system". For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

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

Description	Build margin CO_2 emission factor in year y (tCO_2/MWh) calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data	Calculated based in COES annual statistics. The last one was published in year 2015. The calculation is in spreadsheet "Poechos II BM 2015.xls"
Value(s) applied	0.35520tCO_2/MWh
Choice of data or Measurement methods and procedures	The build margin emission factor is calculated ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. Steps necessary to find the Build margin CO_2 emission factor are found in the "Tool to calculate the emission factor for an electricity system"
Purpose of data	Baseline emission calculation
Any comment	Monitored for the second crediting period, only once ex -ante, following the guidance included in Step 5 of the "Tool to calculate the emission factor for an electricity system". For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

B.6.3. Ex ante calculation of emission reductions

Project Emissions

Project emissions shall be accounted by using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

Since the projects neither consume fossil fuel nor it is a geothermal power plant and does not has reservoir → $PE_{FF,y} = 0$ and $PE_{GP,y} = 0 = PE_{HP,y} = 0$

Thus, projects emissions are considered equal to zero, $PE_y = 0$.

Baseline emissions

The baseline emission factor was calculated prior to Validation in a transparent and conservative manner as a combined margin (CM) consisting of the average of the operating margin (OM) and the build margin (BM), according to the procedures prescribed in the *Tool to calculate the emission factor for an electricity system, Version 05.0.*

Since the Project itself does not lead to any GHG emissions and no leakage[26] was factored into the calculation of estimated ERs, the baseline emissions were estimated to be equal to the Project ERs

Combined Margin Calculation

Step 1: Identify the relevant electricity systems

Poechos II is connected to the SEIN through the Sullana Substation, which belongs to Electronoroeste S.A. (ENOSA), a state-owned enterprise, using a 60 kV transmission line of 34 km from Poechos I to Sullana, which was already constructed for Poechos I and is the property of Sindicato Energetico SA (SINERSA). The project is connected to Poechos I through a 10 kV transmission line of 1 km.

Electricity imports from other grids have not been reported, either by the SEIN or the MINEM. Even if there were imports, for the purpose of determining the OM emission factor, the assumed emission factor for net electricity imports is 0.

Electricity exports to other grids have reported by the SEIN ; therefore, exports should not be subtracted from electricity generation data used in calculating and monitoring the electricity emission factors.

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

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Since project participants considered only grid power plants for the calculation of the operating margin and build margin emission factor, Option I is selected.

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

Out of the four options for the OM, the Dispatch Data Analysis OM was selected because detailed dispatch data is available.

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

For this calculation, the hourly generation in 2015 have been used, which was the most recent data available. At the time the Project's Baseline Study was completed, the hourly generation data did not yet exist for one entire year for the second crediting period. Therefore, it was assumed that the Project operated at 56.54% capacity, which was the annual average load factor of the first crediting of the Project, and dispatched equally during all hours of the year. Considering this assumption, the variables were defined as follows:

- EGPJ,y: An "approximation" of the total electricity generated by the Project in year y.
- EGPJ,h : An "approximation" of the total electricity generated by the Project in each hour of 2015. It was assumed the Project generated at 56.54% of its full installed capacity of 10 MW in each hour.

The following chart shows the $EF_{EL,n,y}$ of all thermal units in the SEIN. Each emission factor has been calculated as per the guidance for the simple OM, using option A2.

[26] Since the energy generating equipment is new and is not replacing any existing facility, the Project does not produce leakage.

[24]Source: COES (2010) Annual Statistics. p 72

The average net energy conversion efficiencies of thermal plants connect to the grid have been taken from the latest publicly available information, which is the COES annual statistics of 2015. The information is located in chart number 4.7.

