



Verified Carbon Standard

LAS PIZARRAS PROJECT

Project title	Las Pizarras Project
Project ID	1348
Crediting period	30-April-2023 to 29-April-2033
Original date of issue	09-August-2024
Most recent date of issue	19-December-2024
Version	3.0
VCS Standard Version	4.7
Prepared by	Empresa Eléctrica Río Doble S. A.: Giobany Cuavoy NTT Data: Alfonso Medrano Gutierrez

CONTENTS

1	PROJECT DETAILS.....	4
1.1	Summary Description of the Project	4
1.2	Audit History.....	4
1.3	Sectoral Scope and Project Type	5
1.4	Project Eligibility	5
1.5	Project Design	6
1.6	Project Proponent	6
1.7	Other Entities Involved in the Project	6
1.8	Ownership.....	8
1.9	Project Start Date	9
1.10	Project Crediting Period	9
1.11	Project Scale and Estimated GHG Emission Reductions or Removals	9
1.12	Description of the Project Activity	10
1.13	Project Location	10
1.14	Conditions Prior to Project Initiation	13
1.15	Compliance with Laws, Statutes and Other Regulatory Frameworks	13
1.16	Double Counting and Participation under Other GHG Programs	14
1.17	Double Claiming, Other Forms of Credit, and Scope 3 Emissions.....	15
1.18	Sustainable Development Contributions	16
1.19	Additional Information Relevant to the Project	17
2	SAFEGUARDS AND STAKEHOLDER ENGAGEMENT	17
2.1	Stakeholder Engagement and Consultation.....	17
2.2	Risks to Stakeholders and the Environment.....	23
2.3	Respect for Human Rights and Equity	24
2.4	Ecosystem Health	26
3	APPLICATION OF METHODOLOGY.....	29
3.1	Title and Reference of Methodology	29
3.2	Applicability of Methodology	29
3.3	Project Boundary	34
3.4	Baseline Scenario	37

3.5	Additionality	37
3.6	Methodology Deviations	40
4	QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS.....	58
4.1	Baseline Emissions	59
4.2	Project Emissions	59
4.3	Leakage Emissions	68
4.4	Estimated GHG Emission Reductions and Carbon Dioxide Removals	68
5	MONITORING	70
5.1	Data and Parameters Available at Validation	70
5.2	Data and Parameters Monitored.....	72
5.3	Monitoring Plan.....	76

1 PROJECT DETAILS

1.1 Summary Description of the Project

The Las Pizarras Project in Peru (hereafter referred to as the “Project”) is a run-of-river hydroelectric power project located at approx. 1,078 m.a.s.l, on the high basin of the Chancay river, in the district of Santa Cruz y Sexi, province of Santa Cruz, region of Cajamarca, in Peru. The total installed capacity of the Project consists of 19.992 MW, with an electricity generation potential of 106.598 GWh per year¹. The Project was implemented by “Empresa Eléctrica Río Doble S.A.” (hereafter referred to as “Río Doble”).

The Project generates renewable electricity by using water from the Chancay river and supply this energy to the National Interconnected Electric Grid (SEIN). The aim of the project is to displace energy generated by fossil fuels from the electricity system (SEIN) through renewable energy generation. The spatial extent of the Project boundary is the SEIN. The plant is connected to the national grid SEIN through 138 kV transmission line to the Espina Colorada sub-station, with a total length of approx. 14.43 km.

Prior to the implementation of the proposed project activity the electricity that will be supplied by the proposed project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of other new generation sources. The baseline scenario is the same as the scenario existing prior to the implementation of the proposed project activity. In the project scenario, the electricity generated from the Las Pizarras Project will displace this more emission-intensive grid sourced electricity and it is expected to reduce around 376,020 tons CO₂e of greenhouse gas (GHG) emissions for this second crediting period.

1.2 Audit History

Audit type	Period	Program	Validation/verification body name	Number of years
Validation	09-September-2014	VCS	AENOR International S.A.U.	Ten years
Verification (1st Monitoring Period)	30-April-2013 – 30-September-2015	VCS	AENOR International S.A.U.	Two years
Verification (2nd Monitoring Period)	01-October-2015 – 30-September-2021	VCS	Applus+ Certification	Six years

¹ “Dossier generador” and “INFORME N° SSMA” documents provided.

Audit type	Period	Program	Validation/verification body name	Number of years
Verification (3rd Monitoring Period)	01-October-2021 – 29-April-2023	VCS	Sustain CERT S.A	Two years
Validation (2 nd Crediting Period)	30-April-2023 – 29-April-2033	VCS	Sustain CERT S.A	Ten years

1.3 Sectoral Scope and Project Type

Sectoral scope	1. Energy (renewable/non-renewable)
Project activity type	Hydroelectric

1.4 Project Eligibility

1.4.1 General eligibility

The project activity is included under the scope of the VCS Program (VCS Program Guide, version 4.4) as an activity related to the generation of GHG emission reductions, and this scope does not include carbon footprint assessments or carbon neutrality claims. The VCS Program provides the standard and framework for independent validation of projects and programs, and verification of GHG emission reductions and removals, based on ISO 14064-2 and ISO 14064-3.

In addition, the participation of this project was and is voluntary and based on objective criteria. This project, which was registered before under CDM (01/01/2013), was validated in VCS as a project with a renewal crediting period of 10 years renewable to a maximum period that does not exceed the period that it would cover as a CDM project (21 years) beyond December 31st, 2033, according to section 3.8.3 of VCS STANDARD v3.4. According to VCS, projects that have completed validation on or before 19 March 2020 remain eligible to apply the crediting period requirements under VCS Version 3, as long as it adheres to the requirements of section 3.9.7 of VCS Standard v4.7. Considering this, this project that demonstrated its eligibility in 2013 for a total project crediting period of 10 years renewable, is considered eligible for this renewal.

At the time of registration under VCS, the project complied with the entire Pipeline Listing Process until reaching the “Registered” status, in accordance with the “*Registration and Issuance Process*” document, going through the validation processes and successive verifications with DOE for the registration and issuance during the first crediting period in a satisfactory manner, as can be shown in Section 1.2 *Audit History*.

The project activity follows the requirements of the internationally recognized CDM (UNFCCC) methodology ACM0002 in its most updated available version, as demonstrated in Section 3.2 *Applicability of Methodology*.

1.4.2 AFOLU project eligibility

This project is not an AFOLU-Project, so this section is not required.

1.4.3 Transfer project eligibility

This project is not a transfer Project, so this section is not required.

1.5 Project Design

This project consists of a run-of-river hydroelectric power plant that connects to the SEIN through a transmission line that feeds the Espina Colorada substation. The transmission line reaches the SEIN interconnecting to the Carhuaquero 220 KV substation. So, the project has been designed as:

- ☒ Single location or installation
- ☐ Multiple locations or project activity instances (but not a grouped project)
- ☐ Grouped project

1.5.1 Grouped project design

This project is not a grouped Project, so this section is not required.

1.6 Project Proponent

Organization name	Empresa Eléctrica Río Doble S. A.
Contact person	Giobany Cuavoy
Title	Apoderado General
Address	Calle Tomas Ramsey N° 930, Of. 804 Magdalena del Mar – Lima. Código Postal N° 15076
Telephone	(511) 992765301
Email	gcuavoy@riodoble.com

Empresa Eléctrica Río Doble, S.A (ERD), Project Participant of Las Pizarras project, has full ownership of the carbon credits generated by the project.

1.7 Other Entities Involved in the Project

Organization name	SMARTENER
Role in the project	The function of SMARTENER in Las Pizarras Project is the responsibility of controlling, organizing, and monitoring the operation, maintenance, and performance results. During the power plant construction phase, Río Doble obtained a contract with the Spanish company ALARDE SOCIEDAD DE ENERGIA SA, which provided financing and made the construction possible. As part of this agreement, ALARDE SOCIEDAD DE ENERGIA SA would be responsible for project development and managing the operation. In December 2016, Alarde's rights were transferred to SMARTENER, and the contract has remained in effect until today. Its validity is renewed annually.
Contact person	Alberto Gandara
Title	Exploitation Responsible
Address	Paseo de la Castellana, 140, Planta 6C, Chamartín, 28046, Madrid
Telephone	+34 917 45 49 68
Email	agandara@smartener.es

Organization name	NTT DATA
Role in the project	SMARTENER, as responsible of operation management, has hired the services of NTT DATA to develop the work related to the revalidation process. NTT DATA's Climate Change Team has extensive experience in advising on CDM and VCS projects, having a large portfolio of projects successfully executed. Rio Doble (PP) and SMARTENER has provided to NTT DATA all the information necessary for the report development and calculations, as well as the evidence on which all the data is based, in a transparent manner.
Contact person	Alfonso Medrano Gutiérrez
Title	Climate Change, Nature and Sustainability Director
Address	Camino de la Fuente de la Mora, 1, Hortaleza, 28050, Madrid

Telephone	+34 917 49 03 00
Email	alfonso.medrano.gutierrez@emeal.nttdata.com

1.8 Ownership

In 2009 a change of concession ownership occurred, as can be seen on evidence provided (see Table below), through a Ministerial Resolution, in conformance with the VCS Program requirements on project ownership. Since then, the ownership and activity of the project was granted in accordance with the competent authority and arising under regional and national laws, in addition to having the Environmental Authorization permits (2008) for the development of the Project activity and the construction licenses (2011).

Through the commissioning date in April 2013, Las Pizarras hydroelectric power plant entry into the commercial operation of Las Pizarras was approved, and the project start its activity, complying with laws, statutes or regulatory frameworks that require activities be undertaken that generate GHG emission reductions.

The relevant information related to the ownership of the Las Pizarras Project is set out in the following table:

Table 1. Relevant information regarding the Project ownership

Date	Key Events	Document name
18/11/2008	Environmental authorization	(RM) Concesión Definitiva de Generación RER. publicación El Peruano (RM) Cambio Titular Concesión Definitiva Generación RER. publicación El Peruano
04/04/2011	Temporary license	20110404_Resolución de la Alcaldía
14/04/2011	Start of Works / Date of construction	Acta de Recepción
01/08/2011	Construction license	20110801 Licencia construcción Santa Cruz
12/07/2012	Purchase of main equipment	Factura Indar - Invoice for purchase of the two Indar generators
30/04/2013	Commissioning date	20130430 Aprobación de puesta en operación comercial – Carta COES

1.9 Project Start Date

Project start date	30-April-2013
Justification	The start date of the project activity was the moment on which the project began generating GHG emission reductions supplying renewable energy to the national electricity grid.

1.10 Project Crediting Period

Crediting period	☐ Seven years, twice renewable ☐ Ten years, fixed ☒ Other (state the selected crediting period and justify how it conforms with the VCS Program requirements)
Start and end date of first or fixed crediting period	30-April-2013 to 29-April-2023 (Renewable)

This project, which was registered before under CDM (01/01/2013), was validated in VCS as a project with a renewal crediting period of 10 years renewable to a maximum period that does not exceed the period that it would cover as a CDM project (21 years) beyond December 31st, 2033, according to section 3.8.3 of VCS STANDARD V3.4 (version applicable to the project in the moment of registry). This means, VCS project activity will end on December 31st, 2033.

According to VCS, projects that have completed validation on or before 19 March 2020 remain eligible to apply the crediting period requirements under VCS Version 3, as long as it adheres to the requirements of section 3.9.7 of VCS Standard v4.7.

The first VCS crediting period started on April 30th, 2013, and according to the registered PD, it can be renewable twice. Therefore, this second crediting period of the project will be 10 years, and it will run from April 30th, 2023 to April 29th, 2033. Considering the situation explained above, the third crediting period can only be renewed for a period less than 1 year, from April 30th, 2033, to December 31st, 2033, to comply with the CDM requirements.

1.11 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions of the project are less than 300,000 tCO₂e/year, so it cannot be considered a large project.

- ☒ < 300,000 tCO₂e/year (project)
☐ ≥ 300,000 tCO₂e/year (large project)

The estimated GHG Emission Reductions for the second crediting period are included in the following table:

Calendar year of crediting period	Estimated GHG emission reductions or removals (tCO ₂ e)
30-April-2023 to 29-April-2024	37,602
30-April-2024 to 29-April-2025	37,602
30-April-2025 to 29-April-2026	37,602
30-April-2026 to 29-April-2027	37,602
30-April-2027 to 29-April-2028	37,602
30-April-2028 to 29-April-2029	37,602
30-April-2029 to 29-April-2030	37,602
30-April-2030 to 29-April-2031	37,602
30-April-2031 to 29-April-2032	37,602
30-April-2032 to 29-April-2033	37,602
Total estimated ERRs during the first or fixed crediting period	376,020
Total number of years	10
Average annual ERRs	37,602

Please, see *P1348_CP2 Emission reduction estimation_Las Pizarras_v2* spreadsheet for calculation details.

1.12 Description of the Project Activity

The Project is a run-of-the-river hydropower technology that utilizes the water flow of the Chancay River to generate electricity. The water is directly diverted from this river, going through a low pressure tunnel consisting of two trams, one upstream with a length of 2.03 km, and the other downstream with a length of 0.96 km, and then sent into a 90 m penstock that then splits into two other trams of 30.03 m and 32.35 m respectively, which in turn feed the water to the downstream power house turbines to transform the potential energy of water into mechanical energy. The Project is not considering any reservoir or regulation tank for its normal operation, only a water diversion and a forebay.

The design discharges 23.2 cubic meters per second (m³/s). The Project has a total installed capacity of 19.992 MW and generates approximately 106.598 GWh per year. The Project employ two Francis turbines with horizontal shafts and of 9,996 MW each. The plant is connected to the

national grid SEIN through 138 kV transmission line to the Espina Colorada sub-station, with a total length of approx. 14.43 km.

Table 2. Technology Characteristics

	Characteristic	Value	Unit
Turbine (2)	Type	Francis Horizontal Axis	-
	Discharge	23.20	m ³ /s
	Expected lifetime	40	Years
	Capacity	9.996	MW
	Expected energy generation	106.598	GWh/year
Alternator	Type	Synchronic three-phase	-
	Capacity	10.023	MVA
	Voltage	6.6	kV
	Expected lifetime	40	Years
Transformer	Primary voltage	6.6	kV
	Secondary voltage	138	kV
	Capacity	20	MVA
Transmission line	Length	14.43	km
	Connection voltage	138	kV
	Frecuence	60	Hz
	Transmission power	30	MW
	Arrival substation	Espina Colorada	-

1.13 Project Location

The Project is located in the northern part of Peru, within the District of Santa Cruz and Sexi, Province of Santa Cruz, and Department of Cajamarca. The powerhouse is placed along the right margin of the Chancay River.

According to the Project's license to undertake studies for electricity generation, granted by the Institute of Natural Resources (INRENA) and then ratified by the water authority (Autoridad Nacional del Agua - ANA), the coordinates for the intake and discharge are the following:

Table 3. Intake and discharge coordinates of the Project activity

Intake Coordinates			
UTM Coordinates	X (East): 721.737	Y (North): 9267.716	PSAD 56
Geographical Coordinates	Longitude: -78.99442485	Latitude: -6.620835649	

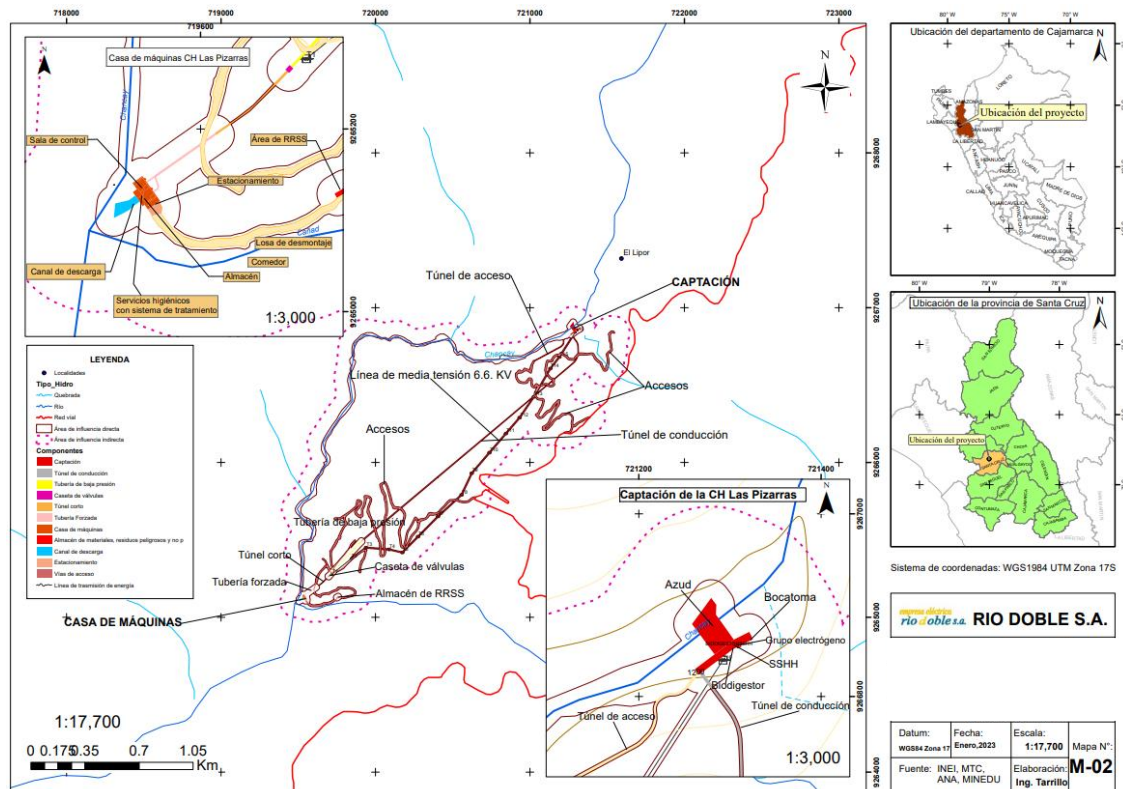


Figure 2. Detailed Project Location

1.14 Conditions Prior to Project Initiation

Las Pizarras Project was implemented to provide renewable energy to the National Interconnected Electric Grid (SEIN) by harnessing the flow of the Chancay River. Prior to the implementation of the Project, the electricity supplied by the project activity would otherwise be generated through the operation of grid-connected power plants and the incorporation of other new generation sources (Please, see Section 3.4. *Baseline Scenario* for more details). Therefore, the project activity displaces electricity generated through the operation of other less clean energy sources from the grid, resulting in a reduction in greenhouse gas (GHG) emissions. In addition, the project does not present emissions from the consumption of other fuels.

