**CLEAN DEVELOPMENT MECHANISM**
**PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM**
**(CDM-PoA-DD) Version 01**

## CONTENTS



NOTE:

This form is for the submission of a CDM PoA whose CPAs apply a large scale approved methodology.

At the time of requesting registration this form must be accompanied by a CDM-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-CPA-DD (using a real case).

## SECTION A. General description of programme of activities (PoA)

### A.1 Title of the programme of activities:

EN BADEN Large-Scale Hydro PoA in Peru
Version of PoA-DD: 03
Date: 15/10/2012

### A.2. Description of the programme of activities:

1. General operating and implementing framework of PoA

Peru is a developing country in South America, with a population of about 30 million and a GDP at USD 275 million[1]. Its economy is heavily dependent on exports of minerals such copper and gold with more than 30% of its population are classified as poor[2]. The current installed capacity of electricity in Peru is a minuscule 8,000 MW[3] but with a market oriented economy that grew at 8% in 2010 and increasing opportunities to export power to its neighbouring countries; this is expected to rise sharply.

An article[3] published by the Economist magazine quotes the current President of Peru that the country has the potential to increase its energy production eight folds by harnessing the increasingly available natural gas supplies and also the hydro potential of the Amazonian rivers.

The responsibility for allocation of water uses, compliance of service delivery commitment and economic regulation (tariffs, etc.) in Peru lies with the National Water Authorization (*ANA – Autoridad Nacional del Agua*), an inter-ministerial body. Peru's electricity policies and regulations lies with the National Electricity Office (*DGE - Dirección General de la Electricidad*), under the Ministry of Energy and Mines (*MEM – Ministerio de Energía y Minas*). The Energy and Mining Investment Supervisory Body *(OSINERGMIN - Organismo Supervisor de Inversión en Energía y Minería*) under the MEM is in charge of enforcing compliance with the Electricity Concessions Law (*LCE*). The LCE[4] (Law 25844, Article 79) has established an official discount rate for investment evaluation of both public and private sector energy projects. It is considered to be a conservative discount rate since public investment is driven by social interests and assumes access to cheap loans. However, a review of the CDM pipeline

[1] Source: https://www.cia.gov/library/publications/the-world-factbook/geos/pe.html (accessed 12/11/2011).

[2] Source: http://en.wikipedia.org/wiki/Peru#cite_note-58 (accessed 12/11/2011).

[3] Source: http://www.economist.com/node/18114659 (accessed 12/11/2011).

[4] Source: Electric Concessions Law. (Law Nº 25844, updated March 2009). Article 79, p. 35. 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. See

http://www2.osinerg.gob.pe/MarcoLegal/pdf/LEYCE-DL25844.pdf (accessed 15/11/2011).

indicates that hydro projects in Peru have consistently been unable to meet this minimum benchmark and additional revenues from sale of carbon credits have been crucial to the success of such projects.

2. Policy/measure or stated goal of the PoA

The objective of this PoA is to develop a platform for overcoming institutional, financial and structural hurdles for the implementation of hydroelectric power plant projects or to increase the generation capacity of existing hydroelectric power plants. All projects are supposed to be new, grid-connected, hydropower plants which will allow the National Electric Power Grid (SEIN, *Sistema Interconectado Nacional*) to maintain in stand-by or delay the development of new thermal power plants. In this way electricity generation fuelled by heavy fuel oil, diesel, coal or natural gas shall be displaced, while at the same time reducing GHG emissions and increasing the amount of energy available on the grid.

Economic sustainability:

- The PoA will increase employment opportunities in the area where the CPAs are located, which will increase income for the local communities.
- The PoA will provide secure access to carbon revenues for small project owners, that have no possibilities to overcome the CDM registration costs, and help to achieve the financial closure.
- The PoA will reduce the time and uncertainties to achieve additional finance trough carbon revenues on future CPAs, making the proposed activity more attractive to others source of capital or equity
- The PoA will create new sources of renewable energy in a sustainable way, sparking the sustainable development of the area influenced by each CPA, with local investment and business environment, and thereby improving the local economy.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

The proposed PoA is a voluntary action by Carbon BW Peru S.A.C. and has not been established due to any existing policy or regulation by the government of Peru. The company would not be developing this initiative if there will be no potential for future carbon cash flow.

## A.3. Coordinating/managing entity and participants of PoA:

1. Coordinating or managing entity of PoA as the entity which communicates with the Board

| Name of Party involved (*) ((host) indicates a host Party) | Private and/or public entity(ies) project participants(*) (as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Republic of Peru | Coordinating and managing entity (CME) of the PoA:<br>Carbon BW Peru S.A.C. | No |
| (*) In accordance with the CDM modalities and procedures, at the time of making the PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required. | | |

## A.4. Technical description of the programme of activities:

### A.4.1. Location of the programme of activities:

#### A.4.1.1. Host Party(ies):

Republic of Peru (Official name in Spanish: *República del Perú*)

#### A.4.1.2. Physical/ Geographical boundary:

All CDM programme activities (CPAs) included in the PoA will be implemented within the territorial area of the Republic of Peru.