Thermal Plants Emission Factors 2015

Thermal Plants (1)	Thermal Plants (2)	Technology (3)	Fuel	nm,y Real NECs (4)	$EFCO_2$ $KgCO_2/Tj$ (5)	CO_2 Emissions Factor (tCO_2/MWh)
LAGRINGAV-BIOGAS	CT LA GRINGA	Biogas Thermal Plant	Biogas	29.70%	46,200	0.56000
PARAMONGA - BAGAZO	CT AGRO INDUSTRIAL PARAMONGA	Cogeneration Bagase/ Diesel	Bagase	8.30%	0.00000	0.00000
MAPLE- BAGAZO	CT MAPLE ETANOL	Cogeneration Bagase/ Diesel	Bagase	16.00%	0.00000	0.00000
HUAYCOLORO - BIOGAS	CT HUAYCOLORO	Biogas Thermal Plant	Biogas	30.60%	46,200	0.54353
OQUENDO TG1 -GAS	CT OQUENDO	Gas Turbine Natural Gas	Natural Gas	33.00%	54,300	0.59236
AGUAYTIA TG1-GAS	CT AGUAYTIA TG1,2	Gas Turbine Natural Gas	Natural Gas	31.40%	54,300	0.62255
BELLAVISTA ALCO - D2	CT BELLAVISTA_1 (A_D)	Diesel 2 / Residual	Diesel 2	26.70%	72,600	0.97888
CHILCA 1 TG1-GAS	CT CHILCA 1 TG1	Gas Turbine Natural Gas	Natural Gas	35.50%	54,300	0.55065
CHILCA 1 TG2 -GAS	CT CHILCA 1 TG2	Gas Turbine Natural Gas	Natural Gas	35.70%	54,300	0.54756
CHILCA 1 TG3 -GAS	CT CHILCA 1 TG3	Gas Turbine Natural Gas	Natural Gas	34.20%	54,300	0.57158
CICLO COMBINADO-D2	CT CHILINA VAPOR CC TV1,2,3 TG	Combined Cycle Gas-Steam	Diesel 2	29.40%	72,600	0.88898
CHILINA SULZ 12-R500 D2	CT CHILINA DIESEL SULZ1,2	Diesel 2 / Residual	Diesel 2	37.10%	72,600	0.70447
DOLORES (GM123 ALC 12)-D2	CT DOLORESPATA	Diesel 2 / Residual	Diesel 2	34.60%	72,600	0.75538
ILO1 CATKATO-D2	CT ILO 1 CATKATO TG1,2 TV1,2,3,4	Diesel 2 / Residual	Diesel 2	38.70%	72,600	0.67535
ILO 2 TV1 -CARB	CT ILO 2 TV1	Steam Turbine / Coal	Coal	37.60%	87,300	0.83585
MALACAS2 TG 4 - D2	CT MALACAS TG1,2,3 TGN4	Gas Turbine Natural Gas	Natural Gas	30.80%	54,300	0.63468
MOLLENDO 123 - D2	CT MOLLENDO DIESEL GD1,2,3	Diesel 2 / Residual	Diesel 2	38.70%	72,600	0.67535
LFLORES TG1 GAS	CT LAS FLORES	Gas Turbine Natural Gas	Natural Gas	36.50%	54,300	0.53556
OLLEROS TG1-GAS	CT OLLEROS TG1	Gas Turbine Natural Gas	Natural Gas	36.60%	54,300	0.53410
PISCO TG2 GAS	CT PISCO TG1,2	Gas Turbine Natural Gas	Natural Gas	27.40%	54,300	0.71343
INDEPENDENCIA GAS	CT INDEPENDENCIA WAR 1,2,3	Diesel Generator/Natural Gas	Natural Gas	40.40%	54,300	0.48386
SANTA ROSA UTI6-D2	CT STA ROSA UTI5,6	Gas Turbine Natural Gas	Natural Gas	30.00%	54,300	0.65160
STAROSA TG8 GAS	CT STA ROSA WEST TG 7,8	Gas Turbine Natural Gas	Natural Gas	35.40%	54,300	0.55220
SAN NICOLAS CUMMINS-D2	CT SAN NICOLAS CUMINS TV1,2, 3	Diesel 2 / Residual	Diesel 2	34.30%	72,600	0.76198
TAPARACHI-D2	CT TAPARACHI	Diesel 2 / Residual	Diesel 2	35.20%	72,600	0.74250
TABLAZO TG1 - GAS	CT TABLAZO TG1	Gas Turbine Natural Gas	Natural Gas	26.40%	54,300	0.74045
CHILCA1 CCOMB TG1 & TG2 &TG3 - GAS	CT CHILCA 1 TV	Combined Cycle	Natural Gas	52.80%	54,300	0.37023
TUMBES-R6	CT TUMBES MAK 1,2	Diesel 2 / Residual	Residual 6	39.30%	75,500	0.69160
VENTANILLA CCOMB TG 4 - GAS	CT VENTANILLA TV	Combined Cycle	Natural Gas	55.20%	54,300	0.35413
VENTANILLA TG 4- GAS	VENTANILLA TG 4- GAS	Gas Turbine Natural Gas	Natural Gas	37.20%	54,300	0.52548
VENTANILLA TG 3- GAS	VENTANILLA TG 3- GAS	Gas Turbine Natural Gas	Natural Gas	35.90%	54,300	0.54451
KALLPA TG1-GAS	CT KALLPA TG1	Gas Turbine Natural Gas	Natural Gas	35.60%	54,300	0.54910
KALLPA TG2-GAS	CT KALLPA TG2	Gas Turbine Natural Gas	Natural Gas	34.70%	54,300	0.56334
KALLPA TG3-GAS	CT KALLPA TG3	Gas Turbine Natural Gas	Natural Gas	34.70%	54,300	0.56334
KALLPA CCOMB TG1 - GAS	CT KALLPA TV	Combined Cycle	Natural Gas	53.40%	54,300	0.36607
FENIX CCOMB TG11 & TG12 - GAS	CT FENIX TV10	Combined Cycle	Natural Gas	57.00%	54,300	0.34295
FENIX TG11	CT FENIX TG11	Gas Turbine Natural Gas	Natural Gas	38.20%	54,300	0.51173
FENIX TG12	CT FENIX TG12	Gas Turbine Natural Gas	Natural Gas	34.90%	54,300	0.56011
RECKA TG1-D2	CT RECKA TG1-D2	Diesel 2 / Residual	Diesel 2	33.00%	72,600	0.79200
RF ETEN TG2 -D2	CT RESERVA FRIA DE GENERACION ETEN GT 1,2	Diesel 2 / Residual	Diesel 2	41.30%	72,600	0.63283
CT CACHIMAYO BLOQUE A	CT CACHIMAYO BLOQUE A	Diesel 2 / Residual	Diesel 2	39.50%	72,600	0.66167
CT RESERVA FRIA DE GENERACION TALARA TG5	CT RESERVA FRIA DE GENERACION TALARA TG5	Diesel 2 / Residual	Diesel 2	39.50%	72,600	0.66167
RF ILO2 TG2 -D2	CT RESERVA FRIA DE ILO TG1,2,3	Diesel 2 / Residual	Diesel 2	34.10%	72,600	0.76645
CTE TAMBURCO		Diesel 2 / Residual	Diesel 2	39.50%	72,600	0.66167
CTE URPIPATA		Diesel 2 / Residual	Diesel 2	39.50%	72,600	0.66167