1.15 Compliance with Laws, Statutes and Other Regulatory Frameworks

The regulatory framework of the Peruvian electrical system is made up of three main laws: electricity concessions law (*Decreto Ley N° 25844*), law to ensure the efficient development of electricity generation (*Ley N° 28832*) and the investment promotion law for the generation of electricity with the use of renewable energies (*Decreto legislativo N° 1002*).

The electricity concessions law (*Decreto Ley N° 25844*) constitutes the first step for the transformation of the Peruvian electrical system. It established the generation, transmission, and distribution of electrical energy as separate activities, and it also established a regime of free

prices for those supplies that can be made in competition (free users) and regulated prices for those supplies that require it (regulated users). In addition, this law created the COES, the entity in charge of coordinating the operation of the interconnected system, seeking the minimum safe cost and efficient use of natural resources.

The Law to Ensure the Efficient Development of Electricity Generation (*Ley N°. 28832*) promotes the timely and efficient supply of electrical energy for the regulated market through tenders that result in long-term electricity supply contracts with firm prices that will be transferred to regulated users.

In addition, by Legislative Decree for the Promotion of Investment for the Generation of Electricity with the Use of Renewable Energies (*Decreto Legislativo N°. 1002*), the participation of electricity generation with renewable resources in the Peruvian grid was declared of national interest, promoting a process of auctions to allow the development of various renewable projects.

In this legal framework, Empresa Eléctrica Río Doble S.A. (ERD) has obtained the concession right granted by the Peruvian State to develop and operate the Las Pizarras Hydroelectric Power Plant, and under the rule for the promotion of renewable generation, the concession for the supply of energy has been obtained renewable electricity to the Peruvian electrical system for a period of 20 years. In this way, ERD complies with the Peruvian regulatory framework and is currently a legitimate and formal operator in the Peruvian electricity system.

1.16 Double Counting and Participation under Other GHG Programs

No GHG credits have been claimed under other GHG programs. However, the Project was initially registered under UNFCCC CDM scheme on October 19th, 2012 (reference 6967 “Las Pizarras Project”). Since the change of Standard, the status of the Project is “withdrawn” from UNFCCC and no GHG credits have been claimed under other GHG programs.

1.16.1 No Double Issuance

Is the project receiving or seeking credit for reductions and removals from a project activity under another GHG program?

☐ Yes ☒ No

1.16.2 Registration in Other GHG Programs

Has the project registered under any other GHG programs?

☒ Yes ☐ No

The Project was initially registered under UNFCCC CDM scheme on October 19th, 2012 (reference 6967 “Las Pizarras Project”).

Is the project active under the other program?

☐ Yes ☒ No

The Project, after its registration in CDM (UNFCCC) on 19/10/2012, decided to change its activity to VCS, abandoning its activity under the previous standard and not developing any verification corresponding to the crediting period started under CDM, as it can be seen on CDM standard website².

1.16.3 Projects Rejected by Other GHG Programs

Has the project been rejected by any other GHG programs?

☐ Yes ☒ No

1.17 Double Claiming, Other Forms of Credit, and Scope 3 Emissions

The Project does not reduce GHG emissions from activities that are included in an emission-trading program or any other mechanism that includes GHG allowance trading. There is no national program or cap, applicable to this project. The Project doesn't use and will not use its GHG emission reductions and removals for compliance under any such programs or mechanisms.

The Project has not created or has not sought or received another form of environmental credit, including renewable energy certificates now or in the future; nor does it have directly impact emissions associated with any good or service other than the electricity supplied to the national grid. Therefore, no double counting within scope 3 should be generated in the supply chain.

1.17.1 No Double Claiming with Emissions Trading Programs or Binding Emission Limits

Are project reductions and removals or project activities also included in an emissions trading program or binding emission limit?

☐ Yes ☒ No

1.17.2 No Double Claiming with Other Forms of Environmental Credit

Has the project activity sought, received, or is planning to receive credit from another GHG-related environmental credit system?

☐ Yes ☒ No

1.17.3 Supply Chain (Scope 3) Emissions

Do the project activities specified in Section 1.12 affect the emissions footprint of any product(s) (goods or services) that are part of a supply chain?

² Project under CDM, UNFCCC - Project 6967: Las Pizarras Project:
<https://cdm.unfccc.int/Projects/DB/SQS1344589168.03/view>

☐ Yes

☒ No

1.18 Sustainable Development Contributions

In line with the Sustainable Development Goals and the 2030 Agenda for Sustainable Development, the Project contributes to sustainable development by contributing to several of its environmental, social, economic and technological objectives. This project contributes with different actions to 8 of the 17 Sustainable Development Goals.

The main activity of the project is based on the production of clean energy that increases the percentage of renewable energy from the energy mix, displacing fossil fuels in the country's electrical system. It responds to Goal 7.

On the other hand, complies with Goal 13 directly with the generation of clean energy and therefore the reduction of GHG emissions. Using renewable energy for generating electricity which otherwise would have been generated through alternate fuel (most likely - fossil fuel) based power plants, contributing to reduction in specific emissions (emissions of pollutant/unit of energy generated) including GHG emissions.

Río Doble is committed to education (Goal 4) equal opportunities by:

- Promoting sustainability throughout academic visits and informative talks. Since the beginning of the project, Río Doble enabled its facilities for guided tours by high school students and teachers from the province of Santa Cruz, so that they can learn about hydroelectric power plants, the work being carried out, and the importance of renewable energy generation. This action also contributes to Goal 13 (Target 13.3).
- As part of its commitment with education quality, since the beginning of the project, Río Doble has donated educational materials, such as printers, projectors, laboratory equipment for students and teachers, as well as sports equipment needed annually by the schools of Santa Cruz and Sexi.
- In addition, since September 2023, Río Doble allocates an annual budget to the installation and implementation of access to the internet service in the district schools of Santa Cruz, and this will continue until the end of the project's lifetime. This action also contributed to Goal 9 (Target 9.C).

It promotes equal opportunities also in the gender and social spheres, ensuring the participation of women in managerial positions (Goal 5). The distribution of leadership positions will be maintained (currently two positions), one of which is held by a woman. Training on occupational health and safety issues is also encouraged.

Recruiting staff from different regions of the country (Goals 8 and 10). It will maintain the policy of hiring personnel from the area, guaranteeing them decent work and conditions for the development of their capabilities. To date, more than 60% of the staff is originally from the province of Santa Cruz, the rest are from nearby provinces and regions.

Moreover, it is committed to strengthening health-care services contributing to Goal 3. Río Doble offers support for the mobilization of health personnel to remote places and the transfer of people who require specialized medical care, providing fuel for the transport units of the health centers in the towns of Santa Cruz and Catache for transport to remote places (hamlets and small communities) as well as for transporting seriously ill patients to the city of Chiclayo where specialized care can be provided.

1.19 Additional Information Relevant to the Project

1.19.1 Leakage Management

This project does not generate leakage, so this section is not required.

1.19.2 Commercially Sensitive Information

Not applicable. This project does not have any commercially sensitive information such as “trade secrets, financial, commercial, scientific, technical or other information whose disclosure could reasonably be expected to result in a material financial loss or gain, prejudice the outcome of contractual or other negotiations or otherwise damage or enrich the person or entity to which the information relates” according to VCS Program Definitions, v4.5.

1.19.3 Further Information

There is not any additional information that may have a bearing on the eligibility of the project, the GHG emission reductions or carbon dioxide removals, or the quantification of the project’s reductions or removals, so this section is not required.

2 SAFEGUARDS AND STAKEHOLDER ENGAGEMENT

2.1 Stakeholder Engagement and Consultation

2.1.1 Stakeholder Identification

Stakeholder Identification

The National Environmental Fund (FONAM) was mandated to undertake a local consultation process with the objective of matching the interests of the Project sponsor with those of the local community. Hence, Río Doble and FONAM held meetings to explain the objectives, scope and commitments of the Project with

	respect to the local stakeholders' livelihoods and with the environment. To establish the Project's zone of influence FONAM set a radius of 6 km. around the Project with the use of maps and geographical coordinates of strategic locations, such as the main square of the district of Santa Cruz and the hydropower plant of the Project. Once this zone of influence was established, the communities inside it were located through interviews and a site visit where the access routes around the Project were visited, as well as the nearby district of Catache. The main actors or representatives of the communities were also identified, and FONAM proceeded to interview the local authorities of the communities and the district, as well as survey the local population on their living conditions, their knowledge on environmental issues (local and global), and their knowledge on the Project.
Legal or customary tenure/access rights	In the area of Las Pizarras CH Project there are no farmers or native communities, therefore, the rights to the land have been negotiated directly with the owners and holders of the land. In addition, in terms of the necessary resources (water), the rights and licenses of the Peruvian State.
Stakeholder diversity and changes over time	The district of Santa Cruz (interaction zone) has a population of around 10,000 inhabitants, which is equivalent to 25% of the total population of the province of Santa Cruz, with a decreasing growth rate (-0,41%). It registers a percentage of urban population of 54.79%, being rural population the 45.21%. In terms of female population, there are 3% more women than men in the district. There are a total of 28 educational centers, with the primary level being the one with the highest percentage of spaces, 50% of which have adequate infrastructure, except for the initial non-schooling institutions (PRONOEIS) that are located in the peri-urban areas of the city, since these are not structurally adequate (private homes, communal premises). These places lack the necessary educational equipment to serve their students. There is an illiteracy rate of 15.38%, which is equivalent to 1,423 people (2017 census).

	Among the main customs and traditions of Santa Cruz, its dances, gastronomy, craft, and traditional festivals stand out. These customs have their origin in pre-Hispanic indigenism.
Expected changes in well-being	The main expected changes in well-being are the generation of direct and indirect formal jobs through the contracting of goods and services in the project area.
Location of stakeholders	The stakeholders are located mainly in the towns of Santa Cruz and Sexi, both towns are capitals of the districts that have the same name and belong to the province of Santa Cruz, department of Cajamarca. These stakeholders located in the project area are not farmers or native communities. This process was part of the Peruvian DNA's requirements for the Letter of Approval for the Project's CDM process. All the details of the process were presented to the DOE by request during the first validation process for the first crediting period.
Location of resources	All parties have free access to the Chancay River. In addition, the use of the water resource must adhere to the scope of the Water Resources Law and the government entity that manages and regulates the resource (ANA, National Water Authority).

2.1.2 Stakeholder Consultation and Ongoing Communication

Date of stakeholder consultation	08/06/2011 (one workshop) and 10/06/2011 (two workshops)
Stakeholder engagement process	To prepare for the information workshops, an informative brochure about the Project was developed by FONAM, as well as some flipcharts about global environmental issues and the Project activity ³ . The authorities and representatives of the communities were then sent written invitations ⁴ to the workshop, and among the other diffusion measures undertaken to invite the population to

³ Available in Annex 2 and 3 of FONAM's Local Stakeholder Consultation report.

⁴ Available in Annex 1 of FONAM's Local Stakeholder Consultation report.

	the final workshop were flyers that were handed out at different hours, a radio announcement, and posters. Two information workshops were held, one, with a total participation of 41 members of the Santa Cruz and Catache districts, including local authorities and school teachers. During these meetings, FONAM shared information on climate change, the greenhouse gas effect, the Clean Development Mechanism, and the environmental and social benefits of the Project, as well as an explanation of the Project in detail. They then listened to the concerns of the local inhabitants. A final information workshop was held, with the participation of 59 members of the local community, and during this meeting representatives of Río Doble and the Executive Director of FONAM were present to address the main concerns of the local populations and present the main elements of the social investment plan of the Project. This process was part of the Peruvian DNA's requirements for the Letter of Approval for the Project's CDM process. All the details of the process were presented to the DOE by request during the first validation process for the first crediting period.
Consultation outcome	The Project has been received positively by the local stakeholders. Specifically, in FONAM's workshops the stakeholders' concerns and questions were discussed and answered thoroughly with the help of presentations, written material, maps and statistics. The main topics discussed were: • Environmental impacts during the Project's construction and their mitigation. • Water shortage and water quality within the river-bordering localities. • Support to communities through educational infrastructure. • Support to communities through health infrastructure. As a result of this consultation process the local stakeholders who participated agreed to support the implementation of the Project.
Ongoing communication	The way to received or have an ongoing communication that Río Doble provide is a mailbox available to the public where anyone can access for complain, comment and/or suggest since the project start date.

Stakeholder input

The comments of the local stakeholders were taken into account and are considered on the elaboration of the Social Investment Plan. Río Doble committed itself to the following, as registered in FONAM's report of the process:

- In March 2013, the company supported the dissemination of environmental knowledge by contributing with two environmental education modules, one for each secondary school of the region.
- In March 2012, the company supported the Santa Cruz high schools with modules 10 computers for each school (a total of 20 computers)
- In January, the company coordinated with the city of Santa Cruz the develop of a reforestation program.

All the information gathered from both meetings was compiled and detailed in a written report, and there are lists with the names and signatures of the participants.

During the COVID-19 pandemic, support was requested for the oxygen plant and ERD participated with 7,000 USD.

It is considered that it is not necessary to carry out new consultation and citizen information sessions since the initial implementation of the project there have been no complaints that suggest that there is any problem with the project activity or any issue to be resolved. Río Doble continues to meet its commitments to local citizens.

2.1.3 Free Prior and Informed Consent

Obtaining consent

In the stakeholder consultation process prior to the execution of the project, it was concluded that the population accepted the development of the "Las Pizarras" project, even considering it beneficial for more than 60% of the population for the development of the local communities.

Since then, Río Doble has been open to dialogue regarding any claim that may arise, and active with the local population, contributing and attending to their needs, beyond its responsibilities derived from the project activity.

There have been no conflicts or incidents from the beginning of the project to the present.

Outcome of FPIC	The entire consultation process is included in a report prepared by the National Environment Fund - Peru (FONAM), which transparently demonstrates the entire process of communication about the project and transmission of knowledge of climate change, images of interviews and workshops with the different main local groups and actors, as well as the final results of all consultations. This process demonstrates that it is not about encroached on land, relocated people without consent, and forced physical or economic displacement. The project was developed legally and with the necessary permits and authorizations from the competent administration, and always considering the possibility of social impacts to the population and their customs.
------------------------	---

2.1.4 Grievance Redress Procedure

Development process	Río Doble has a mailbox available to the general public for complaints, comments and/or suggestions. All complaints or contacts with Río Doble are and will be attended to and resolved.
Grievance redress procedure	Once a request is received, the legal scope is analyzed and, if applicable, a direct meeting is called or, if the contact by call or meeting is impossible, a written response is provided. So far, as an example of the satisfactory relationship with the stakeholders, only requests for support to collaborate with the Saint festivities of Santa Cruz have been received, which have been attended according to the defined method above.

2.1.5 Public Comments

Comments received	Actions taken
No comments received.	Río Doble complied with its commitments and what was agreed upon in the initial project meetings with stakeholders, and no additional comments were received since the initial information sessions. Even so, Río Doble continues carrying out actions to help schools in the area when they request it.

2.2 Risks to Stakeholders and the Environment

2.2.1 Management Experience

The team responsible for the operation and management of Empresa Eléctrica Rio Doble S.A. (ERD) is made up of professionals from various specialties with more than 15 years of experience. Specifically, the management team has remained in ERD since its construction stage (2011-2012) and throughout the commercial operation stage (2013), accumulating knowledge and experience in the implementation of the various ERD activities and programs and in the relationship with the local community.

In addition, the management team has participated in the planning and development of various energy projects in Peru, such as Potrero 20 MW Hydroelectric Plant (Cajamarca), Langui 6.2 MW Hydroelectric Plant (Cusco), Manta 19 MW Hydroelectric Plant (Ancash) Project San Lorenzo 3MW Hydroelectric Power Plant (Cajamarca), generating greater experience in the development of activities and relationships with communities around energy projects.

It is important to highlight that all the necessary knowledge on other topics such as environmental matters are contracted to specialist companies, which act as external advisors.

2.2.2 Risk Assessment

	Risks identified	Mitigation or preventative measure(s) taken
Natural and human-induced risks to stakeholders' wellbeing	Floods.	There is no risk to stakeholders associated to the project because of the human activity. However, as it is a river whose flow is closely related to rainfall, so overflow events and flooding of the river course may occur that affect the stakeholders and Rio Doble facilities. Río Doble has a contingency plan focused on ensuring the safety of personnel and operations. This plan does not include flood risks for other stakeholders, as the risk of flooding and its impact on the environment and populations is minimal. Due to the location of the hydropower plant (within a closed ravine), there are no populations or cultivable lands downstream for up to 6.7 km. The river flows through the ravine, which acts as a physical barrier to prevent flooding or

		overflow during periods of high-water levels. Additionally, the area is located in a highly naturalized environment with significant soil and vegetation absorption capacity, which serves as another natural barrier to mitigate environmental and social risks.
Risks to stakeholder participation	No risk identified.	The project has carried out a consultation process with stakeholders where prevention measures/of occupational hazards had been implemented during participation events, so that no risks are identified.
Working conditions	No risk identified.	All Project activities ensure safe working conditions for employees.
Safety of women and girls	No risk identified.	The Project does not involve harm to women and girls in the local community.
Safety of minority and marginalized groups, including children	No risk identified.	The Project doesn't involve risks in the protection of children and minority and marginalized groups from harm in the local community.
Pollutants (air, noise, discharges to water, generation of waste, and release of hazardous materials and chemical pesticides and fertilizers)	No risk identified.	As it is a run-of-river hydroelectric power plant, no pollutants risks associated with Project activities are identified. To guarantee that there is no impact on the environment, Río Doble carries out quarterly monitoring of noise, electromagnetic radiation, air quality and water quality (biannual).

2.3 Respect for Human Rights and Equity

2.3.1 Labor and Work

	Risks identified	Mitigation or preventative measure(s) taken
Discrimination	No risk identified.	There have been no complaints about discrimination cases and there is no evidence that there has been any case.