Figure 1: Map of Peru.

**A.4.2. Description of a typical CDM programme activity (CPA):**

**A.4.2.1. Technology or measures to be employed by the CPA:**

A typical CPA under this PoA will be a hydro power plant with standard technology employed. CPAs should be connected to the national/sub-national grid. The boundary of the PoA is currently the host country Peru. If the geographical boundaries are extended to include additional countries, they will be in compliance with UNFCCC approved documentation (EB 60, Annex 26).

Even though the detailed technical characteristics might differ per CPA the following general conditions shall apply to all CPAs.

- CPAs are hydro power plants which use hydro energy converted with help of water turbine generators into electricity which is supplied to the national grid/sub-national grid
- The PoA will be open to all technology providers and projects that meet the eligibility criteria of this PoA.
- A CPA under this PoA may be a single plant or a cluster of such plants employing the same technology undertaken by the same project developer or project community.

**A.4.2.2. Eligibility criteria for inclusion of a CPA in the PoA:**

CPAs under the PoA are required to fulfil a range of criteria for inclusion with regards to environmental, regulatory, financial and program specific eligibility criteria considering the 'STANDARD FOR DEMONSTRATION OF ADDITIONALITY, DEVELOPMENT OF ELIGIBILITY CRITERIA AND APPLICATION OF MULTIPLE METHOLOGIES FOR PROGRAMME OF ACTIVITIES', Version 01.0.[5]

| **General eligibility criteria for inclusion of a CPA in the PoA** |
|---|
| (a) The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA. The boundary of the PoA is currently the host country Peru. |
| (b) Each CPA involves the construction and operation of one or several new hydro power projects connected to the national/sub-national power grid and with a total or combined installed capacity not greater than 20MW. The technology and performance specifications fulfil the host country national standards. |
| (c) The CPAs under its PoA are neither registered as an individual CDM project activity nor included in another registered CDM PoA. |
| (d) To avoid double counting of emission reductions each CPA-DD shall be uniquely identified and defined in an unambiguous manner by providing geographic information (e.g. coordinates), a unique CPA identification number, and the exact start date and end date of the crediting period. The following data must be provided to/by the CME prior to inclusion in the PoA in writing:<br>• Name of the CPA; |

[5] See EB 65, Annex 3(accessed 28/01/2012).

- Name of the CPA developer;
- Contact details of the CPA developer including contact person, address, telephone and/or email address;
- Installed capacity and other relevant technical specifications of each power plant under the CPA;

Location of each power plant under the CPA (e.g. GPS coordinates);

(e) Start date of the CPA shall be provided through documentary evidence and shall comply with the applicable CDM guidelines and standards.

(f) The CPAs need to sign an inclusion agreement with the CME.

(g) Each CPA must be applicable to and need to apply the latest version of the CDM baseline and monitoring methodology "ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 13.0.0 as per validation date).

The following applicability conditions apply:

| **Applicability conditions in version 13.0.0 of ACM0002** |
|---|
| The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir) |
| For hydro power projects, one of the following criteria must apply:<br>• The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 $W/m^2$; or<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 $W/m^2$.<br>In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 all the following conditions must apply:<br>• The power density calculated for the entire project activity using equation 5 is greater than 4 W/m2;<br>• Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant;<br>• Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br>• Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m2, is lower than 15 MW;<br>• Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs<br>•<br>The methodology is NOT applicable for hydro projects that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 $W/m^2$. |

| |
|---|
| |
| (h) Only additional projects can be enrolled. Additionality is proven on the CPA level for each CPA separately in accordance with the applicable guidelines established by the UNFCCC. . |
| (i) The CPAs must have undertaken an environmental analysis as per requirements of the CDM modalities and procedures as outlined in Section C and be in accordance with the applicable host country environmental laws and regulations. |
| (j) The CPAs must have undertaken a local stakeholder consultation as outlined in Section D. |
| (k) The CPAs must provide a written affirmation that funding from Annex I party, if any, does not result in a diversion of official development assistance. |

**A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):**

**(i) The proposed PoA is a voluntary coordinated action**

The proposed PoA is a voluntary action by the CME. The CME as the key project participant with the implementation of the PoA intends to facilitate the access to CDM revenues to hydro energy developers and to build an easier entrance for carbon financing for hydro energy project in Peru. When providing such a platform for potential CPAs the CME is taking care of the development of the CDM cycle related tasks of the project activity and will receive a certain return from CERs generated from the CPAs.