(1) Source: COES. Annual Statisctic 2015. Chart No 6.8. Webpage www.coes.org.pe
(2) Source: COES. Hourly Dispatch 2015. Webpage www.coes.org.pe
(3) Source: COES. Annual Statisctic 2015. Chart No 6.8 Technology Webpage www.coes.org.pe
(4) Source: COES. Annual Statisctic 2015. Chart No 6.8. Net Efficient % Webpage www.coes.org.pe

Type of fuel	Type of Fuel: D2	Residual	Natural Gas	Coal	Landfill
EFCO2 (kg/Tj)	72,600	75,500	54,300	87,300	46,200

(1/) Source: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as rpovided in table 1.4 of chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidilenes on National GHG Inventories

Information on the hourly generation of all plants in the SEIN[27] and their associated emission factors was entered using Excel software and organized in columns where the position of the columns was determined by grid dispatch merit order. This process enabled identification of the plants that fall within the top x % of grid dispatch each hour of the year. In the *prior to validation* calculations, the quantity of electricity displaced by the project activity during hour, *h,* divided by the total electricity generation in the grid during that hour, *h* is smaller than 10%; therefore, 10 % is used to determine the plants that fall within the top x % of grid dispatch each hour of the year.

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

$$EF_{grid,OM,DD,y} = \frac{\sum_{h} EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$

$EF_{grid,OM\text{-}DD,y}$ = 25,548.86 tCO_2 / 49,530 MWh = 0.51583 tCO_2/MWh

Step 5: Calculate the built margin (BM) emission factor

In terms of vintage of data, project participants have chosen Option 2. For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1[28]. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.
The annual generation of the additions included in this table for prior-Validation calculations is from 2015, which is the latest year information was publicly available.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

[27] Data provided by COES, the dispatch center.

[28] Option 1 - calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation

Capacity Additions in the SEIN (2012-2015)

Plant	Date	Technology	Installed Capacity Added (MW)	2015 Generation (MWh) of the new addition
CT RECKA TG1-D2	Sep-15	Diesel 2 / Residual	181.32	16,504
C.H Machupichu G4	Aug-15	Hydro	99.86	398,792
CT RESERVA FRIA DE GENERACION ETEN GT 1,2	Jul-15	Diesel 2 / Residual	183.47	31,149
CT FENIX TV10	Dec-14	Combined Cycle	570.10	3,621,051
CT STA ROSA WEST TG 7,8	Dec-14	Gas Turbine Natural Gas	121.02	73,367
CT OLLEROS TG1	Oct-13	Gas Turbine Natural Gas	208.75	379,708
CT RESERVA FRIA DE ILO TG1,2,3	Jun-13	Diesel 2 / Residual	460.00	0
CTE TAMBURCO	Apr-13	Diesel 2 / Residual	4.00	0
CT DOLORESPATA	Apr-13	Diesel 2 / Residual	10.32	0
CT CACHIMAYO BLOQUE A	Apr-13	Diesel 2 / Residual	3.23	0
CTE URPIPATA	Apr-13	Diesel 2 / Residual	1.55	0
CT CHILCA 1 TV	Nov-12	Combined Cycle	811.14	5,837,717

SOURCES:

Energy Generation, 2015

Source for year 2015: COES- Dispatch Center Annual Statistic 2015" Chapter V. Chart 5.7.A and Chart 5.7.B
http://www.coes.org.pe

Plant/ Date/Installed Capacity Added

Source for year 2015: COES- Dispatch Center Annual Statistic 2015" Chapter 3 chart 3.8
www.coes.org.pe/portal/publicaciones/estadisticas/

In the table above , it can be seen that the 5 most recently built ($SET_{5\text{-units}}$) plants up to year 2015 were: (1) Thermal Plant Recka, (2) Hydro power plant Machupichu Unit 4, (3) Thermal Plant Eten (4) Combined cycle thermal plant Fenix and (5) Thermal plant Santa Rosa unit 7 being 4,140,862 MWh ($AEG_{SET\text{-}5\text{-units}}$).

On the other hand, the total annual generation of the most recently built plants ($SET_{\geq 20\%}$) accounting for 20 % of the grid was higher 10,358,287 MWh ($AEG_{SET\geq 20\%}$), therefore, the most recently built plants accounting for 20 % of the grid was selected for the BM calculation.