Sexual harassment	No risk identified.	There have been no complaints about sexual harassment cases and there is no evidence that there has been any case.
Equal pay for equal work	No risk identified.	The Project provides equal opportunities in the context of gender equity and remuneration of labor and work as there are two managerial positions in the plant and one of them is occupied by a woman, there are workers native and of the province and district of Santa Cruz as well as technicians who come from various provinces in the north of Peru and Río Doble is their first job placement, all of them with a job continuity for 4 – 6 years.
Gender equity in labor and work	No risk identified.	
Forced labor	No risk identified.	Rio Doble workers are declared on a way that is supervised by government authorities, using legal contracts, who ensure that there is no infringement their labor rights. In the same way, there are no hiring or labor exploitation of minors.
Child labor	No risk identified.	
Human trafficking	No risk identified.	

2.3.2 Human Rights

Risks identified	Mitigation or preventative measure(s) taken
No risk identified.	Rio Doble hires local staff and represents a great influence on the surrounding area. In addition, they are part of the management team. Guaranteeing them all the benefits or requirements of the law and conditions of the international human rights law, it demonstrates the commitment to respecting the right to work. In addition, the cultural events of the area are supported since they are part of the traditional celebrations of the area. There are no indigenous towns, tribal peoples, or peasant/farmers communities in the Project area.

2.3.3 Indigenous Peoples and Cultural Heritage

Risks identified	Mitigation(s) or preventative measure taken
------------------	---

No risk identified.	Rio Doble has supported and participated in the traditional celebrations of local populations, spaces in which art, dance and tourism are promoted in the areas involved.
---------------------	---

2.3.4 Property Rights

Risks identified	Mitigation or preventative measure(s) taken
No risk identified.	In the Project area there are no indigenous populations or peasant communities holding property rights, so this point does not apply.

2.3.5 Benefit Sharing

There are no property rights as is said the section 2.3.4 above, so doesn't apply the description of the project's benefit sharing agreement.

2.4 Ecosystem Health

In 2023, Rio Doble developed the Detailed Environmental Plan (PAD), which establishes the reference baseline of the project's area of influence and an environmental management plan, as well as citizen participation mechanisms. This Plan is delivered to the competent authority and is subsequently approved under *Decreto Supremo No. 014-2019*, "Regulation for the Environmental Protection of Electrical Activities". In this way, the interest in knowledge of environmental baseline and the development of a new action plan, Rio Doble continues showing commitment with the environment and its relationships with stakeholders.

	Risks identified	Mitigation or preventative measure(s) taken
Impacts on biodiversity and ecosystems	No risk identified.	Río Doble carries out quarterly monitoring of noise, electromagnetic radiation, air quality and water quality (biannual) that guarantee that there is no affection over biodiversity and ecosystems.
Soil degradation and soil erosion	No risk identified.	Not applicable. The project activity does not affect the soils.
Water consumption and stress	No risk identified.	The project activity does not produce water stress neither water consumption with its main activity since it is a run-of-river hydroelectric power plant. However, the alteration of the amount of

		water may be affected by the development of the operating sub activity of the collection components for the operation of the Las Pizarras HPP, but always respecting the ecological flow limits for the conservation aquatic flora and fauna.
--	--	--

2.4.1 Rare, Threatened, and Endangered Species

The project is not located in or adjacent to habitats than contains rare, threatened, or endangered species.

☒ Yes

☐ No

However, as all electricity generation activities, it has a transmission line with a larger area of influence for which an environmental impact study was carried out. In this study the presence of some threatened species was identified.

Species and habitat	Las Pizarras, due to its type of activity, does not present relevant risks or impacts to species, beyond the turbine action, nor is there any damage to ecological connectivity identified as it is a run-of-the-river hydroelectric plant. However, although the project activity does not present relevant impacts on the species and their ecosystems, EIA studies were carried out for the transmission line. Based on sources from the Ministry of the Environment of Peru, SERNANP and IUCN, some threatened species were identified in the area of influence of the transmission line: Birds: <i>Penelope barbata</i>: “Vulnerable” (UICN), “Endangered” (Decreto Supremo N°034-2004-AG) Rio Doble carries out periodic environmental monitoring in which bird mortality due to collision with the transmission line is monitored, and in that case, it is reported to the competent environmental authority. Flora: <i>Kageneckia lanceolata</i> (Endangered). However, it was not found during field works.
----------------------------	--

	• <i>Loxopterygium huasango</i> (<i>Endangered</i>). Confirm during field works. • <i>Polylepis racemosa</i> (<i>Endangered</i>). Confirm during field works. • <i>Tabebuia</i> sp. (<i>Endangered</i>). Confirm during field works. These species are not affected by the project activity as the flora is not in interaction with the transmission line. There are no threatened mammals, amphibians, reptiles or fish. However, there is an identified amphibian, <i>Hyloxalus elachyhistus</i>, that are not categorized as threatened in IUCN Red List but appears as <i>Near Threatened</i> on Perú DS N° 034-2004-AG. This species is not affected by the transmission line.
Areas needed for habitat connectivity	There are no relevant connectivity areas that are affected by the operation of the project, as it is a run-of-the-river hydroelectric plant.

	Risks identified	Mitigation or preventative measure(s) taken
Habitats for rare, threatened, and endangered species	There is only potential risk to birds due to the existence of the electrical transmission line.	The line was evaluated in EIA, and possible damage to birds is monitored and subsequently reported.
Areas for habitat connectivity	No risk identified.	The operation of the plant does not affect the connectivity of the habitats as it is a run-of-the-river hydroelectric plant that does not generate physical barriers. In addition, noise and water quality and quantity monitoring is carried out preventively to ensure the integrity of the ecosystem.

2.4.2 Introduction of Species

The Project doesn't involve the introduction of species, so this section is not required. In addition, no invasive species have been identified.

2.4.3 Ecosystem Conversion

The Project doesn't involve ecosystem conversion, so this section is not required.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The methodologies and tools applicable to the project activity are included in the following table:

Type (methodology, tool or module).	Reference ID, if applicable	Title	Version
Methodology	ACM0002	Grid-connected electricity generation from renewable sources.	22.0
Tool	07	Tool to calculate the emission factor for an electricity system.	7.0
Tool	01	Tool for the demonstration and assessment of additionality.	7.0.0
Tool	11	Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.	3.0.1

3.2 Applicability of Methodology

The choice of baseline methodology ACM0002 (Version 22.0) is justified for the proposed project activity as it satisfies the required applicability criteria. Table below demonstrate how the applicability conditions of the selected methodology and tools are met by the project activity:

Methodology ID	Applicability condition	Justification of compliance
ACM0002	1. 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);	It is a grid-connected renewable power generation project: run of river hydro power plant.

	(c) Involve a retrofit of (an) existing operating plant(s)/unit(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	
ACM0002	2. In case the project activity involves the integration of a BESS, the methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Integrate BESS with a Greenfield power plant; (b) Integrate a BESS together with implementing a capacity addition to (an) existing solar photovoltaic or wind power plant(s)/unit(s); (c) Integrate a BESS to (an) existing solar photovoltaic or wind power plant(s)/unit(s) without implementing any other changes to the existing plant(s); (d) Integrate a BESS together with implementing a retrofit of (an) existing solar photovoltaic or wind power plant(s)/unit(s).	Not applicable. The project doesn't involve the integration of a BESS.
ACM0002	3. The methodology is applicable under the following conditions: (a) 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	(a) The project activity includes a hydro power plant/unit without reservoir. (b) Not applicable. It is not a capacity addition, retrofit or replacement of an existing power plant. (c) Not applicable. The project doesn't involve the integration of a BESS.

	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; (c) In case of Greenfield project activities applicable under paragraph 7 (a) above, the project participants shall demonstrate that the BESS was an integral part of the design of the renewable energy project activity (e.g. by referring to feasibility studies or investment decision documents); (d) The BESS should be charged with electricity generated from the associated renewable energy power plant(s).	(d) Not applicable. The project doesn't involve the integration of a BESS.
ACM0002	4. 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 (7), 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 (7), is greater than 4 W/m²; or	There is no reservoir or regulating tank in the Project, as it involves only the construction of an intake, tunnel, low-pressure tunnel, forebay, and powerhouse.

	(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 (7), 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 (8), 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.	
ACM0002	5. In the case of integrated hydro power projects, project participants shall: (a) 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 (b) 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	Not applicable. This project doesn't integrate different hydro power projects.

	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 of five years prior to the implementation of the CDM project activity.	
ACM0002	6. The methodology is not applicable to: (a) 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; (b) Biomass fired power plants/units.	Not applicable. The project activity doesn't involve the use of fossil fuels or Biomass fired.
ACM0002	7. 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.
ACM0002	8. In addition, the applicability conditions included in the tools referred to below apply.	The project activity meets the applicability conditions included in the tools referred in the methodology (See Table below).

Tool ID	Applicability condition	Justification of compliance
TOOL 07	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).	The present project activity substitutes grid electricity by supplying clean and renewable electricity to a grid.
TOOL 07	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 emission factor for the project activity electricity system is calculated for grid power plants only.
TOOL 07	In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity electricity system is located exclusively in Perú.
TOOL 07	Under this tool, the value applied to the CO2 emission factor of biofuels is zero.	The CO2 emission factor of biofuels power plants connected to the grid is considered zero.

Tool ID	Applicability condition	Justification of compliance
TOOL 01	“This tool provides for a step-wise approach to demonstrate and assess additionality. These steps include: • Demonstration whether the proposed project activity is the first-of-its-kind; • Investment analysis to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible; • Barriers analysis; and	The project activity has followed the step-wise approach of the tool as it illustrated in section 3.5. This section of additionality section has not been modified with respect to the original PD.

Tool ID	Applicability condition	Justification of compliance
	Common practice analysis. Based on the information about activities similar to the proposed project activity, the common practice analysis is to complement and reinforce the investment and/or barriers analysis.¹ The steps are summarized in Figure 1”.	
TOOL 01	The document provides a general framework for demonstrating and assessing additionality and is applicable to a wide range of project types. Some project types may require adjustments to this general framework.	The present project applied the tool and did not required adjustments.
TOOL 01	This tool does not replace the need for the baseline methodology to provide a step-wise approach to identify the baseline scenario. Project participants that propose new baseline methodologies shall ensure consistency between the determination of additionality of a project activity and the determination of a baseline scenario. Project participants can also use the “Combined tool to identify the baseline scenario and demonstrate additionality”, which provides a procedure for baseline scenario identification as well as additionality demonstration.	ACM0002 provides the baseline scenario of the present hydroelectric project.

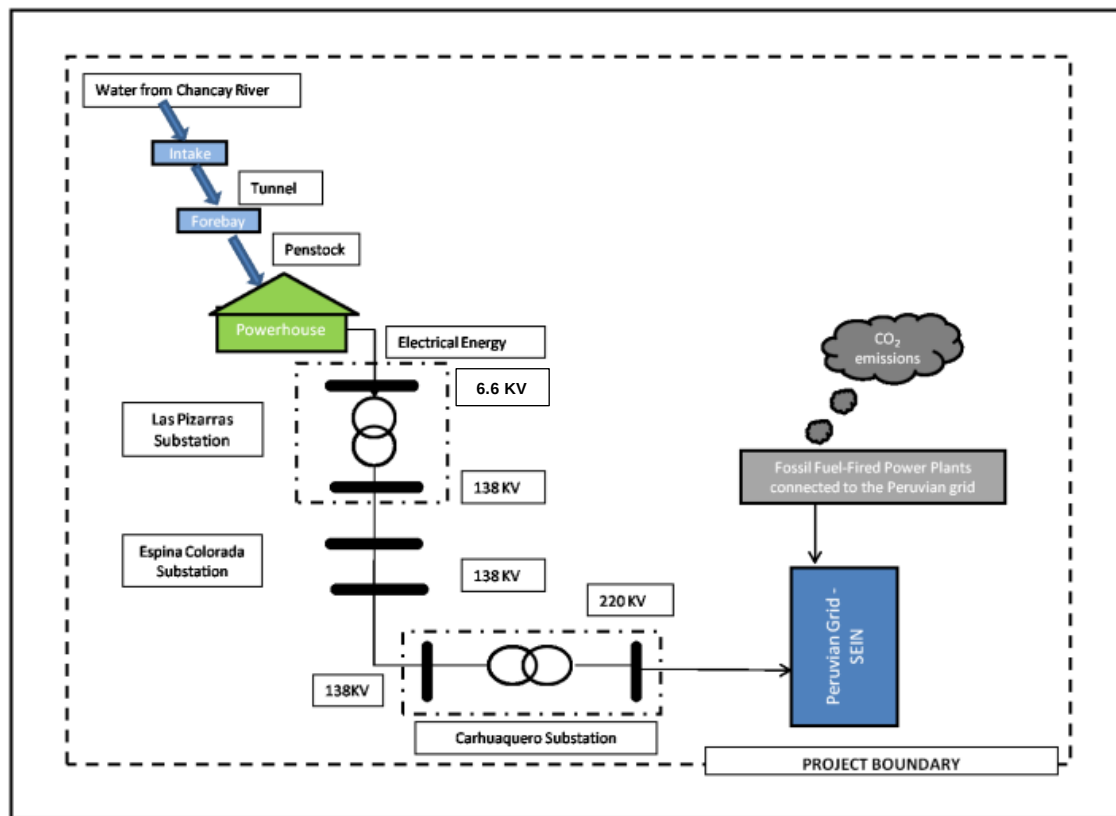
3.3 Project Boundary

According to ACM0002 Version 22.0, the spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to.

The Project boundary is the area of the concession of the Las Pizarras hydroelectric plant and transmission line. The Project is connected to the SEIN through a transmission line that feeds

into the Espina Colorada sub-station. The transmission line will reach the SEIN by interconnecting to the Carhuaquero 220 KV sub-station; so the SEIN is also included in the Project's boundary.

Source	Gas	Included?	Justification/Explanation
Baseline	CO ₂	Yes	In accordance with ACM0002, the baseline should only include CO ₂ fossil fuel fired power that is displaced due to the project activity.
	CH ₄	No	
	N ₂ O	No	
Project	CO ₂	No	Minor emission source
	CH ₄	No	The Project is not considering any reservoir or regulation tank for its normal operation, only a water diversion and a forebay
	N ₂ O	No	Minor emission source



Source: Project Developer.

Figure 3. Project Boundary

3.4 Baseline Scenario

ACM0002 “Grid-connected electricity generation from renewable sources” Version 22.0 identifies two options for defining the baseline scenario, dependent on whether the project activity is a new project or a modification or retrofit of an existing generation facility.

Since the proposed project activity does not involve the modification or retrofit of any existing electricity generation facilities, the baseline scenario is defined as: “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”.

The baseline scenario is calculated as a combined margin (CM), result of a weighted average of the operating margin (OM) and build margin (BM) factors calculated using steps specified in the “Tool to calculate the emission factor for an electricity system” (Version 07.0) which are outlined in detail in Section 5.1.

The Project considers the same baseline scenario as for the first crediting period (30/04/2013 - 29/04/2023), which is the National Interconnected Electricity Grid (SEIN).

The ex-ante emission reduction calculation considers the emission factor according to the “Tool to calculate the emission factor for an electricity system” (TOOL 07).

For the renewal of the crediting period and particularly with regards to the baseline, section 3.9.8 of the *VCS Standard*, Version 4.7 establishes:

“2) The validity of the original baseline scenario shall be demonstrated, or where invalid, a new baseline scenario shall be determined when renewing the project crediting period as follows:

a) The validity of the original baseline scenario shall be assessed. Such assessment shall include an evaluation of the impact of new relevant national and/or sectoral policies and circumstances on the validity of the baseline scenario.

b) Where it is determined that the original baseline scenario is still valid, the GHG emissions associated with the original baseline scenario shall be reassessed using the latest version of the *CDM Tool to assess the validity of the original/current baseline and to update the baseline at the renewal of a crediting period*.

c) Where it is determined that the original baseline scenario is no longer valid, the current baseline scenario shall be established in accordance with the VCS Program rules.”.

Thus, to demonstrate the validity of the updated baseline (above presented) an analysis following the Methodological Tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (Version 3.0.1) is presented below.

Step 1: Assess the validity of the current baseline for the next crediting period**Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies.**

According to the 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), “if 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 or the submission of the previous request for renewal of the crediting period and are applicable at the time of requesting renewal of the crediting period, go to Step 1.2”.

There are no new national and/or sectoral policies that have come into effect after the submission of the project for the first validation that are applicable to the project activity.

Therefore, at the time of requesting renewal of the crediting period all relevant mandatory national and/or sectoral policies are the same as those that were applicable at the time of submitting the project for validation and the current baseline complies with them.

Step 1.2: Assess the impact of circumstances

According to the tool, “in the situation where the baseline scenario identified at the validation of the project activity was the continuation of the current practice without any investment, an assessment of the changes in market characteristics is required for the renewal of the crediting period”.

The circumstances existing at the time COES of requesting renewal of the crediting period are similar to those that prevailed at the time of submitting the project activity to validation. The market characteristics for the electricity sector are still the same than described in the original baseline scenario. I.e.: the planning authority (COES) is still the same as originally described and the private sector is still the responsible actor in electricity generation, distribution and transmission market.

Therefore, there have not been relevant changes to the original circumstances in the market that could affect the applicability of the original baseline scenario.

The conditions used to determine the baseline emissions in the previous crediting period are still valid, as baseline emissions depend on the grid connected power plants operation.

Step 1.3: Assess whether the continuation of the use of current baseline equipment is the most likely scenario for the crediting period for which the renewal is requested.

According to the tool, “this sub-step should only be applied if the baseline scenario identified at the validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology”.

This sub-step is not applicable since the baseline scenario identified at the validation of the project has not been modified and the baseline didn't consider the use of any existing equipment by the project participant, because in the absence of the project activity the energy generated would have been generated by the operation of grid-connected power plants and by the addition of new generation sources to the grid. In addition, the end of the technical lifetime of the equipment(s) is not expected to be before the end of the crediting period because according to the manufacturer's reports, the turbines have a useful lifetime of 40 – 50 years.

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

According to the tool, in this step it should be assessed “whether data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are still valid or whether they should be updated”.

For the second crediting period, the CO₂ emission factor of the electricity system (which is relevant for the baseline emissions determination) is calculated according to the latest version of the “Tool to calculate the emission factor for an electricity system” and its calculation includes IPCC default values and local relevant data and parameters.

Thus, data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period need to be updated for the second crediting period.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

According to the tool, in this step it should be updated “the current baseline emissions for the subsequent crediting period, without reassessing the baseline scenario, based on the latest approved version of the methodology applicable to the project activity. The procedure should be applied in the context of the sectoral policies and circumstances that are applicable at the time of request for renewal of the crediting period”.