Table 6: Selection of SET_{sample} power plants

Year	Plant Name	Plant Type	Most recent year generation(MWh)	Filter most recent 20%	Most recent 20% units generation MWh	Filter 5 most recent units	5 Most recent units generation MWh
Sep-15	CT RECKA TG1-D2	Diesel 2 / Residual	16,504	1	16,504	1	16,504
Aug-15	C.H Machupichu G4	Hydro	398,792	1	398,792	1	398,792
Jul-15	CT RESERVA FRIA DE GENERACION ETEN GT	Diesel 2 / Residual	31,149	1	31,149	1	31,149
Dec-14	CT FENIX TV10	Combined Cycle	3,621,051	1	3,621,051	1	3,621,051
Dec-14	CT STA ROSA WEST TG 7,8	Gas Turbine Natural Gas	73,367	1	73,367	1	73,367
Oct-13	CT OLLEROS TG1	Gas Turbine Natural Gas	379,708	1	379,708		
Jun-13	CT RESERVA FRIA DE ILO TG1,2,3	Diesel 2 / Residual	-	1	-		
Apr-13	CTE TAMBURCO	Diesel 2 / Residual	-	1	-		
Apr-13	CT DOLORESPATA	Diesel 2 / Residual	-	1	-		
Apr-13	CT CACHIMAYO BLOQUE A	Diesel 2 / Residual	-	1	-		
Apr-13	CTE URPIPATA	Diesel 2 / Residual	-	1	-		
Nov-12	CT CHILCA 1 TV	Combined Cycle	5,837,717	1	5,837,717		
Total			10,358,287	12	10,358,287	5	4,140,862
					23.26%		
				SEIN Annual Genera	44,540,000		
				20% of SEIN Generat	8,908,000		

Most recent 20% units generation		5 Most recent units generation
10,358,287	>	4,140,862

In the table below, the selected sample of most recently built plants was organized by their annual electricity generation output, their weights with respect to the total generation of the selected sample, and their emission factors. By multiplying the emission factor per plant with its assigned weight and then summing up the results, the weighted average of the selected sample was obtained. The resulting **BM** equals **0.35520 tCO_2/MWh** for the year 2015.

Table 7: BM Calculation

Plant Name	Most recent 20%	CO_2 emission Factor tCO_2/MWh
CT RECKA TG1-D2	16,504	0.79200
C.H Machupichu G4	398,792	0.00000
RESERVA FRIA DE GENERACION ETEN GT 1,2	31,149	0.63283
CT FENIX TV10	3,621,051	0.34295
CT STA ROSA WEST TG 7,8	73,367	0.55220
CT OLLEROS TG1	379,708	0.53410
CT RESERVA FRIA DE ILO TG1,2,3	-	0.76645
CTE TAMBURCO	-	0.66167
CT DOLORESPATA	-	0.53410
CT CACHIMAYO BLOQUE A	-	0.66167
CTE URPIPATA	-	0.66167
CT CHILCA 1 TV	5,837,717	0.37023
Total	10,358,287	
BM2=	**0.35520**	**tCO_2/MWh**

Step 6:

Calculate the combined margin (CM) emissions factor

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

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

$$EF_{grid,CM,y} = 0.25^* (\mathbf{0.51583}) + 0.75^* (0.35520) = 0.39536 tCO_2/MWh$$

The resulting Emission Factor is 0.39536 **tCO_2/MWh.**

Calculation of the Project's Emission Reductions Prior to Validation

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

$$ERy = BEy – PEy- LEy$$

Where:

ERy = Emission reductions in year *y* (t CO2/yr)

BEy = Baseline emissions in year *y* (t CO2/yr)

PEy = Project emissions in year *y* (t CO2/yr)

LEy = Leakege emissions in year y (t CO2/yr)

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

BE_y = 49,530 MWh * 0.39536tCO2/MWh = 19,582 tCO2

PE_y = 0 (Zero)

LEy = 0 (Zero)

Estimated Emission Reductions:

$$ERy = BEy - PEy - LEy = 19{,}582\ tCO_2 - 0 - 0 = 19{,}582\ tCO_2$$

B.6.4. Summary of ex ante estimates of emission reductions

Year[29]	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2016	14,687	0	0	14,687
2017	19,582	0	0	19,582
2018	19,582	0	0	19,582
2019	19,582	0	0	19,582
2020	19,582	0	0	19,582
2021	19,582	0	0	19,582
2023	19,582	0	0	19,582
2024	4,896	0	0	4,896
Total	137,074	0	0	137,074
Total number of crediting years	7 years			

[29] For the Project "the year" would run from April 1st to March 31st, the first year of the second crediting period being April 2016-March 2017, and the last year of the first crediting period being April 2022-March 2023.

Annual average over the crediting period	19,582	0	0	19,582

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”
Source of data	As per the “Tool to calculate the emission factor for an electricity system”
Value(s) applied	0.39536tCO_2 per MWh
Measurement methods and procedures	As per the “Tool to calculate the emission factor for an electricity system”
Monitoring frequency	yearly
QA/QC procedures	As per the “Tool to calculate the emission factor for an electricity system”
Purpose of data	Baseline Emissions calculation
Additional comment	The parameters defined in the tool have been included in this section of the PDD.

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the “Tool to calculate the emission factor for an electricity system”
Source of data	As per the “Tool to calculate the emission factor for an electricity system”
Value(s) applied	0.51583 tCO_2/MWh
Measurement methods and procedures	As per the “Tool to calculate the emission factor for an electricity system”
Monitoring frequency	Yearly
QA/QC procedures	As per the “Tool to calculate the emission factor for an electricity system”
Purpose of data	Baseline emissions calculation
Additional comment	The parameters defined in the tool have been included in this section of the PDD.

Data / Parameter	$EG_{m,y}$ and $EG_{n,h}$
Data unit	MWh
Description	Net electricity generated and delivered to the grid by power plant / unit m, or n in year y or hour h
Source of data	COES

Value(s) applied	Raw data recorded every 15 minutes: COES data from year 2015. Data recorded hourly. “Poechos II OM year 2015.xls” spread sheet
Measurement methods and procedures	Directly measured by power plants energy meters and recorded every 15 minutes by COES. This data is processed s and recorded hourly by project participant in “Poechos II OM.xls” spread sheet. The proportion of data to be monitored is 100% and the data will be archived electronically.
Monitoring frequency	Monitoring frequency: • Dispatch data OM: Hourly • BM: For the second and third crediting period, only once ex-ante at the start of the second crediting period.
QA/QC procedures	Cross check with COES official data
Purpose of data	Baseline Emissions calculation
Additional comment	-

Data / Parameter	$EG_{PJ,h}$
Data unit	MWh
Description	Electricity displaced by the project activity in hour h of year y
Source of data	Information provided by project electricity meters
Value(s) applied	Real hourly data of Poechos II during year 2015
Measurement methods and procedures	Directly Measured in the meter of Poechos II. This data will be measured continuously and recorded hourly. The proportion of data to be monitored is 100% and all data will be archived electronically, and backed up regularly. Moreover, this information will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. Poechos II will have a separate control and measuring system, distinct from that for Poechos I, and as per requirements by COES. This separate measuring system is composed by one meter that measures 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).
Monitoring frequency	This data will be measured continuously and recorded hourly. The proportion of data to be monitored is 100% and all data will be archived electronically, and backed up regularly.

QA/QC procedures	The monitoring report will verify that the sum of electricity reported of Poechos II and Poechos I in each hour is equal to the net electricity metered in the meter of Sullana. Sales records to the grid (SEIN) or to the final client, as well as other records are used to ensure consistency. The electricity meters are regulated by the dispatch center (COES)[30]. According to this, the electricity meter will be subject to regular maintenance and testing in accordance with the stipulation of the meter supplier and/or as per the requirements set by the grid operators or national requirements. The calibration of meters will be done every three years. According to COES requisites, the accuracy class of the meters is 0.2.
Purpose of data	Baseline Emissions calculation
Additional comment	Electricity supplied by the project activity to the grid. Double check with receipt of sales

Data / Parameter	$\eta_{m,y}$
Data unit	-
Description	Average net energy conversion efficiency of power unit m in year y
Source of data	Data from the dispatch center (COES) Annual statistics
Value(s) applied	Net Energy Conversion Efficiencies (NEC) for all thermal plants are available in the annual statistics of COES. For ex-ante calculation it was used the most updated information that is for year 2015.
Measurement methods and procedures	Every year this data will be checked with the last available annual report of COES.
Monitoring frequency	This information will be monitored once during the crediting period
QA/QC procedures	The data from COES is reliable since efficiency is calculated according to the COES procedure Number 17 for the determination of effective power and efficiency of thermal power plants. (http://www.coes.org.pe/coes/Procedimientos/procedimiento_n17.pdf). This procedure established that the efficiency of the plants have to be calculated according to international standards. For diesel engines ISO-3046-1 or its updated versions, for gas turbines: section 8 of ISO 2314: 1989 or its updated versions, for steam turbines: DIN1943, Sections 6 a 8, February 1975, or it updated version. Etc. These calculations and measurements will be performed with a COES accredited consultants and the result are reviewed and supervised by COES experts.
Purpose of data	Baseline emissions calculation
Additional comment	-

[30] Source: "Procedimiento Técnico del Comité de Operación Económica del SEIN. PR – 20 "Ingreso, Modificación y retiro de Instalaciones en el SEINs". Pages 134 to 136. http://www.coes.org.pe/Portal/MarcoNormativo/Procedimientos/Tecnicos .

B.7.2. Sampling plan

Not applicable

B.7.3. Other elements of monitoring plan

No especial monitoring equipment is needed. ONCE 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 Appendix 5.

SECTION C. Start date, crediting period type and duration

C.1. Start date of project activity

12/02/2007

C.2. Expected operational lifetime of project activity

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

C.3. Crediting period of project activity

C.3.1. Type of crediting period

Renewable Crediting Period

C.3.2. Start date of crediting period

Starting date of the first crediting period: 01/04/2009

The starting date of the second crediting period is 01/04/2016

C.3.3. Duration of crediting period

7 years

SECTION D. Environmental impacts

D.1. Analysis of environmental 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.[31]

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;
- 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. Environmental impact assessment

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 below.

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	No impact; hydropower energy from HPP

[31] 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.

	High (+)	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. Local stakeholder consultation

E.1. Modalities for local stakeholder consultation

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 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. Consideration of 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.