Since the original baseline is still in compliance with the current relevant mandatory national and/or sectoral policies of Peru and there are no new circumstances which may impact the validity of the project activity baseline, this step is not applied.

Step 2.2: Update the data and parameters

According to the tool “if the application of Step 1.4 showed that the data and/or parameters that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, project participants should update all applicable data and parameters, following the guidance in Step 1.4.”

As mentioned in Step 1.4, the emission factor of the electricity system has been updated, considering the latest IPCC default values and local relevant data and parameters. The updated values of data and parameters are described in section 4 below.

The conclusion regarding the assessment of the validity of the original baseline scenario, is that, in accordance with the procedures for renewal of the crediting period of a registered VCS project activity, the original baseline, as updated in accordance with the TOOL 11 (CDM UNFCCC) version 3.0.1 remains valid.

3.5 Additionality

In accordance with the *VCS Standard* (version 4.5), and since this is a Renewal document, this Additionality section remains fixed as recorded in the original PD. The additionality of the project is demonstrated in the following sections.

3.5.1 Regulatory Surplus

Peru is not an Annex I country of the Kyoto protocol, so it is not participating in the Assigned Amount Unit (AAU) markets. Also, the country has not implemented a national emission rights market. Peru is preparing a national registry for GHG mitigation measures that will collect, register, monitor and manage information whose main purpose is to help monitor the NDC at the national level.

So:

Is the project located in an UNFCCC Annex 1 or Non-Annex 1 country?

☐ Annex 1 country ☒ Non-Annex 1 country

Are the project activities mandated by any law, statute, or other regulatory framework?

☐ Yes ☒ No

3.5.2 Additionality Methods

As the ACM0002 methodology requires, the additionality of the Project is demonstrated on the basis of the *Tool for the demonstration and assessment of additionality* (Version 7.0.0). The step-wise assessment is outlined below.

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

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

As per ACM0002, *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*, since the Project activity is the installation of a new grid-connected renewable power plant, the baseline scenario is the electricity delivered to the grid by the project activity that 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 calculations described in the *Tool to calculate the emission factor for an electricity system*.

Therefore, two alternative scenarios are evaluated:

Scenario 1: Implementation of the Project as a hydroelectric power generation plant without CDM incentives.

Scenario 2: Continuation of the current practice, whereas the Project participants do not invest, and that power is generated by the operation of grid-connected power plants and by the addition of new generation sources.

Sub-step 1b: Consistency with mandatory laws and regulations:

The scenarios identified above are in compliance with all applicable legal and regulatory requirements, including the Electric Concessions Law.⁵ Some relevant articles of this law are described below:

- a) Article 1: Electricity generating activities can be developed by people or legal entities, i.e. private companies, whether they are Peruvian nationals or foreigners, as long as the legal entities are incorporated under Peruvian laws.
- b) Article 3: A concession is required for the development of hydropower plants (or geothermal power plants) if their installed capacity is greater than 500 kW.
- c) Article 4: An authorization is required to develop fossil fuel-fired power plants with an installed capacity greater than 500 kW.
- d) Article 6: The concessions and authorizations can be granted by Peru's Ministry 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) 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.

Therefore, under Step 1 both alternatives are plausible.

Step 2: Investment Analysis

The objective in this section will be to evaluate the financial attractiveness of the Project without CDM income. For the purpose of this PDD the investment analysis constitutes the ultimate barrier analysis with regard to the additionally of the project activity.

⁵ <http://www2.osinerg.gob.pe/MarcoLegal/pdf/LEYCE-DL25844.pdf> - Web link last accessed on 20/07/2011.

Sub-step 2a: Determine appropriate analysis method

Since the alternative to the Project activity is the supply of electricity from a grid and this is not an investment, a benchmark analysis is appropriate.

Sub-step 2b: Option III. Apply benchmark analysis

The financial indicator that will be used is the Project's internal rate of return (IRR). The Project IRR is compared to a calculated benchmark, a discount rate of 12% that has been selected as a benchmark to evaluate the economic viability of an investment in the electricity sector in Peru. This 12% discount rate is established by the government in the Electric Concession Law as the reference rate to evaluate investments in the power sector. This rate has also emerged in several studies as well as in official governmental decisions related to project investment evaluation.⁶

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

The main parameters of the IRR analysis are based on conservative assumptions available to the Project developer at the time of the investment decision, and are shown below:

Table 4. Main parameters for calculation of financial indicators

Parameters	Unit	Value	Data Source
Electricity Price – Peak Hours	USD per kWh	0.037087	OSINERGMIN Resolution N° 079-2010-OS/CD. Fixed prices applicable for the period between 01/05/2010 and 30/04/2011. ⁷
Electricity Price – Off-Peak Hours	USD per kWh	0.030155	OSINERGMIN Resolution N° 079-2010-OS/CD. Fixed prices applicable for the period between 01/05/2010 and 30/04/2011. ⁸
PPA Price	USD per kWh	0.064	Power Purchase Agreement Contract signed between the Ministry of Energy and Mines and Río Doble, dated 30/11/2010.

⁶ Law 25844 – Electric Concessions Law. Article 79, Page 40. A specific discount rate for the electric sector has been determined by the Ministry of Energy and Mines within the Peruvian Electric Concession Law, and is used principally by the electric sector regulator assessing the opportunity cost of investment for the new additions to the system in order to forecast and determine the regulated tariff in Peru. This discount rate is 12% and represents an official rate of discount for the Peruvian electric sector, and has been widely used 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. A copy of the concession law will be provided to the DOE. <http://www2.osinerg.gob.pe/MarcoLegal/pdf/LEYCE-DL25844.pdf> - Web link last accessed on 20/07/2011.

⁷ <http://www2.osinerg.gob.pe/Resoluciones/pdf/2010/OSINERGMIN%20No.079-2010-OS-CD.pdf> – Web link last accessed on 20/07/2011.

⁸ <http://www2.osinerg.gob.pe/Resoluciones/pdf/2010/OSINERGMIN%20No.079-2010-OS-CD.pdf> – Web link last accessed on 20/07/2011.

Parameters	Unit	Value	Data Source
PPA Volume	MWh per year	85,000	Power Purchase Agreement Contract signed between the Ministry of Energy and Mines and Río Doble, dated 30/11/2010.
Guaranteed Power Capacity Tariff	USD per kW per month	5.816327	OSINERGMIN Resolution N° 079-2010-OS/CD. Fixed prices applicable for the period between 01/05/2010 and 30/04/2011. ⁹
Generation Capacity	MW	18.00	Socoin (2011). Revisión de Estudios y Diseño (Revision of Studies and Design). 31/01/2011.
Load Factor	%	66.0	Socoin (2011). Revisión de Estudios y Diseño (Revision of Studies and Design). 31/01/2011.
Initial Investment	USD Mio.	33.73	Socoin (2011). Revisión de Estudios y Diseño (Revision of Studies and Design). 31/01/2011.
Running Costs – Operation & Maintenance	USD Mio. per year	0.79	Project developer calculations undertaken in January 2011.
Contribution to OSINERG	% of income per year	1.00	Executive Order No. 136-2002-PCM, dated 24/12/2002. ¹⁰
Water Tariff	% of income per year	1.00	Law 25844 – Rulebook for the Electric Concessions Law. Article 214, Page 92. ¹¹
Depreciation – Civil Works	years	33	Rulebook for the Income Tax Law, Chapter VI, Article 22: Sets the standard depreciation rates per category. ¹²
Depreciation – Machinery & Equipment	years	10	Rulebook for the Income Tax Law, Chapter VI, Article 22: Sets the standard depreciation rates per category. ¹³

⁹ <http://www2.osinerg.gob.pe/Resoluciones/pdf/2010/OSINERGMIN%20No.079-2010-OS-CD.pdf> – Web link last accessed on 20/07/2011.

¹⁰ <http://www.osinerg.gob.pe/newweb/uploads/JARU/CD/008fiscalizacion/ds136-2002-pcm.pdf> – Web link last accessed on 20/07/2011.

¹¹ <http://www2.osinerg.gob.pe/MarcoLegal/pdf/REGLACE.pdf> - Web link last accessed on 20/07/2011

¹² <http://www.sunat.gob.pe/legislacion/renta/reglamento.html#> - Web link last accessed on 20/07/2011.

¹³ <http://www.sunat.gob.pe/legislacion/renta/reglamento.html#> - Web link last accessed on 20/07/2011.

Parameters	Unit	Value	Data Source
Income Tax	%	30	Income Tax Law, Chapter VII, Article 55. ¹⁴
Distribution of Income to Workers	%	5	Law 892, Article 2. ¹⁵
Discount Rate	%	12	Law 25844 – Electric Concessions Law, Article 79, Page 40. ¹⁶
Exchange Rate	S/. per USD	2.842	OSINERGMIN Resolution N° 079-2010-OS/CD. Fixed prices applicable for the period between 01/05/2010 and 30/04/2011. ¹⁷
CER Price	EUR	11.88	Carbon Market Daily 16/12/2010.
Emission Factor	tCO ₂ e / MWh	0.65943	Calculated in accordance to the CDM rules, with latest available data.
Technical Lifetime of Project	Years	40	Andritz Hydro (2011). Technical lifetime assessment letter.

A comparison of the IRR for the proposed Project activity and the financial benchmark IRR (12%), with and without CDM revenues, is shown in Table 5. Without CDM revenues, the IRR of the total Project investment is 9.82%, which is considerably below the benchmark level. The proposed Project can be considered as financially unattractive to investors.

With the CDM revenue the IRR of the total investment would increase 194 basis points to 11.76%. The attractiveness of the Project activity to the new investor is improved with CDM revenue, as the Project has been made attractive from the combination of the return it brings out of its income from its operation and from the sale of emission reduction credits. Hence, the economic evaluation demonstrates the importance of CDM benefits to achieve more profitable margins that help to overcome the barriers presented in this document.

¹⁴ <http://www.sunat.gob.pe/legislacion/renta/ley/capvii.htm> - Web link last accessed on 20/07/2011.

¹⁵ <http://www.mintra.gob.pe/contenidos/archivos/prodlab/D.%20Leg.%20892%2011-11-96.pdf> - Web link last accessed on 20/07/2011.

¹⁶ <http://www2.osinerg.gob.pe/MarcoLegal/pdf/LEYCE-DL25844.pdf> - Web link last accessed on 20/07/2011.

¹⁷ <http://www2.osinerg.gob.pe/Resoluciones/pdf/2010/OSINERGMIN%20No.079-2010-OS-CD.pdf> – Web link last accessed on 20/07/2011.

Table 5. Comparison of financial indicator with and without CER revenue

Item	Unit	Without CER revenue	Benchmark	With CER revenue
IRR	%	9.82	12.00	11.76

Sub-step 2d: Sensitivity Analysis

For the proposed Project activity, the following financial parameters were taken as uncertainty factors for the sensitivity analysis as they constitute around or more than 20% of the Project revenues and expenses:

1. Energy Sales (from variations in the spot price of energy)
2. Energy Sales (from variations in the load factor)
3. Initial investment
4. Operation & Maintenance costs

Table 6 shows the variation magnitude that each one of the above parameters would need in order for the project IRR to reach the benchmark level.

Table 6. Sensitivity Analysis of Project IRR

Turning point condition to reach the benchmark of 12%			
Energy Sales (from variations in the price of energy)	Energy Sales (from variations in the load factor)	Initial Investment Costs	Operation & Maintenance Costs
22%	+38%	-18%	-154%

The probability of such large variations in any of these parameters is considered highly improbable in practical terms, as detailed below:

The revenues from energy sales are not projected to increase in levels superior to those analysed due to the following main reasons:

- (i) In the case of Las Pizarras HPP, most of the income during the first 20 years depends on a price fixed by the PPA. This price will only change if a factor based on the US PPI Index WPSSOP3500 (Finished Goods Less Food and Energy) increases or decreases more than 5% with respect to the previous year's factor, as established in the PPA Contract. However, an analysis of the behaviour of the

index for the past 20 years shows that there was never a fluctuation of the calculated factor that surpassed the $\pm 5\%$.¹⁸ Therefore, fluctuations over the established limits are considered highly improbable.

- (ii) The energy that is not sold through the PPA contract will be sold in the spot market. The energy price is set by the regulator OSINERGMIN, who calculates this price based on the cost of the fuel used in the total electricity generation, which is mainly natural gas and diesel. Natural gas has a very low price¹⁹ due to the Camisea contract, which also guarantees that the price will be kept at a similar level, impeding the set price by OSINERGMIN to increase significantly, and even leading it to a decrease.²⁰ Therefore, a variation in the income from energy sales rooted in an increase in the price of energy is not likely to occur due to variations in the spot price.
- (iii) Energy sales are not expected to increase due to an increase in the generation capacity (load factor) due to the fact that an increase in the load factor of 38% would mean a load factor higher than 100%, which is technically impossible.

The initial investment is not likely to decrease in levels superior to 10% as the figures are already conservative, and as mentioned prices have tended to increase during the last decade. Evidence even discusses the concern regarding the escalation of the cost of civil works for the hydropower projects in Peru which seems to have increased significantly higher than the general rate of inflation.²¹ Furthermore, the Project's last updated budget presents a figure of USD Mio. 42.56, which is already 26% higher than the investment figure available at the start date of the Project (14/03/2011).

The operation and maintenance costs are not likely to decrease in levels superior to 10% due to the fact that the Project developer undertook an extensive analysis of all items involved in the cost structure, and furthermore prices have tended to increase during the last decade.²²

¹⁸ http://data.bls.gov/timeseries/WPSSOP3500?include_graphs=false&output_type=column&years_option=all_years – Web link last accessed on 20/07/2011.

¹⁹ “The current Peruvian price of gas for power generation is below the opportunity cost, as set by the international market for traded LNG”, in ESMAP (2011), Peru Opportunities and Challenges for Small Hydropower Development, p. 19.

²⁰ “The low price of natural gas and the resulting low tariff for power generation (which is even declining in real terms) have made it very difficult for most small hydro projects to compete in the marketplace”, in ESMAP (2011), Peru Opportunities and Challenges for Small Hydropower Development, p. 19. It must be noted that reference to small hydro projects is intended for those that have a capacity smaller than 20MW.

²¹ ESMAP (2011), Peru Opportunities and Challenges for Small Hydropower Development, p. 21.

²² The wholesale general price index increased by 29% in the ten-year period from March 2001 to March 2011, while the construction materials price index increased by 51% for the same period, according to the economic data published by the National Institute of Statistics and Informatics (Instituto Nacional de Estadística e Informática – INEI): www.inei.gob.pe - Web link last accessed on 20/07/2011.

In conclusion, the sensitivity analysis conducted above confirms that the Project is not financially attractive for private investors and its successful implementation requires the assistance of the CDM revenues. As a result, the Project is considered additional under Step 2.

In the following Step 3: Barrier analysis provides additional difficulties the project activity is facing without discriminating the findings established in the investment analysis. Those information below are given for information purposes only and shall complement the investment analysis in its understanding.

Step 3: Barrier analysis

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

- **Investment barriers**

Aluz, the previous owner of Río Doble, needed project finance to develop the Las Pizarras Project. A shareholder agreement was therefore signed between Aluz and EnBW on 16/06/2010, where EnBW invested in 45% of the shares of Río Doble for the development of the CDM Project. The shareholder agreement clearly states that the Project is to be developed as a CDM project, and it reflects the fact that EnBW's sole motivation for investing was the acquisition of the emission reduction certificates that could be generated by the Project, as the agreement includes an Emission Reduction Purchase Agreement clause whereas EnBW is granted the right to acquire the generated CERs, and the agreement also includes a put option for EnBW to sell its shares if the Project is not registered under the CDM. Furthermore, EnBW's investment in a hydro power project in Peru is solely for the purpose of securing carbon credits for its own commitment's compliance, as according to the present strategy of the EnBW Group, Peru is not a target country for investments.²³

Hence, the previous owner had secured the project finance through EnBW's investment, which was conditioned on the CDM characteristic of the Project. This was key as the Project otherwise had limited possibilities for project finance without the CDM incentive. The Project's nature (small hydropower) faces a high risk premium in the eyes of traditional investors, who therefore pay little interest to hydro generation investment possibilities.²⁴ Local banks consider this type of project as high risk because of the associated risks that they accrue to all hydropower projects (i.e. construction risks, water availability risk), and their financing conditions increase project

²³ EnBW Annual Report (2010): "EnBW is focusing on selected countries in central and eastern Europe as well as Turkey", p. 105. See also pages 25 and 124.

²⁴ "Access to finance is limited by the high transaction costs in relation to profitability of such small projects, and also by the lack of familiarity of banks with the project characteristics and issues that need to be appraised. Although debt finance is available in principal, in actual fact developers would be unlikely to receive project financing for 12 to 15 years at competitive rates", in ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 49. It must be noted that reference to small hydro projects is intended for those that have a capacity smaller than 20MW.

development costs.²⁵ Furthermore, banks in average impose not only high interest rates for their credit, but also impose restrictive conditions (in terms of financial performance²⁶ and management), restrict their loans to short maturity terms which require high annually payments,²⁷ enquire high guarantees, and charge considerable transaction costs due to the fact that the corporate finance departments of the major banks have limited staff who are focused on larger transactions, leading them to have little interest in smaller projects located in remote areas that pose difficulties for the due diligence.²⁸ The Project's nature (hydropower) also faces a disadvantage when compared to the other common type of energy generation used in Peru, thermal generation. Under the existing regulatory framework in Peru, the payment that a generating unit receives for its electricity supply is in function of its contribution to the peak power demand (capacity). Firm capacity of thermal and hydroelectrically units are defined under the electric concessions law²⁹ as each unit's capacity to provide power to the grid with a high level of certainty. Under the calculation method proposed by the law, a hydroelectric unit faces a disadvantage if compared to a thermal plant, as the firm capacity of the former will always be lower than that of the latter and therefore hydroelectric units in general are less profitable considering projects of similar size and conditions.³⁰ Additionally, investment costs per KW for other technology options are considerably lower than those incurred by the Project, as shown below. All these issues place hydropower projects at a serious disadvantage when looking for traditional investment sources.

²⁵ "Small hydro projects suffer from their association with large hydro projects, where the completion risk is clearly greater. Even though few small hydro projects involve tunneling risk, the banks and asset fund managers take the view that completion risks are sufficiently great to require the involvement of large EPCs. But this significantly increases construction costs, which are under great pressure from the low tariff", in ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 50. It must be noted that reference to small hydro projects is intended for those that have a capacity smaller than 20MW.

²⁶ "Project financing is generally difficult to obtain and the debt-to-equity ratios required by Peruvian banks for such projects are high by international standards", in ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 35.

²⁷ "Although debt finance is available in principal, in actual fact developers would be unlikely to receive project financing for 12 to 15 years at competitive rates", in: ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 49. It must be noted that reference to small hydro projects is intended for those that have a capacity smaller than 20MW.

²⁸ 5 ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 39. It must be noted that reference to small hydro projects is intended for those that have a capacity smaller than 20MW.

²⁹ <http://www2.osinerg.gob.pe/MarcoLegal/pdf/LEYCE-DL25844.pdf> - Web link last accessed on 20/07/2011.

³⁰ COES (2009). Annual Statistics Report. Chapter XIII, p. 99.
<http://www.coes.org.pe/Dataweb2/2009/STR/estadistica/anual/anual.htm> - Web link last accessed on 20/07/2011.

Table 7. Capital cost for power generation technologies (USD/kW)

Capital cost per technology		
Technology	Size Range (MW)	Investment Cost (USD/kW)
Mini Hydro ¹	5.0	1,400 – 2,200
Gasoline/Diesel Power System ¹	5.0	600
Combustion Turbine ¹	150.0	490
Combined Cycle Turbine ¹	300.0	650
Las Pizarras HPP ²	18.00	1,873.73

¹ The World Bank. (2006). “Technical and Economic Assessment: Off Grid, Mini-Grid, and Grid Electrification Technologies Summary Report”.

² Socoin (2011). Revisión de Estudios y Diseño (Studies and Design Revision).

At the beginning of 2011 Aluz decided to sell the Project to Eólica Galenova, a company that had already manifested interest in the Project,³¹ considering the stable income it had secured by winning a RER (Renewable Energy Resources) auction whereas it was granted a power purchase agreement for an annual generation of 85,000 MWh at a fixed price,³² and especially the additional income the Project could achieve from CDM revenues that would allow it to reach a financial return comparable to the established government benchmark, making the Project an attractive investment (as demonstrated in step 2). Eólica Galenova’s purchase of Río Doble was based on a financial structure that considered CDM income, which is why on the same date that the total sale is confirmed in the Board of Directors (14/03/2011) an ERPA is signed between Río Doble (now owned by Eólica Galenova) and EnBW to secure this income.

• Technological barriers

With respect to the technical and technological issues that surround hydropower investment and credit, 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 the particular hydrological regimen, geological conditions, and possible design failures that can only be fully known ex-post. In terms of technology, hydropower plants constitute a much more challenging investment than fossil fuel-fired plants.

³¹ As stated in an email sent by Eólica Galenova / Alarde to the representative of Aluz on 18/12/2010.

³² The power purchase agreement (PPA) contract was granted by the Peruvian government and dated 28/05/2010, and later signed on 30/11/2011.

Moreover, fossil fuel-fired plants can also be built as close as necessary to the end-user, reducing considerably the transmission line investment costs.³³ In the case of the Project activity, the Las Pizarras Hydroelectric Plant can only be constructed on the selected site, considering the water availability and other geographical conditions, and it will only be possible with the development of a new transmission line.

These technological barriers are indirectly mitigated by the Project's CDM income as they add to the hydropower project's higher costs when compared to other technologies such as thermal, and also add to the causes for which local banks do not favour project finance for hydropower projects, as explained previously.

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 investment and technological barriers identified in sub-step 3a would not prevent scenario 2. Scenario 2 would probably lead to the growth in energy demand being met by another form of supply, most probably a fossil fuel-fired thermal plant, as these have been the business-as-usual scenario for energy generation in Peru since the Camisea gas project and the government's measures to promote the use of natural gas. The two-part system regulation for generation (capacity and energy) has favoured thermal units against hydro, and furthermore hydro projects have the disadvantage against thermal projects because of their need for longer transmission networks.³⁴ Fossil fuel-fired thermal plants have lower up-front investment costs and higher financial viability, as the limited financing options and investors lean towards natural gas investment due to the technology being more widely available and well-known, and to the fact that these projects are not regarded as risky as hydropower projects since they do not face water resource limitations and do not require unique and limited geographical conditions, being able to be located almost anywhere.

As a result, scenario 1 faces restrictions due to the identified investment and technological barriers. The only remaining scenario is the baseline (scenario 2), which implies no investment from the Project developer.

The barrier analysis conducted demonstrated that in addition to the restrictions identified the barriers are real, but not preventive.

Step 4: Common practice analysis

Step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.

The project activity has been analysed based on installed capacity, then the range will be between 9 MW and 27 MW.

³³ ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 51

³⁴ ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 51.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all} .

The applicable geographical is the one covered by the SEIN and considers only the projects that have started commercial operation before the start date of the project and are connected to the grid. Information used in the present analysis has been given by COES annual statistical report, information send via CD and formal letter of submission or online documents.³⁵

Registered CDM project activities and projects activities undergoing validation are not included in the evaluation. The following table details the operative power plants in the SEIN, their type, installed capacity and CDM condition.

The project plants in bold are in the range determined in Step1.

Table 8. Operative power plants in the SEIN

Power Plant	Technology	Energy source/fuel	Installed Capacity (MW)	CDM Status
Paramonga	TV	Bagasse	23.0	-
Pías	Francis	Hydro	6.3	Registered
Platanal	Pelton	Hydro	220.0	Registered
Chimay	Francis	Hydro	142.8	-
Yanango	Francis	Hydro	42.3	-
Huanchor	Francis	Hydro	18.4	-
Callahuanca	Pelton	Hydro	82.6	-
Huampani	Francis	Hydro	31.4	-
Huinco	Pelton	Hydro	258.4	-
Matucana	Pelton	Hydro	120.0	-
Moyopampa	Pelton	Hydro	75.4	-
Santa rosa	TG	Natural Gas	446.7	-
Ventanilla	Ccomb	Natural Gas	522.0	Registered
Malacas	TG	Natural Gas	135.7	-
Charcani I	Francis	Hydro	1.8	-
Charcani II	Francis	Hydro	0.6	-
Charcani III	Francis	Hydro	4.2	-
Charcani IV	Francis	Hydro	15.5	-
Charcani V	Pelton	Hydro	145.4	-
Charcani VI	Francis	Hydro	9.0	-
Chilina	CC	Diesel 2	48.5	-
Mollendo	Diesel	Residual 500	31.7	-
Pisco	TG	Natural Gas	74.8	-
Machupicchu	Pelton	Hydro	90.5	-
Caña Brava	Kaplan	Hydro	5.3	Registered

³⁵ Website: <http://www.coes.org.pe/>. 2011 statistics: http://www.coes.org.pe/wcoes/coes/salaprensa/estadistica_anual.aspx. Web link last accessed: 14/06/2012.

Power Plant	Technology	Energy source/fuel	Installed Capacity (MW)	CDM Status
Cañon del pato	Pelton	Hydro	246.6	-
Carhuaquero	Pelton	Hydro	95.1	-
Carhuaquero IV	Pelton	Hydro	10.0	Registered
<i>Chiclayo Oeste</i>	<i>Diesel</i>	<i>Residual 6</i>	<i>26.7</i>	-
<i>Chimbote</i>	<i>Tg</i>	<i>Diesel 2</i>	<i>21.0</i>	-
Las Flores	Tg	Natural Gas	192.5	-
Piura	Diesel - Tg	Residual 6 - Diesel 2	34.7	-
<i>Aricota I</i>	<i>Pelton</i>	<i>Hydro</i>	<i>23.8</i>	-
<i>Aricota II</i>	<i>Pelton</i>	<i>Hydro</i>	<i>11.9</i>	-
<i>Independencia</i>	<i>TG</i>	<i>Natural Gas</i>	<i>22.9</i>	-
Mantaro	Pelton	Hydro	798.0	-
Restitucion	Pelton	Hydro	210.4	-
Emergencia Trujillo	Diesel	Diesel 2	64.0	-
<i>Tumbes</i>	<i>Diesel</i>	<i>Residual 6</i>	<i>18.7</i>	-
Yuncan	Pelton	Hydro	130.1	At validation
Chilca	TG	Natural Gas	559.8	-
<i>Ilo1</i>	Diesel	Diesel 2	238.6	-
Ilo2	TV	Carbón	135.0	-
La Joya	Francis	Hydro	10.0	Registered
Kallpa	TG	Natural Gas	629.0	-
Roncador	Francis	Hydro	3.8	-
Huaycoloro	Diesel	Biogás	4.8	-
San Gaban II	Pelton	Hydro	110.0	-
Bellavista	Diesel	Diesel 2	4.8	-
Taparachi	Diesel	Diesel 2	6.7	-
Santa Cruz	Francis	Hydro	7.0	Registered
Santa Cruz II	Francis	Hydro	7.0	Registered
Purmacana	Francis	Hydro	1.8	-
Oquendo	TG	Natural Gas	31.0	-
San Nicolás	TG - TV	Diesel 2	68.5	-
Poechos ii	Kaplan	Hydro	10.0	Registered
Cahua	Francis	Hydro	43.6	-
Gallito Ciego	Francis	Hydro	34.0	-
Malpaso	Francis	Hydro	54.4	-
<i>Oroya</i>	Pelton	<i>Hydro</i>	<i>9.0</i>	-
<i>Pachachaca</i>	Pelton	<i>Hydro</i>	<i>9.0</i>	-
Pariac	Francis	Hydro	4.9	-
Yaupi	Pelton	Hydro	108.0	-
Huayllacho	Pelton	Hydro	0.3	-
Misapuquio	Pelton	Hydro	3.9	-
San Antonio	Francis	Hydro	0.6	-
San Ignacio	Francis	Hydro	0.5	-
Aguaytia	TG	Natural Gas	191.9	-

Source: COES

As per the previous table, N_{all} = is 12.

Step 3: Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number N_{diff} .

As can be seen in table 8:

- Power plants Paramonga (bagasse), Chiclayo Oeste, Chimbote and Tumbes (Residual fuel oil) and Independencia (natural Gas) are power plants with a different technology and energy/fuel source.
- Charcani IV is a hydro power plant implemented between 1959 and 1970. Therefore, the power plant construction and investment decision was made in a different regulatory and economic framework. The energy sector was significantly modified with the Electric Concessions Law in 1992 (desegregation in distribution, transmission and generation activities and companies, creation of a wholesale market and regulated market, concession system, among others). In addition, the project owner of Charcani IV is now Egasa³⁶, which is a public company created in 1994 under private law and is part of the FONAFE Corporation³⁷. In Peru, FONAFE is responsible for regulating and directing the business activities of the government, and then all productive companies where the government is the major shareholder are part of the corporation. By doing this, projects have to comply with special requirements in order to be implemented, e.g. fulfilling SNIP procedures (project evaluation system for governmental projects)³⁸. As a conclusion, Charcani IV faced a different investment climate in the date of the investment decision and is owned by a company with a different management structure compared to the project developer which is entirely private.
- Charcani VI faces the same conditions as Charcani IV. The power plant is property of EGASA and started operations in 1976³⁹, therefore is not considered similar to the proposed project activity since faced a different investment climate in the date of the investment decision and is owned by a company with a different management structure compared to the project developer.
- Aricota I and Aricota II have the same conditions as Charcani IV since the projects were implemented in 1966 and 1967. Now are owned by the public company under private

³⁶ EGASA <http://www.egasa.com.pe>. Charcani IV description on: <http://www.egasa.com.pe/esp/institucional/instalaciones/instalaciones.detalle.php?id=4>. Web link last accessed on 14/06/2012

³⁷ Fonafe webpage: <http://www.fonafe.gob.pe/portal?accion=empresas&t=1&i=5&o=01&m=3>. Web link last accessed on 14/06/2012

³⁸ http://www.mef.gob.pe/index.php?option=com_content&view=article&id=306&Itemid=100883. - Web link last accessed on 15/06/2012 and <http://www.fonafe.gob.pe/portal?accion=c&t=13&i=103&n=1&o=103&m=2> Web link last accessed on 14/06/2012

³⁹ Charcani VI, <http://www.egasa.com.pe/esp/institucional/instalaciones/instalaciones.detalle.php?id=00000000006>, Web link last accessed on 15/06/2012

law named Egesur⁴⁰ that is also part of FONAFE⁴¹. In addition, both projects operate with Pelton turbines while the proposed project will use Francis turbines.

- Oroya and Pachachaca also faced a different investment climate in the date of the investment decision since the power plant started operations in 1914⁴² and 1917⁴³ respectively. The power plants were built to satisfy the energy requirements of the company Cerro de Pasco Copper Corporation (or CENTROMIN, after the nationalization), then were part of the company Electroandes in 1996 and are now property of a private company named SN Power Perú Holding S.R.L.⁴⁴ In addition the projects operate with Pelton turbines while the proposed project will use Francis turbines.

Considering the previous paragraphs, 11 projects identified in Step 2 apply a different technology as per the descriptions Additionality Tool (Paragraph 9), then N_{diff} = is 11.

Step 4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity.

The result of the applicable two formulas is:

$$a) F = 1 - N_{diff} / N_{all} = 1 - 11/12 = 0.08$$

$$b) N_{all} - N_{diff} = 12 - 11 = 1$$

The result of a) is below 0.2 and the result of b) is below 3, then the project activity is not considered a common practice and is additional.

Additional comments on the Peruvian electric market

The investment environment for a hydropower project has not been enthusiastic. As a matter of fact, hydropower generation only increased by 5% from 2003 to 2007,⁴⁵ as almost all the

⁴⁰ EGESUR: <http://www.egesur.com.pe>. Web link last accessed on 15/06/2012. Aricota I <http://www.egesur.com.pe/pages/instal/aricota1.aspx> and Aricota II in <http://www.egesur.com.pe/pages/instal/aricota2.aspx>.

⁴¹ Fonafe webpage: <http://www.fonafe.gob.pe/portal?accion=empresas&t=1&i=2&o=01&m=3>. Web link last accessed on 14/06/2012

⁴² Oroya power plant description in SN Power webpage: <http://www.snpower.com.pe/operaciones/centrales-de-produccion/oroya>

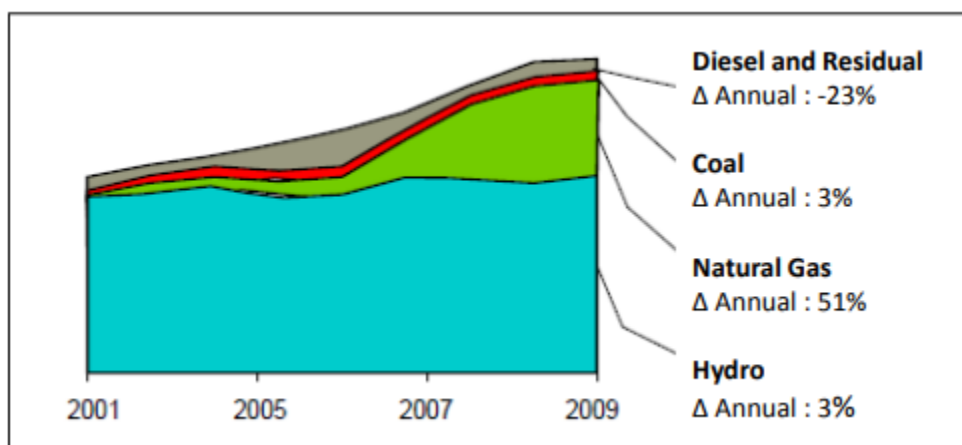
⁴³ Pachachaca power plant description in SN Power webpage: <http://www.snpower.com.pe/operaciones/centralesde-produccion/pachachaca>

⁴⁴ Equilibrium report (Risk classification). <http://www.equilibrium.com.pe/Electroandes.pdf>.

⁴⁵ ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 1.

increase in electricity demand has been supplied by new thermal generation,⁴⁶ which is a more viable investment in terms of costs and access to finance.

According to MINEM's 2010 report on Peru's electricity sector,⁴⁷ the evolution of the sources used for electricity generation shows that energy generated by the hydropower sector has increased 3% annually in the last five years, while the average annual growth in the use of natural gas for generation has been of 51%.



Source: Peru electricity sector 2010.⁴⁸

Figure 4. Evolution of the sources used for electricity generation

Under this scenario, the larger power plants that are interconnected to the SEIN use natural gas for energy production. The following table shows the thermoelectric power plants that have been added to SEIN since the year 2000.

Table 9. Thermoelectric power plants added to the SEIN since 2000

Power Plant	Date of Entry to the SEIN	Technology	Installed Capacity (MW)
Pisco TG1	September 2010	Natural gas turbine	37.40
Pisco TG2	September 2010	Natural gas turbine	37.40
Independencia	September 2010	Diesel/Natural gas turbine	22.93
Las flores	April 2010	Natural gas turbine	192.50
Kallpa TG3	February 2010	Natural gas turbine	233.00

⁴⁶ ESMAP (2011). Peru Opportunities and Challenges for Small Hydropower Development, p. 1.

⁴⁷ <http://www.minem.gob.pe/publicacion.php?idSector=6&idPublicacion=52> - Web link last accessed on 20/07/2011.

⁴⁸ <http://www.minem.gob.pe/publicacion.php?idSector=6&idPublicacion=52> - Web link last accessed on 20/07/2011.

Power Plant	Date of Entry to the SEIN	Technology	Installed Capacity (MW)
Paramonga	January 2010	Gas Turbine/Biomass	23.00
Santa Rosa TG8	August 2009	Natural gas turbine	193.18
Chilca 1 TG3	July 2009	Natural gas turbine	199.80
Trujillo Norte	June 2009	Diesel 2 / Residual	64.00
Kallpa TG2	June 2009	Natural gas turbine	216.00
Oquendo TG1	January 2009	Natural gas turbine	31.00
Chilca 1 TG2	July 2007	Natural gas turbine	179.24
Kallpa TG1	July 2007	Natural gas turbine	180.00
Chilca 1 TG1	December 2006	Natural gas turbine	179.24
Ventanilla	October 2006	Combined cycle	457.00
Santa Rosa UTI5 –UTI6	August 2006	Natural gas turbine	119.20
Santa Rosa WTG7	June 2005	Natural gas turbine	127.50
Yarinacocha	March 2003	Diesel 2 / Residual	25.36
San Nicolas Cummings	July 2001	Diesel 2 / Residual	1.25
Tumbes	February 2001	Diesel 2 / Residual	18.68
Ilo2 TV1	August 2000	Steam Turbine / Coal	135.20

Source: COES Annual Statistic Reports⁴⁹

The following table shows the hydropower plants that have been added to SEIN since the year 2005.