SECTION F. Approval and authorization

The letter of approval and authorization from the host country was gotten in 04/01/2007. See the letter bellow.

CONAM
POR EL DESARROLLO SOSTENIBLE

Lima, 04 January, 2007

<u>Letter N° 0019-2007-CONAM/SE</u>

Mr.
Branislav Zdravkovic
Gerente General
Sindicato Energético S.A.
Calle Los Ruiseñores Oste N° 277 Of 102 – Córpac
San Isidro

Dear Mr. Zdravkovic:

By means of this document we inform our positive opinion for the project submitted under File N° 005975, on 30 October 2006 "Poechos II Hydroelectric Plant" in order to continue the project cycle approval for the Clean Development Mechanism of the Kyoto Protocol. The project has found to contribute for national sustainable development and harmonizes with Peru's national environmental policy.

By means of this letter of approval, it is voluntarily accepted and authorized, the transfer of certified emission reductions by the requesting company to the correspondent Annex B Party of the Kyoto Protocol as a result of the voluntary CDM project activities

This document should be used with no other purposes that to be submitted as part of the request for registration before the Clean Development Mechanism Executive Board within the framework of the Kyoto Protocol, ratified by the Government of Peru through Parliament Resolution N° 27824 (2002).

A copy of this communication is delivered to the Executive Board in English and Spanish as the Designated National Authority of Peru for the Kyoto Protocol, under Supreme Decree 095-2002-PCM.

This letter of approval will be no longer valid should the operational entity designated by the Executive Board of the Clean Development Mechanism has formally reported that the project is not validated.

Sincerely yours,

María Esperanza Castañeda Pinto
Executive Secretary

Appendix 1. Contact information of project participants

Organization name	Sindicato Energético SA
Country	Peru
Address	Calle Los Ruisenhores Oeste 277, San Isidro, Lima. Peru
Telephone	(51-1) 421-7359 / 222-4888
Fax	(51-1) 222-4888
E-mail	bzdrav@sinersaperu.com
Website	www.sinersaperu.com
Contact person	Mr. Branislav Zdravkovic

Organization name	VERT CONSERVATION PTE LTD
Country	Singapore
Address	57 Mohd Sultan Road, #03-05 Sultan-Link
Telephone	(65) 91823590
Fax	
E-mail	varsha@vertconservation.com
Website	http://www.vertconservation.com/
Contact person	Ms. Varsha Tripathi

Appendix 2. Affirmation regarding public funding

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

Appendix 3. Applicability of methodologies and standardized baselines

No further information to show as it is explained in the PDD

Appendix 4. Further background information on ex ante calculation of emission reductions

No further information to show as it is explained in the PDD

Appendix 5. Further background information on monitoring plan

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).

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 the grid.

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[32]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).

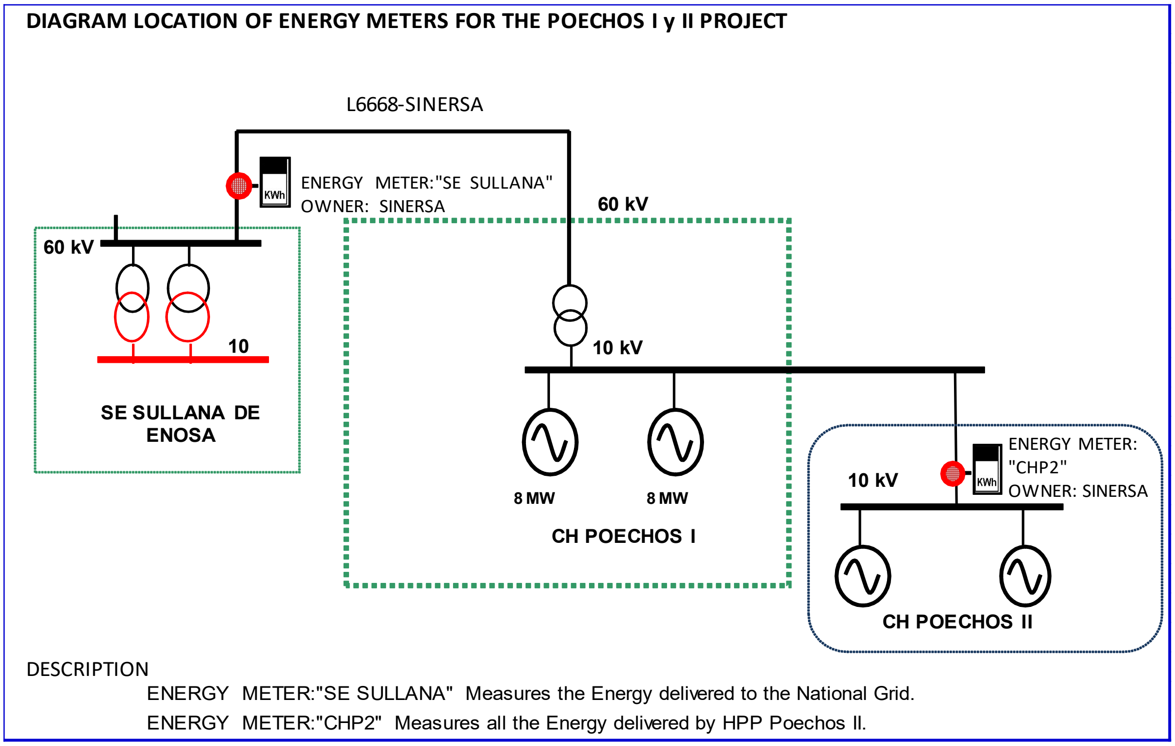
Data gathering and processing should be done by the Operator, as follows:

COES (Data Provider)	Report hourly generation of plants in the SEIN (measurement: 15'), available monthly. Report dispatch merit orders. As the Project will be an active member of COES all data will come from COES. Use real NECs per power plant in the SEIN. Available once a year in the Annual Statistic of COES. This information will be monitored once for the crediting period.
Operator (Data processor)	Substantiate all ER claims with COES report data and /or final clients. Fill in monthly data in all required spreadsheets, following the ERCP Report hourly net generation of Poechos II Hydroelectric Power Plant in the SEIN (measurement: 15') and/or final clients, available monthly.

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.

[32] As long as the Project Operator is not an active member of COES. When it is, all data will come from COES.

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.

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

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.

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 column 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 Operating margin emission factor for the monitoring period. .

15 worksheets compose the DDA-OM Spreadsheet:

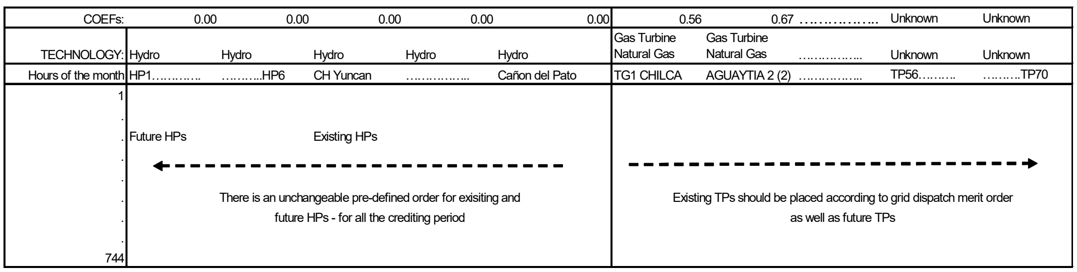
- Worksheet #0: Emissions Factor (tCO_2/MWh) calculation for each plant in the SEIN. The Emissions Factor will be calculated *ex- post* along the monitoring period, according to the information published by COES each year.

  It contains pre-established formulas to calculate the emission factors. Data of 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.

- Worksheet #1: Emissions Factor (tCO_2/MWh) to assign to each plant in the SEIN, according to the Emissions Factor established in Worksheet #0. It holds up to 105 plants, of which 39 are renewable energy plants and 66 are thermal plants. Data on future plants should be filled as the arrows in the table indicate, as they enter to 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.
- Worksheet #2: Grid dispatch merit order for all thermal plants in the SEIN. Merit order is public available in the annual statistics of COES
- Worksheet #3 to Worksheet #14: One worksheet per month in the monitoring period. These worksheets contain the hourly generation of the plants in the SEIN. The number of worksheet will depended of the number of months in the monitoring period.

Columns C to DD should be organized as follows:



Hourly generation of renewable energy plants (both existing and future) should occupy columns D to AP only. Hourly generation of thermal plants (both existing and future) should occupy columns AQ to DD only.

The plants should be sorted according to their merit order in the grid dispatch. Plants with higher dispatch merit order will be ordered from right to left.

The associated Emission Factors of SEIN plants should be entered in the first row of the corresponding plant's column. For future plants Emission Factors = 0.

The Operating margin emission factor calculation result is in (WS-14) cell EJ758

BM Spreadsheet:

This Excel file contains all data and formulas necessary to calculate the Build margin emission factor for the monitoring period. .

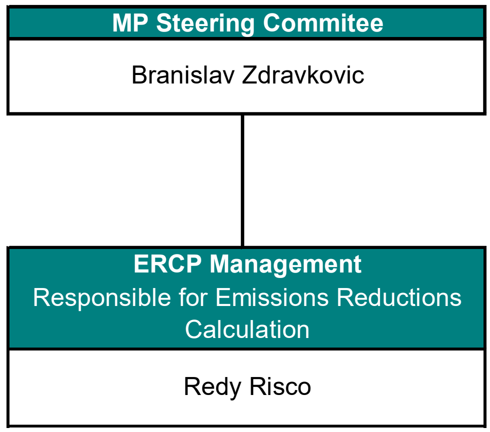
4 worksheets compose the BM Spreadsheet:

- Worksheet #0: Emissions Factor (tCO2/MWh) calculation for each plant in the SEIN. The Emissions Factors are calculated only once ex ante as The BM calculation is fixed in the second crediting period.
- Worksheet #1: Additions to the SEIN according to COES, Fixed for the second crediting period.
- Worksheet #2: The BM calculation *ex-ante*. Fixed for the second crediting period.
- Worksheet #3: It shows the Baseline Emission Factor and ERs calculated in the monitoring period of the Project's generation.