Table 10. Hydropower plants added to the SEIN since 2005

Power Plant	Date of Entry to the SEIN	Technology	Installed Capacity (MW)	CDM Status
Santa Cruz II ⁵⁰	May 2010	Hydro	3.50	Registered project
Poehos II ⁵¹	April 2010	Hydro	10.00	Registered project

⁴⁹ <http://www.coes.org.pe/wcoes/coes/estadistica/estadanual.aspx> - Web link last accessed on 20/07/2011.

⁵⁰ <http://cdm.unfccc.int/Projects/DB/AENOR1265015026.4/view> - Web link last accessed on 20/07/2011.

⁵¹ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1210240197.56/view> - Web link last accessed on 20/07/2011.

Power Plant	Date of Entry to the SEIN	Technology	Installed Capacity (MW)	CDM Status
Roncador	April 2010	Hydro	3.80	-
El Platana ⁵²	December 2009	Hydro	220.00	Registered project
La Joya ⁵³	July 2009	Hydro	10.00	Registered project
Santa Cruz I ⁵⁴	February 2009	Hydro	6.20	Registered project
Caña Brava ⁵⁵	November 2008	Hydro	5.31	Registered project
Carhuaquero IV ⁵⁶	May 2008	Hydro	10.00	Registered project
Santa Rosa I ⁵⁷	January 2006	Hydro	1.02	Registered project
Yuncan ⁵⁸	August 2005	Hydro	130.14	Validation

Source: COES Annual Statistic Reports⁵⁹

This scenario is a result of the discovery of substantial gas fields in the country.⁶⁰ The government has been developing the domestic natural gas market to obtain energy self-sufficiency and attend the growing energy demand. Therefore, newly constructed hydropower plants are not common practice, but sporadically built as a result of special conditions.

Natural Gas promotion in Peru began in 1999, when the law for the Promotion of Development of the Natural Gas Industry (Law No. 27133)⁶¹ was promulgated. Thus, since the year 2000 the contracts were signed for the development of the Camisea Project. The studies to exploit the Camisea natural gas estimated that reserves were of 11 TCF (Trillion cubic feet) of natural gas

⁵² <http://cdm.unfccc.int/Projects/DB/DNV-CUK1236231305.7/view> - Web link last accessed on 20/07/2011.

⁵³ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1214563651.47/view> - Web link last accessed on 20/07/2011.

⁵⁴ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1234847056.6/view> - Web link last accessed on 20/07/2011.

⁵⁵ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1195731585.43/view> - Web link last accessed on 20/07/2011.

⁵⁶ <http://cdm.unfccc.int/Projects/DB/DNV-CUK1195027195.68/view> - Web link last accessed on 20/07/2011.

⁵⁷ <http://cdm.unfccc.int/Projects/DB/SGS-UKL1125047848.33/view> - Web link last accessed on 20/07/2011.

⁵⁸ http://www.dnv.com/focus/climate_change/upload/peru%20yuncan%20pdd%20-%20final%20version%2025%20september%202007.pdf - Web link last accessed on 20/07/2011.

⁵⁹ <http://www.coes.org.pe/wcoes/coes/estadistica/estadanual.aspx> - Web link last accessed on 20/07/2011.

⁶⁰ The San Martín and Cashiriari fields (known as Block-88 - Camisea) are home to one of the most important non-associated natural gas reserves in Latin America and represent around ten times all of the other existing natural gas reserves in Peru. <http://www.camisea.pluspetrol.com.pe/project.asp> - Web link last accessed on 20/07/2011.

⁶¹ http://www.minem.gob.pe/minem/archivos/file/Hidrocarburos/normas_legales/ley27133.pdf - Web link last accessed on 20/07/2011.

and that the estimated recovery, considering the proven and probable, was of 8.24 TCF of gas and 482 million barrels of natural gas liquids. Natural Gas price and promotion policies of the government have made the use of this fuel in generating electricity more feasible, generating significant investments in the installation of new power plants since then.

All this is reflected in the evolution of natural gas consumption, as natural gas has become one of the most important components in the electric power generation of the SEIN. The 2010 annual report of the Committee for the System's Economic Operation (COES) shows that the use of the Camisea natural gas for electricity generation has been increasing over time, while hydropower production has increased very little compared to this.

In the case of the hydropower plants that have been interconnected to the SEIN since the year 2005, almost all of them have been registered as CDM projects or are under validation process. The only exception to this behaviour is the Roncador Hydropower Plant, which cannot be considered as similar to the proposed Project activity due to the fact that the Roncador project is a 3.8 MW project with an investment cost of 658 USD/kW,⁶² which is considered very low when compared to the Las Pizarras Project (representing 7.4% of the investment cost of Las Pizarras). Based on these elements, it is clear that the construction of thermal power plants has been the common practice in the country, adding most of the power generation capacity over the last years. Furthermore, over the last 6 years all hydropower projects have been registered under the CDM or are currently under validation (except, as mentioned, Roncador). In the case of the thermal power plants, only the Ventanilla thermoelectric plant has applied to the CDM for the conversion of a single cycle system to a combined cycle system.

3.6 Methodology Deviations

There is no methodology deviation. Not applicable.

⁶² Ministerio de Energía y Minas (2007). Portafolio de Proyectos de Centrales de Generación (Portfolio of generation projects), p. 36.

4 QUANTIFICATION OF ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The baseline emission is calculated as the product of electrical energy baseline $EG_{PJ,y}$ expressed in MWh, produced by the renewable generating unit and multiplied by the grid emission factor:

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

Where:

BE_y : Baseline Emission in year y (tCO₂).

$EG_{PJ,y}$: 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 CO₂ emission factor for grid connected power generation in year y calculated using the latest version of the Tool to calculate the emission factor for an electricity system (tCO₂/MWh).

Calculation of $EG_{PJ,y}$

The calculation of $EG_{PJ,y}$ is different for (a) Greenfield plants, (b) retrofits and replacements, and (c) capacity additions.

Since the project involves 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 (Case (a) Greenfield plant), 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).

$EG_{\text{facility},y}$: Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr).

The net electricity generation is estimated to be 106,598 MWh per year.

$$EG_{PJ,y} = EG_{\text{facility},y} = 106,598 \text{ MWh per year}$$

Calculation of the emission factor (EF) of the national electricity grid

The Tool to calculate the emission factor for an electricity system determines the CO₂ emission factor for the displacement of electricity generated by power plants in an electricity system by calculating the “operating margin”, “build margin” and “combined margin” through the following 6 steps:

Step 1: Identify the relevant electric power system.

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

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

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

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

Step 6: Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electric power system

The electricity generation will be supplied to the SEIN, therefore the project displaces consumption of energy from Peru's SEIN.

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

The Tool proposes 2 options:

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.

Because the data from grid connected power plants is available, Option I is chosen for the calculation of the grid emission factor.

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

Out of four options for the OM, the Dispatch Data Analysis OM (OM-DD) was selected. The Simple OM method cannot be used since low cost, must-run resources constitute more than 50% of total grid generation in Perú. 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

As it says above, at the time that the Project's baseline study was completed, the hourly generation data for the year 2023 had not yet been published in the Official COES website. Therefore, for this calculation the hourly generation in 2022 was used, as it was the most recent data available. For the first monitoring period, as non-ex-ante factor, EFOM will be calculated for 2023.

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

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

Where:

$EF_{grid,OM-DD,y}$ = Dispatch data analysis operating margin CO₂ emission factor in year y (tCO₂/MWh).

$EG_{PJ,h}$ = Electricity displaced by the project activity in hour h of year y (MWh).

$EF_{EL,DD,h}$ = CO₂ emission factor for grid power units in the top of the dispatch order in hour h in year y (tCO₂/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.

The hourly emissions factor is calculated based on the energy efficiency of the grid power unit and the fuel type used.

The hourly emission factor for power units at the top of the dispatch order in each hour is calculated as follows:

$$EF_{EL,DD,h} = (\sum_n EG_{n,h} \times EF_{EL,n,y}) / \sum_n EG_{n,h}$$

Where:

$EF_{EL,DD,h}$ = CO₂ emission factor for grid power units in the top of the dispatch order in hour h in year y (tCO₂/MWh).

$EG_{n,h}$ = Net quantity of electricity generated and delivered to the grid by grid power unit n, in hour h (MWh).

$EF_{EL,n,y}$ = CO₂ emission factor of grid power unit n, in year y (tCO₂/MWh).

n = Grid power units at the top of the dispatch order.

h = Hours in year y in which the project activity is displacing grid electricity.

To determine the set of grid power units n that are at the top of the dispatch order at each hour h , the power units were stacked using the merit order. The group of power units n in the dispatch margin includes the units at 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 generations by grid power plants during that hour h .

The greater of them is chosen, being the one corresponding to the 10%, as option A defined: if 10 per cent falls on part of the generation of a unit, the generation of that unit is fully included in the calculation.

The CO₂ emission factor of the power unit ($EF_{EL,n,y}$) is calculated as per the guidance for the simple OM, using the option A2.

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

Where:

$EF_{EL,m,y}$ = CO₂ emission factor of power unit n in year y (tCO₂/MWh).

$EF_{CO2,n,i,y}$ = Average CO₂ emission factor of fuel type i used in power unit n in year y (tCO₂/GJ).

$\eta_{n,y}$ = Average net energy conversion efficiency of power unit n 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).

Table 11. Emission Factors for Thermal Units in the SEIN in 2022 ⁶³

THERMAL PLANTS (1)	THERMAL PLANTS (2)	TECHNOLOGY (1)	FUEL (1)	η_{th} (%) EFFICIENCY (1)	$EF_{CO_2,th}$ KgCO ₂ /TJ (3)	Emissions Factor $EF_{L,th}$ (tCO ₂ /MW h) (4)
AGUAYTIA TG 1 - GAS	C.T. AGUAYTIA_AGE_TG1	TURBINA DE GAS	GAS NATURAL	32,9%	54,300	0,5943
AGUAYTIA TG 2 - GAS	C.T. AGUAYTIA_AGE_TG2	TURBINA DE GAS	GAS NATURAL	32,9%	54,300	0,5948
CALLAO - BIOGAS	C.T.B. CALLAO_G1,2 CALLAO	MOTOR RECIPROCANTE	BIOGAS	34,1%	46,200	0,4884
CANA BRAVA TV1 - BAGAZO	C.T. CAÑA BRAVA_G-FAB-G01	TURBINA DE VAPOR	BAGAZO	11,5%	84,700	2,6461
CANA BRAVA TV2 - BAGAZO	C.T. CAÑA BRAVA_G-FAB-G02	TURBINA DE VAPOR	BAGAZO	4,6%	84,700	6,6484
CHILCA1 CCOMB TG1 & TG2 - GAS	C.T. CHILCA_1_CHILCA1_TV	CICLO COMBINADO	GAS NATURAL	57,3%	54,300	0,3411
CHILCA1 TG1 - GAS	C.T. CHILCA_1_CHILCA1_TG11	TURBINA DE GAS	GAS NATURAL	37,4%	54,300	0,5220
CHILCA1 TG2 - GAS	C.T. CHILCA_1_CHILCA1_TG12	TURBINA DE GAS	GAS NATURAL	38,5%	54,300	0,5078
CHILCA1 TG3 - GAS	C.T. CHILCA_1_CHILCA1_TG13	TURBINA DE GAS	GAS NATURAL	36,2%	54,300	0,5394
CHILCA2 CCOMB TG41 - GAS	C.T. CHILCA_2_CHILCA2_TV42	CICLO COMBINADO	GAS NATURAL	54,1%	54,300	0,3614
CHILCA2 TG41 - GAS	C.T. CHILCA_2_CHILCA2_TG41	TURBINA DE GAS	GAS NATURAL	36,2%	54,300	0,5395
CHILINA SULZ 12 - D2	C.T. CHILINA DIESEL_CHI_SLZ12_SLZ1,2	MOTOR RECIPROCANTE	DIESEL 2	37,7%	72,600	0,6933
CHILINA TG - D2	C.T. CHILINA DIESEL_CHILT_G TG	TURBINA DE GAS	DIESEL 2	22,5%	72,600	1,1629
CTNEPITG41D2	C.T. NEPI_NEPI_TG41	TURBINA DE GAS	DIESEL 2	38,5%	72,600	0,6787
CTNEPITG42D2	C.T. NEPI_NEPI_TG42	TURBINA DE GAS	DIESEL 2	38,7%	72,600	0,6754
CTNEPITG43D2	C.T. NEPI_NEPI_TG43	TURBINA DE GAS	DIESEL 2	38,5%	72,600	0,6790
DOMACATALINA - BIOGAS	C.T.B. DOÑA CATALINA_Catalina_G1,2	MOTOR RECIPROCANTE	BIOGAS	39,2%	46,200	0,4239
FENIX CCOMB GT11 & GT12 - GAS	C.T. FENIX_FENIX_TV10	CICLO COMBINADO	GAS NATURAL	57,4%	54,300	0,3408
FENIX GT11 - GAS	C.T. FENIX_FENIX_GT11	TURBINA DE GAS	GAS NATURAL	37,8%	54,300	0,5168
FENIX GT12 - GAS	C.T. FENIX_FENIX_GT12	TURBINA DE GAS	GAS NATURAL	38,0%	54,300	0,5138
HUAYCOLORO - BIOGAS	C.T. HUAYCOLORO_Huay_G1,2,3	MOTOR RECIPROCANTE	BIOGAS	35,7%	46,200	0,4657
ILO2 TV1 - CARB	C.T. ILO 2_ILO2_CARB_TV1	TURBINA DE VAPOR	CARBÓN	38,5%	87,300	0,8164
INDEPENDENCIA GAS	C.T. INDEPENDENCIA_INDEP_WAR1,2,3,4	MOTOR RECIPROCANTE	GAS NATURAL	42,8%	54,300	0,4572
KALLPA CCOMB TG1 & TG2 & TG3 - GAS	C.T. KALLPA_KALLPATV	CICLO COMBINADO	GAS NATURAL	56,7%	54,300	0,3449
KALLPA TG1 - GAS	C.T. KALLPA_KALLPATG1	TURBINA DE GAS	GAS NATURAL	36,3%	54,300	0,5382
KALLPA TG2 - GAS	C.T. KALLPA_KALLPATG2	TURBINA DE GAS	GAS NATURAL	35,2%	54,300	0,5553
KALLPA TG3 - GAS	C.T. KALLPA_KALLPATG3	TURBINA DE GAS	GAS NATURAL	35,8%	54,300	0,5465
LAGRINGAV - BIOGAS	C.T. LA GRINGA_Gringa_G1,2	MOTOR RECIPROCANTE	BIOGAS	33,7%	46,200	0,4943
LFLORES CCOMB TG1 - GAS	C.T. LAS FLORES_TV-LAS FLORES	CICLO COMBINADO	GAS NATURAL	58,0%	54,300	0,3370
LFLORES TG1 GAS	C.T. LAS FLORES_TG1-LAS FLORES	TURBINA DE GAS	GAS NATURAL	38,7%	54,300	0,5050
MALACAS1 TG 6 - GAS	C.T. MALACAS_1_TG6	TURBINA DE GAS	GAS NATURAL	38,1%	54,300	0,5135
MALACAS2 TG 4 - GAS	C.T. MALACAS_2_M_TG4	TURBINA DE GAS	GAS NATURAL	33,9%	54,300	0,5771
MALACAS3 TG 5 - GAS	C.T. RF DE GENERACION TALARA_M_TG5	TURBINA DE GAS	GAS NATURAL	30,8%	54,300	0,6337
MAPLE - BAGAZO	C.T. MAPLE ETANOL_MAPLE ETANOL_TV	TURBINA DE VAPOR	BAGAZO	20,0%	84,700	1,5214
MOLLEND 123 - D2	C.T. MOLLEND DIESEL_MOLL123_GD1,2,3	MOTOR RECIPROCANTE	DIESEL 2	41,6%	72,600	0,6281
OLLEROS CCOMB TG1 - GAS	C.T. OLLEROS_OLLEROS_TV	CICLO COMBINADO	GAS NATURAL	55,1%	54,300	0,3551
OLLEROS TG1 - GAS	C.T. OLLEROS_OLLEROS TG1	TURBINA DE GAS	GAS NATURAL	35,3%	54,300	0,5532
OQUENDO TG1 - GAS	C.T. OQUENDO_OQUENDO_TG1	TURBINA DE GAS	GAS NATURAL	34,2%	54,300	0,5719
PARAMONGA - BAGAZO	C.T. PARAMONGA_TGVO1	TURBINA DE VAPOR	BAGAZO	13,5%	84,700	2,2658
PTO_BRVO TG1 - D2	C.T. PUERTO BRAVO_PUERTO BRAVO TG1	TURBINA DE GAS	DIESEL 2	36,2%	72,600	0,7222
PTO_BRVO TG2 - D2	C.T. PUERTO BRAVO_PUERTO BRAVO TG2	TURBINA DE GAS	DIESEL 2	35,8%	72,600	0,7301
PTO_BRVO TG3 - D2	C.T. PUERTO BRAVO_PUERTO BRAVO TG3	TURBINA DE GAS	DIESEL 2	36,3%	72,600	0,7203
PTO_BRVO TG4 - D2	C.T. PUERTO BRAVO_PUERTO BRAVO TG4	TURBINA DE GAS	DIESEL 2	36,0%	72,600	0,7266
RECKA TG1 - D2	C.T. RECKA_RECKA TG1-01MKA10	TURBINA DE GAS	DIESEL 2	34,9%	72,600	0,7487
RF ETEN TG1 - D2	C.T. RF DE GENERACION ETEN_RF ETEN TG1	TURBINA DE GAS	DIESEL 2	35,3%	72,600	0,7410
RF ETEN TG2 - D2	C.T. RF DE GENERACION ETEN_RF ETEN TG2	MOTOR RECIPROCANTE	DIESEL 2	44,7%	72,600	0,5849
RF ILO2 TG1 - D2	C.T. RF PLANTA ILO_PLANTAILO_TG1	TURBINA DE GAS	DIESEL 2	36,7%	72,600	0,7120
RF ILO2 TG2 - D2	C.T. RF PLANTA ILO_PLANTAILO_TG2	TURBINA DE GAS	DIESEL 2	36,6%	72,600	0,7145
RF ILO2 TG3 - D2	C.T. RF PLANTA ILO_PLANTAILO_TG3	TURBINA DE GAS	DIESEL 2	36,8%	72,600	0,7095
RF PTO MALDONADO - D2	C.T. RF PTO MALDONADO_G1-G11	MOTOR RECIPROCANTE	DIESEL 2	33,1%	72,600	0,7896
RF PUCALLPA - D2	C.T. RF PUCALLPA_G1-G25	MOTOR RECIPROCANTE	DIESEL 2	33,0%	72,600	0,7909
SAN NICOLAS CUMMINS - D2	C.T. SAN NICOLAS_CUMMINS	MOTOR RECIPROCANTE	DIESEL 2	38,9%	72,600	0,6719
SAN NICOLAS TV 1 - R500	C.T. SAN NICOLAS_SH_TV1	TURBINA DE VAPOR	RESIDUAL	25,8%	46,200	0,6454
SAN NICOLAS TV 2 - R500	C.T. SAN NICOLAS_SH_TV2	TURBINA DE VAPOR	RESIDUAL	26,4%	46,200	0,6293
SAN NICOLAS TV 3 - R500	C.T. SAN NICOLAS_SH_TV3	TURBINA DE VAPOR	RESIDUAL	25,9%	46,200	0,6417
SAN JACINTO - BAGAZO	C.T. SAN JACINTO_G1	TURBINA DE VAPOR	BAGAZO	9,3%	84,700	3,2704
STA ROSA UTI 5 - GAS	C.T. SANTA ROSA_I_UTI5	TURBINA DE GAS	GAS NATURAL	29,4%	54,300	0,6650

⁶³ COES Annual Statistics reports 2022. Folder No.4. Energy resources used in the Sein: Table C.8. CV of COES thermoelectric power plants: <https://www.coes.org.pe/Portal/Publicaciones/Estadisticas/>

COES Generation Meters records 2022. Monthly generation data every 15 minutes of Active Power (MW): <https://www.coes.org.pe/Portal/mediciones/medidoresgeneracion>

The information on the hourly generation of all plants in the SEIN and their associated emission factors was entered using excel software and organized in columns where the position of the columns was determined by the monthly grid dispatch merit order. This organization helped identify the plants that fall within the X% of grid dispatch order each hour of the year.

The resulting OM-DD emission factor had been calculated as follows:

$$EF_{grid, OM-DD, y} = \frac{(\sum_h EG_{PJ, h} \times EF_{EL, DD, h})}{EG_{PJ, y}}$$

$$EF_{grid, OM-DD, 2022} = 60,334.11 / 106,598.00$$

$$EF_{grid, OM-DD, 2022} = 0.565 \text{ tCO}_2/\text{MWh}$$

Please refer to “OM 2022_PD_v1” spreadsheet attached for detailed information and calculations.

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

In terms of vintage of data Option 1 has been chosen, where the build margin emission factor is calculated as an ex-ante parameter for the crediting period. Thus, according to the TOOL 07 Version 07.0: “For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. This option does not require monitoring the emission factor during the crediting period.”

According to the Tool to calculate the emission factor for an electricity system, the sample group of power units m used to calculate the build margin should be determined as per the following procedure, consistent with the vintage data 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 (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEGtotal, 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 AEGtotal (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh);

(c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SETsample); Identify the date when the power units in

SETsample started to supply electricity to the grid. If none of the power units in SETsample started to supply electricity to the grid more than 10 years ago, then use SETsample to calculate the build margin. Ignore steps (d), (e) and (f).

(d) Exclude from SETsample 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 activity, 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 (SETsample-CDM) the annual electricity generation (AEGSET-sample-CDM, in MWh); If the annual electricity generation of that set is comprising at least 20% of the annual electricity generation of the project electricity system (i.e. $AEGSET\text{-}sample\text{-}CDM \geq 0.2 \times AEG_{total}$), then use the sample group SETsample-CDM to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group SETsample-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);

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

Therefore, the sample group of power units m used to calculate the build margin has been determined according to the stepwise of the tool as: the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and no more than 10 years ago, and that comprise 20 per cent of the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}), as it comprises the larger annual electricity generation (SETsample).

A power unit is considered to have been built at the date when it started to supply electricity to the grid.

Capacity additions from retrofits of power plants were not included in the calculation of the build margin emission factor, as required in the TOOL 07.

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 power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

EF_{grid,BM,y} = Build margin CO2 emission factor in year y (tCO2/MWh);

EG_{m,y} = Net 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 (tCO2/MWh);

m = Power units included in the build margin;

y = Most recent historical year for which power generation data is available.

According to TOOL 07 “Tool to calculate the emission factor for an electricity system” (Version 07.0) the following procedures must be followed:

- a) The five set of latest power units (excluding CDM) supplying to the grid (SET5-units) has been determined and calculated the generation of each power plants:
 - Set of latest five power units (excluding CDM) that supply to the grid (SET5-units) represent 3,123,211.25 MWh.

<i>m</i>	COMPANY	POWER UNIT	TECHNOLOGY TYPE	STARTING DATA	NET ELECTRICITY WITHOUT CDM PROJECTS
1	ENGIE	C.E. EXPANSIÓN PUNTA LOMITAS	WIND	24/12/2023	54,268.95
3	COGENERACIÓN OQUENDOC	C.T. OQUENDO	THERMAL	28/06/2023	231.15
4	ENGIE	C.E. PUNTA LOMITAS	WIND	16/06/2023	653,556.61
5	COGENERACIÓN OQUENDOC	C.T. OQUENDO	THERMAL	16/02/2023	114,680.99
6	KALLPA	C.T. LAS FLORES	THERMAL	09/06/2022	2,300,473.56
AEG SET-5 units					3,123,211.25 MWh

- b) The units that comprise at least 20% of the system generation, excluding CDM registered projects (SET≥20%):
 - Units that comprise at least 20% of the system generation, excluding CDM registered projects (SET≥20%) represent 7,462,237.70 MWh. The power units in the larger annual generation (AEGSET≥20%) sample have been supplying electricity to the grid less than 10 years ago, with the earliest power unit built in 2016.

CDM Registry	m	COMPANY (ORIGEN)	POWER UNIT	SUB-UNIT	TECHNOLOGY TYPE	RESOURCE TYPE	STARTING DATA	NET ELECTRICITY 2023 (MWh)	ELECTRICITY ACCUMULATE D (MWh)	PROPORTION OF TOTAL (%)
CDM, 06 Apr 07	1	ENGIE	C.E. EXPANSION PUNTA LOMITAS	CENTRAL	WIND	WIND	24/12/2023	54,268.95	54,268.95	0%
	2	ENERSUR	C.H. QUITARACSA	G2	HYDRO	WATER	17/12/2023		54,268.95	0%
	3	COGENERACIÓN OQUEENDO S.A.C.	C.T. OQUEENDO	TG1	THERMAL	NATURAL GAS	28/06/2023	231.15	54,500.09	0%
	4	ENGIE	C.E. PUNTA LOMITAS	CENTRAL	WIND	WIND	18/09/2023	653,556.61	708,056.71	2%
	5	COGENERACIÓN OQUEENDO S.A.C.	C.T. OQUEENDO	TV	THERMAL	NATURAL GAS	16/02/2023	114,680.99	822,737.70	2%
	6	KALLPA	C.T. LAS FLORES	TV	THERMAL	NATURAL GAS	09/09/2022	2,300,473.56	3,123,211.25	8%
	7	COLCA SOLAR S.A.C.	C.S. YARUCAY A	25 MOMDULOS	SOLAR	SUN	26/09/2021	2,509.14	3,125,720.39	8%
	8	CENTRALES SANTA ROSA S.A.C.	C.H. SANTA ROSA I	G1	HYDRO	WATER	11/08/2021	4,583.54	3,130,303.93	8%
	9	CENTRALES SANTA ROSA S.A.C.	C.H. SANTA ROSA II	G1	HYDRO	WATER	11/08/2021	8,614.38	3,138,918.31	8%
	10	GR TARIJUA	C.E. DUNA	7 AEROGENERADORES	WIND	WIND	06/05/2021	82,451.32	3,221,369.63	9%
	11	GR PAIND	C.E. HUAMBOS	7 AEROGENERADORES	WIND	WIND	06/05/2021	68,227.76	3,289,597.39	9%
	12	GR TARIJUA	C.E. DUNA	7 AEROGENERADORES	WIND	WIND	31/12/2020		3,289,597.39	9%
	13	GR PAIND	C.E. HUAMBOS	7 AEROGENERADORES	WIND	WIND	31/12/2020		3,289,597.39	9%
CDM, 01 Oct 12	14	PERUANA DE INVERSIONES EN ENER	C.H. MANTA I	G1, G2	HYDRO	WATER	16/07/2020		3,289,597.39	9%
CDM, 20 Aug 12	15	PETRAMÁS	C.T. CALLAO	G1, G2	THERMAL	LANDFILL GAS	13/07/2020		3,289,597.39	9%
CDM, 20 Nov 12	16	GENERACIÓN ANDINA	C.H. 8 DE AGOSTO	G1, G2	HYDRO	WATER	25/12/2019		3,289,597.39	9%
CDM, 17 Mar 08	17	GENERACIÓN ANDINA	C.H. EL CARMEN	G1, G2	HYDRO	WATER	30/11/2019	44,943.30	3,334,546.69	9%
	18	LA VIRGEN	C.H. LA VIRGEN	G1, G2, G3	HYDRO	WATER	30/11/2019		3,334,546.69	9%
CDM, 20 Jun 12	19	BIDENERGÍA DEL CHIRI	C.T. CAÑA BRAVA	TV1, TV2	THERMAL	BAGASSE	02/10/2019	66,830.11	3,401,376.80	9%
	20	SINDICATO ENERGÉTICO	C.H. CHANCAY	G1, G2	HYDRO	WATER	04/06/2019		3,401,376.80	9%
CDM, 04 Jan 08	21	EMPRESA DE GENERACIÓN ELÉCTRICA	C.H. RUCUY	G1, G2	HYDRO	WATER	01/06/2019	134,007.09	3,535,383.89	9%
	22	AGROINDUSTRIAS SAN JACINTO	C.T. SAN JACINTO	TV1	THERMAL	BAGASSE	13/04/2019	46,027.52	3,581,411.41	10%
CDM, 18 Oct 12	23	ENEL GENERACIÓN PERÚ	C.H. CALLAHUANCA	G1, G2, G3, G4	HYDRO	WATER	30/03/2018		3,581,411.41	10%
	24	HYDRO PATAPO	C.H. PATAPO	G1	HYDRO	WATER	15/03/2019		3,581,411.41	10%
CDM, 18 Oct 12	25	ELECTRO ZAÑA	C.H. ZAÑA	G1	HYDRO	WATER	15/02/2019		3,581,411.41	10%
	26	ELECTRO ZAÑA	C.H. ZAÑA	G2	HYDRO	WATER	29/12/2018		3,581,411.41	10%
CDM, 18 Oct 12	27	ANDEAN POWER	C.H. CARHUAC	G1, G2	HYDRO	WATER	07/11/2018	102,113.89	3,683,525.31	10%
CDM, 18 Oct 12	28	GEPSA	C.H. ANGEL I	G1, G2	HYDRO	WATER	30/08/2018		3,683,525.31	10%
	29	GEPSA	C.H. ANGEL II	G1, G2	HYDRO	WATER	30/08/2018		3,683,525.31	10%
CDM, 18 Oct 12	30	GEPSA	C.H. ANGEL III	G1, G2	HYDRO	WATER	30/09/2018		3,683,525.31	10%
	31	ENEL GENERACIÓN PERÚ	C.H. HERI	G3-G4	HYDRO	WATER	30/08/2018	4,162.25	3,687,687.55	10%
CDM, 15 Oct 12	32	PETRAMÁS	C.T.B. DOÑA CATALINA	G1-G2	THERMAL	LANDFILL GAS	29/08/2018	15,848.49	3,703,536.04	10%
	33	ENEL GREEN PERÚ	C.E. WAYRA I	42 AEROGENERADORES	WIND	WIND	19/05/2018	483,502.29	4,187,038.33	11%
CDM, 15 Oct 12	34	ENGIE	C.S. INTIPAMPA	138 120 MODULOS	SOLAR	SUN	31/03/2018	107,153.63	4,294,197.95	11%
	35	TERMOCHILCA	C.T. STO DOMINGO DE LOS OLIVEROS	TG1, TV	THERMAL	NATURAL GAS	25/03/2018	1,586,348.37	5,880,546.33	16%
CDM, 30 Oct 12	36	SANTA ANA	C.H. RENO VANDER H1	G1	HYDRO	WATER	20/03/2018		5,880,546.33	16%
	37	ENEL GREEN PERU	C.H. RENO VANDER H1	560 880 MODULOS	SOLAR	SUN	30/01/2018	440,270.00	6,320,816.33	17%
CDM, 30 Oct 12	38	KALLPA	M.C.H. CERRO DEL AGUILA	G1	HYDRO	WATER	27/10/2017	52,841.31	6,373,657.64	17%
	39	HUAYRA POWER GROUP	C.H. YARUCAY A	G1-G2	HYDRO	WATER	17/08/2017	140,132.50	6,513,790.14	17%
CDM, 30 Nov 12	40	HIDROELECTRICA MARAÑON	C.H. MARAÑON	G1-G2-G3	HYDRO	WATER	23/06/2017		6,513,790.14	17%
	41	EMPRESA ELÉCTRICA AGUA AZUL	C.H. POTRERO	G1-G2	HYDRO	WATER	23/04/2017		6,513,790.14	17%
CDM, 30 Nov 12	42	ENEL GENERACIÓN PIURA	C.T. MALACAS 1	TG-6	THERMAL	NATURAL GAS	25/02/2017	55,247.06	6,569,038.00	17%
	43	ENGIE	C.T. CHILCA 2	TG41-TG42	THERMAL	NATURAL GAS	16/12/2016	595,165.57	7,164,203.57	19%
	44	ENGIE	C.T. NEPI	TG41, TG42, TG43	THERMAL	DIESEL	22/10/2016	308,034.14	7,462,237.70	20%

AEG SET** >20 per cent 7,462,237.70

Hence, the build margin is calculated using SETsample = AEGSET-≥20%.

Annual emission generation between: SET ≥20 per cent and SET 5 units	
SET ≥20 per cent	7,462,237.70 MWh
SET 5 units	3,123,211.25 MWh
SET sample	7,462,237.70 MWh

The CO2 emission factor of each power unit m (EFEL,m,y) was determined as per the guidance in Step 4 for the simple OM, using option A2 (as described for the Dispatch OM above).

Based on the above calculations and data from 2023 (the latest year available), the result of the build margin emissions factor, calculated as the generation-weighted average emission factor (tCO2/MWh) of all power units m, has been:

$$EF_{grid, BM, 2023} = \frac{\sum m EGm, 2023 \times EF_{EL, m, y}}{SET_{sample} \sum m EGm, 2023}$$

$$EF_{grid, BM, 2023} = \frac{2,106,171 (tCO_2/year)}{7,462,238 (MWh/year)}$$

$$EF_{grid, BM, 2023} = 0.282 tCO_2/MWh$$

Please refer to “Peru Electricity System EFBM 2023 calculation_v1” calculator attached for detailed information and calculations.

Step 6. Calculate the combined margin emission factor

The combined margin emission factor is calculated as the weighted average of the CM:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh).

$EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh).

W_{OM} = Weighting of operating margin emission factor (%).

W_{BM} = Weighting of build margin emission factor (%).

The default weights for hydroelectric power projects for the second crediting period has been applied: $W_{OM} = 0.25$ and $W_{BM} = 0.75$

So, the Combined Margin (CM) for the year 2022 is calculated:

$$EF_{grid,CM,y} = 0.565 \times 0.25 + 0.282 \times 0.75$$

$$EF_{grid,CM,2022} = 0.353 \text{ tCO2/MWh}$$

For detailed information and calculations, please refer to *Peru Electricity System EFBM 2023 calculation_v1* calculator and *P1348_CP2 Emission reduction estimation_Las Pizarras_v2* attached.

4.2 Project Emissions

For most renewable energy project activities, the project emissions are neglected. Following the methodology, as the project is a run-of-the-river project, it does not lead to any GHG emissions and therefore project emissions are considered equal to zero.

$$PE_y = 0 \text{ tCO}_2\text{e / year}$$

4.3 Leakage Emissions

Following the applied methodology, no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transportation). These emissions sources are neglected.

$$LE_y = 0 \text{ tCO}_2\text{e / year}$$

4.4 Estimated GHG Emission Reductions and Carbon Dioxide Removals

The net GHG emission reduction is calculated following the guidance of the methodology ACM0002, as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y : Emission reduction in year y (tCO₂)

BE_y : Baseline Emission in year y (tCO₂)

PE_y : Project emission in year y (tCO₂)

So, according to methodology, $ER_y = BE_y - 0$, the emission reductions are equal to the baseline emissions, therefore the emissions reductions are:

$$ER_y = BE_y$$

$$ER_y = 37,602 \text{ tCO}_2/\text{year}$$

The Emission Reduction results can be found on the attached spreadsheet *P1348_CP2 Emission reduction estimation_Las Pizarras_v2*.