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)

Monitoring Plan –Emissions Reductions Calculation Procedure

ERCP Quality Control

Steering Committee	Operating Margin Calculation	• Cross-checking • Corrective actions • Check calibration of electricity meters
ERCP Management	**Data**	1. The Project hourly generation data 2. SEIN units hourly generation data 3. COES public merit order 4. Real NECs
ERCP Management	**Quality of Data Collection**	✓Which data comes? All of the above ✓By what means does it come? By E-mail/CD/Webpage ✓How does it come? In Excel ✓How frequently does it come? Monthly (1 and 2), yearly (3) and Once in the crediting period (4) ✓From whom does it come? From COES ✓To whom does it come? ERCP Manager.
ERCP Management	**Quality of data Processing**	✓ Original Data ✓ Organized Data ✓ Entered Data ✓ Processed Data ✓ Result → ✓ Monthly calculation ✓ Follow ERCP ✓ Monitoring Period consolidation
Steering Committee	**Quality of Data Storage**	✓ Keep all data for 2 years after the first crediting period. ✓ Save the document with the last date in which an alteration was made.
Steering Committee	**Quality of data Delivery**	✓ Provide to the verifier e-mails/cd/web page trough which the data provider (COES delivered the original data ✓Provide to the verifier report from COES or clients. ✓Provide to the verifier all calculations made.

Appendix 6. Summary report of comments received from local stakeholders

No further information to show as it is explained in the PDD

Appendix 7. Summary of post-registration changes

Description of changes as compared to the description in the registered PDD according to validation report to the revision of the PDD done by the DOE AENOR in 28/09/2011:

A) Changes in the description of the project activity and technology employed by the project activity

The registered PDD described that the energy generated by the project activity would be sold to Electronoroeste S.A (ENOSA). However, AENOR team found during the on site visit corresponding to the first verification process that the energy generated by the project activity is being sold to the COES (National Grid) instead of ENOSA as it had been described in the registered PDD.

B) **Changes** in the description of the ex-ante calculation of emission reductions

There are not changes in the description of the calculation of emission reductions.

C) Changes in the Monitoring Plan

AENOR team found, during the first verification process covering the period 01/04/2009 " 31/03/2010, that the monitoring of the parameter EGh, is not carried out according to the indications included in the registered monitoring plan. The monitoring plan registered cites that this parameter will be *"Directly Measured based on the information provided by COES…, … Poechos II will have a separate control and measuring system, distinct from that for Poechos I."*

The information included in the registered monitoring plan is not according to the real project implementation because, although Poechos II has an individual energy meter that measures its energy generation after auxiliary consumptions, it does not take into account the transmission loses, so the energy measured at Poechos II cannot be considered as net energy generation.

In order to be more accurate and conservative, the project developer is measuring the energy sold to the National Grid using a different meter located at Sullana Substation (interconnection point with the National Grid) and also owned by SINERSA. In this way, the energy metered there includes transformation and transmission energy loses, so it can be considered as net energy.

However, as AENOR team could verify during the on site visit, the meter located at Sullana Substation, not only measures the energy generated by Poechos II, it also measures the electricity generated by another CDM project, Poechos I (Ref: 0086) owned by the same Project Participant.

Poechos II is connected to Poechos I through a transmission line of 10kV, of 1 km length, and both projects, Poechos II and Poechos I, are connected to the national grid by the same 38 Km length transmission line, sharing the electricity meter located at Sullana Substation.

The location of the meters is showed in the following figure:

Poechos I does not have its own electricity meter, its electricity generation is calculated by the difference between the electricity metered at Sullana Substation and the electricity metered at Poechos II (MWh Poechos I = MWh Sullana – MWh Poechos II).

Consequently, the sum of net electricity delivered to the grid and eligible for CERs calculations of both projects (Poechos II and Poechos I) is the electricity metered at Sullana Substation, thus transformation and transmission loses from both projects are absorbed by Poechos I.

In order to ensure the accuracy of the measurement, the PP has developed a spreadsheet "Poechos II EGh net electricity check.xls", which will be used in every monitoring period to 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. (MWh Poechos I + MWh Poechos II = MWh Sullana)

Furthermore, all the equipment involved in the measure of the energy generated will be calibrated according to the Peruvian legislation and at least once every four years and all energy generated by Poechos I and Poechos II will be crosschecked against the invoices emitted by COES and ENOSA.

Poechos I is selling its energy to ENOSA and Poechos II is selling its energy to the COES. The amount of energy included in the invoices emitted by ENOSA plus to the amount of energy included in the invoices emitted by COES is equal to the energy metered at Sullana Substation

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Document information

Version	*Date*	*Description*
10.1	28 June 2017	Revision to make editorial improvement.
10.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for project activities" and with the PoA-DD and CPA-DD forms; • Make editorial improvement.
09.0	24 May 2017	Revision to: • Ensure consistency with the "CDM project standard for project activities" (CDM-EB93-A04-STAN) (version 01.0); • Incorporate the "Project design document form for small-scale CDM project activities" (CDM-SSC-PDD-FORM); • Make editorial improvement.
08.0	22 July 2016	EB 90, Annex 1 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revision to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Make editorial improvement.
05.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from F-CDM-PDD to CDM-PDD-FORM; • Make editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for CDM project activities" (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b

Version	*Date*	*Description*
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

Decision Class: Regulatory
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