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated reduction VCU (tCO ₂ e)	Estimated removal VCU (tCO ₂ e)	Estimated total VCUs (tCO ₂ e)
30-April-2023 to 29-April-2024	37,602	0	0	37,602	0	37,602
30-April-2024 to 29-April-2025	37,602	0	0	37,602	0	37,602
30-April-2025 to 29-April-2026	37,602	0	0	37,602	0	37,602
30-April-2026 to 29-April-2027	37,602	0	0	37,602	0	37,602
30-April-2027 to 29-April-2028	37,602	0	0	37,602	0	37,602
30-April-2028 to 29-April-2029	37,602	0	0	37,602	0	37,602
30-April-2029 to 29-April-2030	37,602	0	0	37,602	0	37,602

Vintage period	Estimated baseline emissions (tCO ₂ e)	Estimated project emissions (tCO ₂ e)	Estimated leakage emissions (tCO ₂ e)	Estimated reduction VCU (tCO ₂ e)	Estimated removal VCU (tCO ₂ e)	Estimated total VCUs (tCO ₂ e)
30-April-2030 to 29-April-2031	37,602	0	0	37,602	0	37,602
30-April-2031 to 29-April-2032	37,602	0	0	37,602	0	37,602
30-April-2032 to 29-April-2033	37,602	0	0	37,602	0	37,602
Total	376,020	0	0	376,020	0	376,020

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	EF _{CO2,i,y} and EF _{CO2,m,i,y}
Data unit	tCO ₂ /GJ
Description	CO ₂ emission factor of fossil fuel type i in year y.
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value applied	Diesel Oil = 72,600 Residual Fuel Oil = 75,500 Natural Gas = 54,300 Coal = 87,300 Other Primary Solid Biomass = 84,700 Landfill Gas = 46,200
Justification of choice of data or description of measurement methods and procedures applied	The CO ₂ emission factor is used to calculate the CO ₂ emission coefficients of the power plants in the grid. This is a step necessary to find the baseline CO ₂ emission of the grid.
Purpose of Data	Calculation of baseline emissions.
Comments	None.

Data / Parameter	EF _{grid,BM,y}
------------------	-------------------------

Data unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor of the grid connected power generation in year y, calculated using the “Tool to calculate the emission factor for an electricity system”.
Source of data	COES records.
Value applied	0.282 tCO ₂ /MWh
Justification of choice of data or description of measurement methods and procedures applied	Built Margin, as a component of the Combined Margin (CM) emission factor of the grid, is calculated as a fixed value for the entire crediting period, according to the procedures described in the “Tool to calculate the Emission Factor for an electricity system”. A fixed value for EF_{grid,BM,y} is used accordingly to the CDM tool mentioned above. For the calculation of the BM, the option 1 was chosen, therefore the BM does not require monitoring during the crediting period, and it should be calculated as per the <i>Tool to calculate the emission factor for an electricity system</i>: “for the first crediting period, ex-ante based on the most recent information available on units already built (sample group m) at the time of CDM-PDD submission to the DOE for validation (2023). For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used”. According to that, EFBM has been updated for this second crediting period as can be seen on Step 5 from Section 4.1 for more details.
Purpose of Data	Calculation of baseline emissions.
Comments	None.

Data / Parameter	EF _{EL,m,y}
Data unit	tCO ₂ /MWh
Description	CO ₂ emission factor of power unit m in year y.
Source of data	COES Annual Statistics report ⁶⁴ and IPCC default values for CO ₂ emission factor of fossil fuel type ⁶⁵ .

⁶⁴ COES Annual Statistics report 2022. Chapter 4. Energy resources used in SEIN. Table No 8. Variable costs of thermoelectric power plants: <https://www.coes.org.pe/Portal/Publicaciones/Estadisticas/>

⁶⁵ 2006 IPCC Guidelines on National GHG Inventories. 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): https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

Value applied	All Thermal Plants Emission Factors.
Justification of choice of data or description of measurement methods and procedures applied	CO ₂ emission factor of power unit $EE_{EL,m,y} = (EF_{CO2,m,y,i} * 3.6) / n_{m,y}$ The $EF_{EL,m,y}$ will be calculated as per the guidance for the simple OM, using the option A2.
Purpose of Data	Calculation of baseline emissions.
Comments	None.

5.2 Data and Parameters Monitored

Data / Parameter	EG _{PJ,h} and EG _{PJ,y}
Data unit	MWh
Description	Electricity displaced by the project activity in hour h of year y.
Source of data	Empresa Eléctrica Río Doble S.A. based in data meters.
Description of measurement methods and procedures to be applied	Electricity will be measured continuously by the installed electricity metering system consisting of calibrated electricity meter(s). Meters will be calibrated as stated in Section 5.3. The generation information used to report to COES is downloaded at the beginning of each month directly from the internal memory register of each meter (where it remains collected for 60 days). Collected data will be also available in the installed SCADA system and recorded every 15 minutes. In addition, data will be archived electronically and retained for 2 years following the end of the crediting period.
Frequency of monitoring/recording	Continuous (hourly) measurements and monthly recording.
Value applied	EG _{PJ,y} = 106,598 MWh per year (expected) EG _{PJ,h} = 12.17 MWh (expected)
Monitoring equipment	The equipment used to monitor the parameters are the main meter M1 and backup meters M2 and M3. The three meters are class 0.2 (as currently required by COES) and monitor the energy supplied to SEIN.
QA/QC procedures to be applied	The monthly measurement results recorded will be used to cross check with reports of active energy transfers (VTEA) ⁶⁶ provided by COES to

⁶⁶ Valorización de Transferencia de Energía Activa (VTEA) COES reports (2022):

<https://www.coes.org.pe/Portal/PostOperacion/ValorizacionTransferencias/ValorizacionTransferenciaEP> > “Select year” > “Select month” > VALORIZACIONES > INFORMES > VTEA report

	ensure consistency. Conservative values will be used for calculation of emission reductions.
Purpose of data	Calculation of baseline emissions.
Calculation method	In case of failure or maintenance of the main meter M1, the Plant Manager will request the electricity supplied by the project to the Coordinator of the grid node Carhuaquero, who will develop an energy balance with the rest of electricity meters of the system.
Comments	The three meters could be configured to work either in a unidirectional or bi-directional way, but for the project purposes they had been configured to work in a bidirectional way. The electric energy displaced by the project activity is the net energy delivered to the grid. This net energy considers the self-consumption of the auxiliary systems.

Data / Parameter	$EF_{grid,OM-DD,y}$
Data unit	tCO ₂ /MWh per year
Description	Operating margin CO ₂ emission factor of the grid connected power generation in year y, calculated using the “Tool to calculate the emission factor for an electricity system”.
Source of data	COES records and Río Doble data meters.
Description of measurement methods and procedures to be applied	Operating Margin, as a component of the Combined Margin (CM) emission factor of the grid, is calculated every year as a monitoring parameter since it is recorded in the PDD as an ex-post parameter. The Emission Factor has been calculated following the “Tool to calculate the emission factor for an electricity system”, version 07.0.0. Based on the tool, the Combined Margin Emission Factor ($EF_{grid,OM-DD,y}$) has been calculated through the following formula: $EF_{grid,OM-DD,y} = (\sum EG_{PJ,h} * EF_{EL,DD,h}) / EG_{PJ,y}$
Frequency of monitoring/recording	For the calculation of the dispatch data analysis (OM), the project developer shall use the year in which the project activity displaces grid electricity and update the emission factor annually during monitoring. However, if the data to calculate the operating emission factor in a certain period of time is not available during the monitoring, then the most recent data available should be used.
Value applied	Value of data applied for 2022: $EF_{grid,OM-DD,2022} = 0.565$ tCO ₂ /MWh.
Monitoring equipment	None.
QA/QC procedures to be applied	Any consideration or recalculation undertaken by the IPCC would be considered in the calculations.
Purpose of data	Calculation of baseline emissions.

Calculation method	The value will be calculated again in each monitoring period, as per the 07.0 version of the “Tool to calculate the emission factor for an electricity system”.
Comments	None.

Data / Parameter	$EF_{CO2,grid,y} = EF_{grid,CM,y}$
Data unit	tCO ₂ /MWh per year
Description	CO ₂ emission factor of the grid electricity in year y.
Source of data	COES records and Río Doble data meters.
Description of measurement methods and procedures to be applied	The Emission Factor will be calculated following the “Tool to calculate the emission factor for an electricity system”, version 07.0.0. Based on the tool, the Combined Margin Emission Factor ($EF_{grid,CM,y}$) need the result of calculate the $EF_{grid,BM,y}$ and $EF_{grid,OM-DD,y}$, and shall use the weighted-average formula, considering both and the weights w_{OM} and w_{BM}, as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$ In hydroelectric projects, $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period. However, if the data to calculate the combined emission factor in a certain period is not available during the monitoring, then the most recent data available should be used.
Frequency of monitoring/recording	According to the <i>Tool to calculate the emission factor for an electricity system</i> .
Value applied	Value of data applied: $EF_{grid,CM,y} = 0.353$ tCO ₂ /MWh.
Monitoring equipment	None.
QA/QC procedures to be applied	Any consideration or recalculation undertaken by the IPCC would be considered in the ex-post calculations.
Purpose of data	Calculation of baseline emissions.
Calculation method	The value will be calculated again in each monitoring period, as per the 07.0 version of the “Tool to calculate the emission factor for an electricity system”.
Comments	None.

Data / Parameter	$EG_{m,y}$ and $EG_{n,y}$
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. m: Power units included in the build margin. n: Grid power units in the top of the dispatch.
Source of data	COES Generation records.
Description of measurement methods and procedures to be applied	Data is directly measured based on the information provided by COES. This data is measured and recorded every 15 minutes. The proportion of data monitored is 100% and the data is archived electronically.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording.
Value applied	COES Generation Meters records ⁶⁷ .
Monitoring equipment	None.
QA/QC procedures to be applied	None, the data would be provided by the COES.
Purpose of data	Calculation of baseline emissions.
Calculation method	None.
Comments	None.

Data / Parameter	$\eta_{m,y}$
Data unit	%
Description	Average net energy conversion efficiency of power unit m in year y.
Source of data	COES Annual Statistics Report. ⁶⁸
Description of measurement methods and procedures to be applied	Every year this data will be checked with the latest available Annual Statistics report of the COES.
Frequency of monitoring/recording	Annually.

⁶⁷ COES Generation Meters records. Monthly generation data every 15 minutes of Active Power (MW) for the year 2022: <https://www.coes.org.pe/Portal/mediciones/medidoresgeneracion>

⁶⁸ COES Annual Statistics report 2022. Chapter 4. Energy resources used in SEIN. Table No 8. Variable costs of thermoelectric power plants: <https://www.coes.org.pe/Portal/Publicaciones/Estadisticas/>

Value applied	COES Annual Statistics Report.
Monitoring equipment	None.
QA/QC procedures to be applied	If the data used is significantly lower than the default value of the applicable technology, project proponents should assess the reliability of the values and provide appropriate justification if deemed reliable. Otherwise, the default values shall be used.
Purpose of data	Calculation of baseline emissions.
Calculation method	None.
Comments	None.

5.3 Monitoring Plan

The Monitoring Plan is developed in accordance with the approved consolidated baselines and monitoring methodology for grid-connected electricity generation from renewable sources – ACM0002, version 22.0, and sets out the procedures for metering, monitoring and calculating the ERs generated through the net electricity supplied to the SEIN by the project activity.

Monitoring equipment

The 100% of electricity delivered to the grid by the project is continuously measured through the main meter M1 installed at Espina Colorada Substation. In order to ensure maximum availability of monitoring data and quality controls, after the main meter had been installed two backup meters, M2 and M3.

If problems which can affect the quality of data occur, the Plant Manager will initiate and supervise the implementation of corrective actions by the Maintenance Provider. In these situations, the Plant Manager will request the electricity supplied by the project to the Coordinator of the grid node Carhuaquero, who will develop an energy balance with the rest of electricity meters of the system.

The following grid connection diagram indicates the principles of positioning of metering instruments that will be used in the monitoring periods for the emission reductions:

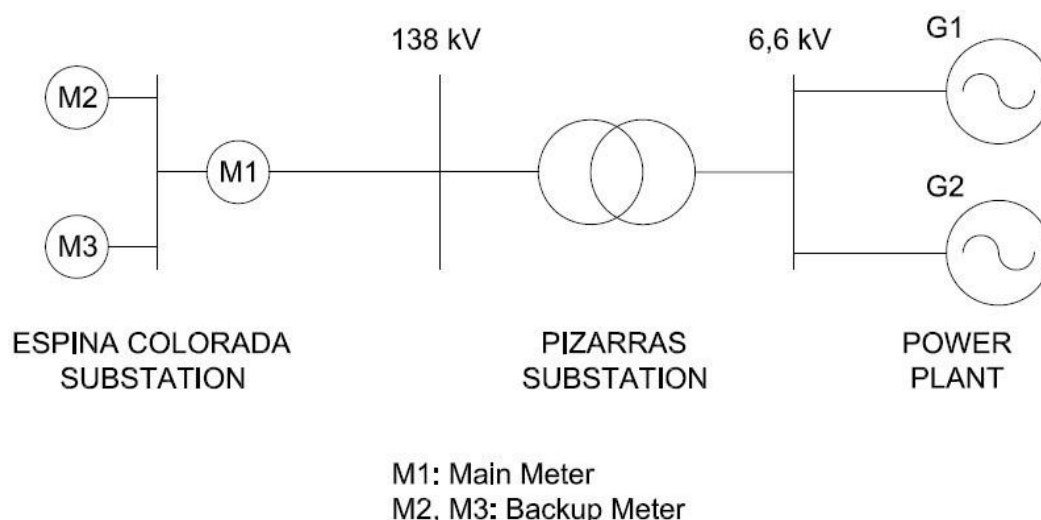


Figure 5. Positioning of metering instruments

The meters comply with the specifications set up in the PPA as the measurement equipment are electronic multifunction type class 0.2, available to connect through ethernet grid and with capacity for 60 days of recorded information in order to invoice. Also, the three meters could be configured to work either in a unidirectional or bi-directional way, but for the project purposes they had been configured to work in a bidirectional way.

The calibration of the meters is carried out according to IEC standards to ensure the accuracy of the measurements. The main specifications are the followings:

Table 12. Meters specifications

Meter	Manufacturer	Type	Serial number	Accuracy class	Calibration frequency	Carried out by
M1 Main meter - PosPizarras	Schneider Electric	ION 8650	MW-1211A328-01	0.2S	At least once every three years according to appropriate intervals of manufacturer specifications. Last calibration date: 29/11/2022	Peruvian Enterprise Service SAC
M2 Backup meter - PosCutervo	Schneider Electric	ION 8650	MW-1211A330-01	0.2S		Peruvian Enterprise Service SAC
M3 Backup meter - PosCarhuaquero	Schneider Electric	ION 8650	MW-1205A219-01	0.2S		Peruvian Enterprise Service SAC

The electricity generated is continuously measured and recorded every 15 minutes as well as recorded on monthly monitoring reports by Technical Operators. Due to the complexity of the invoice system of the Peruvian grid, the monthly recorded electricity will be cross checked with the monthly reports of active energy transfers provided by COES (VTEA records), where state the income and outcome energy by the project. Conservative values are used for emission reduction calculations.

Procedures for maintenance and installation of equipment, as well as calibration, will be performed according to manufacturer specifications, at least once every three years according to appropriate intervals, and will follow applicable requirements of the Electricity General Direction of the Peruvian Energy and Mines Ministry (these requirements are currently under development by the Ministry).

Organizational structure

The following figure outlines the operational and management structure that the project proponent has implemented to monitor the emission reductions generated by the project activity. The responsible person for the monitoring of the entire data required is the Operations Manager.

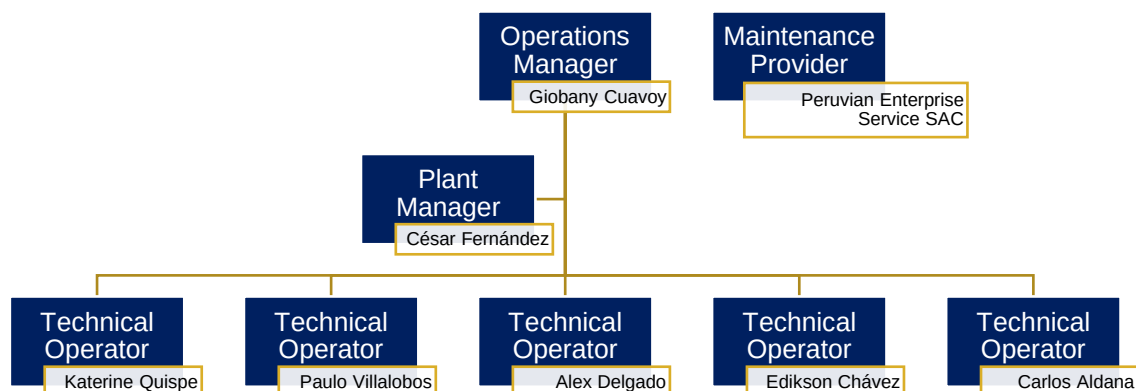


Figure 6. General management structure

All data gathering is archived electronically and will be kept at least for 2 years after the end of the last crediting period.

Technical Operators

The monitoring performance of the project requires the fulfilment of operational data collection and processing obligations by the Technical Operators. The Technical Operators are obligated to ensure that sufficient and accurate information is available to calculate ERs in a transparent manner, and that adequate information is collected and maintained to facilitate successful verification of accounted ERs.

The Technical Operators are responsible for:

- Monitoring the following parameters:
 - Energy and power supplied by the project activity to the national grid.
 - The installed capacity of the hydro power plant.
- Record and store data from the main and back up meters.
- Control the accurate operation of any meters or equipment needed for monitoring, and preliminarily determine the needs for maintenance or repair work.
- Elaborate monthly monitoring report and send them to Plant Manager.

The Maintenance Provider

Maintenance and calibrations of the measuring equipment are developed by the company Peruvian Enterprise Service SAC following the applicable requirements of the Electricity General Direction of the Peruvian MINEM (these requirements are currently under development by the Ministry), as well as manufacturer's specifications. Calibration certificates of the accredited calibration agency, and the relevant calibration document, are collected by the Operations Manager and will be archived for at least 2 years after the last crediting period.

Plant Manager

The Plant Manager supervises the Technical Operators and is responsible for:

- Compile and analyze all the monthly monitoring reports.
- Compile all the calibration certifications.
- Ensure that the Technical Operators are appropriately trained for monitoring/checking the different parameters/meters with training sessions and an instruction manual.

Operations Manager

The Operations Manager has the final responsibility for all aspects related to data measurements and the monitoring of data recordings. Mainly:

- Manage and supervise all monitoring activities under the generation project.
- Ensure that all data is recorded accurately.
- Supervise the Maintenance Provider and Plant Manager.
- Elaborate the draft Monitoring Report with all its attachments, which will be verified by the VVB.
- Elaborate an estimate of emission reductions in the Emission Reduction Monitoring Report.

- Calculate the Combined Margin and recalculate the Grid Emission Factor every year.

For the present monitoring period, the calculation of the Combined Margin to recalculate the annually Grid Emission Factor.

The CO₂ Emission Factor for the electricity grid is and will be based on latest available data from the Official COES website and following the most recent version of the “Tool to calculate the emission factor for an electricity system”.