**(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA**

The PoA is a voluntary coordinated action by the CME allowing conditional participation of CPAs. The CME is developing and coordinating the PoA due to the expected CER revenues from the underlying CPAs. The voluntary coordinated action would not be implemented by the CME in the absence of the PoA. Additionality has to be proven on the CPA level for each CPA separately following the CDM baseline and monitoring methodology "ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources" Version 13.0.0 together with the relevant corresponding tools.

For CPAs additionality shall be proven based on the latest version of the UNFCCC "Tool for the demonstration and assessment of additionality" (Version 6.0.0) as applicable. An investment analysis will be carried out to demonstrate that the proposed CPAs are not the most economically or financially attractive choice of investment. The aspects are discussed in sections E.5.1 and E.5.2 of this document.

The investment environment for hydropower projects has not been enthusiastic. The World Bank's Energy Sector Management Assistance Program (ESMAP) report for 2011 indicates that total hydropower generation increased by only 5 percent over the five years from 2003 to 2007. Almost all the increase in demand is being supplied by new thermal generation[6]. The report summarizes (ESMAP p. xiii) "*The most fundamental constraint to developing Peru's hydro potential has been the low tariff faced by generators, which is a consequence of the low domestic price of natural gas. Almost all new power generation installed in Peru during the last decade has been based on low priced natural gas from the Camisea Field.*"

On the basis of the high risk factors listed above, CPA developers would not build the projects without the financial incentive of the CDM.

**(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced**

Not applicable since there is no mandatory policy/regulation in connection with this PoA.

[6] Source: ESMAP (2011). *Peru Opportunities and Challenges for Small Hydropower Development*, p. 1 (accessed 12/11/2011).

**(iv) If mandatory a policy/regulation are enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.**

Not applicable since there is no mandatory policy/regulation in connection with this PoA.

## A.4.4. Operational, management and monitoring plan for the programme of activities:

### A.4.4.1. Operational and management plan:

Description of the operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA, including:

**(i) A record keeping system for each CPA under the PoA,**

The CME will operate a PoA Monitoring database including the CPAs for the PoA. Each CPA will be uniquely identified within the PoA Monitoring database of all CPAs. According to the eligibility criteria the following data must be provided to the CME prior to inclusion in the PoA in writting:

| | |
|---|---|
| Basic data for inclusion | • Name of the CPA;<br>• Name of the CPA developer ;<br>• Contact details of the developer including contact person, address, telephone and/or email address;<br>• Installed capacity and other relevant technical specifications of each power plant under the CPA;<br>• Location of each power plant under the CPA (e.g. via GPS coordinates); |
| Data during crediting period | • Verification status (i.e. periods verified, amount of CERs issued, etc.)<br>• CPA monitoring records and monitoring reports of each CPA. |

The basic data for inclusion listed above will be provided by each CPA developer prior to inclusion in writting. The CPA developer will record the required monitoring data (CPA monitoring records) and will ensure that the CPA monitoring records are made available to the CME. The CME will be responsible for the management of the PoA Monitoring database, consisting of the basic data for inclusion and of all CPA monitoring records. All records will be stored for a period of two years after the end of the relevant crediting period. Relevant data capture, verification and storage procedures will be followed in maintaining the data to ensure its accuracy, validity and completeness.

**(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as CDM project activity or as a CPA of another PoA,**

Each CPA shall be uniquely identified within the PoA monitoring database described in (i) above. The geographical boundary for the PoA is limited by the borders of the host country eligibly under this PoA. The PoA monitoring database will report and contain the physical location of each CPA.

Prior to inclusion of a new CPA within the proposed PoA, the CME will check publicly available project and or pipeline databases (e.g. UNFCCC CDM, IGES CDM, UNEP Risoe CDM/JI) to verify whether a CDM project activity or CPA of another PoA for grid-connected hydro power projects has already been registered within the applicable host country. Moreover, the CME will contact the Directorate-General for Climate Change in Peru to seek the written aforementioned verification. In an instance where a CPA

of another PoA or CDM project activity is already registered, the CME will ensure through cross-checking the PoA monitoring database of the other CPA or CDM project that there is no double counting of the individual CPA for this PoA.

**(iii) the provisions to ensure that those operating the CPA are aware and have agreed that their activity is being subscribed to the PoA;**

Carbon BW Peru S.A.C. as CME will be involved in the implementation phase of the PoA and in the monitoring, however CPA developers will be in charge of monitoring the parameters for the CPA and providing monitoring reports to CME. The CME will interact with the regulatory bodies, e.g. UNFCCC, DOEs and DNAs and provide CDM services and necessary documentation to the CPA developers. The CME will agree with the CPA developer on a commercial/inclusion agreement. The commercial agreement will, inter alia, define the ownership of CERs. The following figure illustrates the general business model of the PoA.

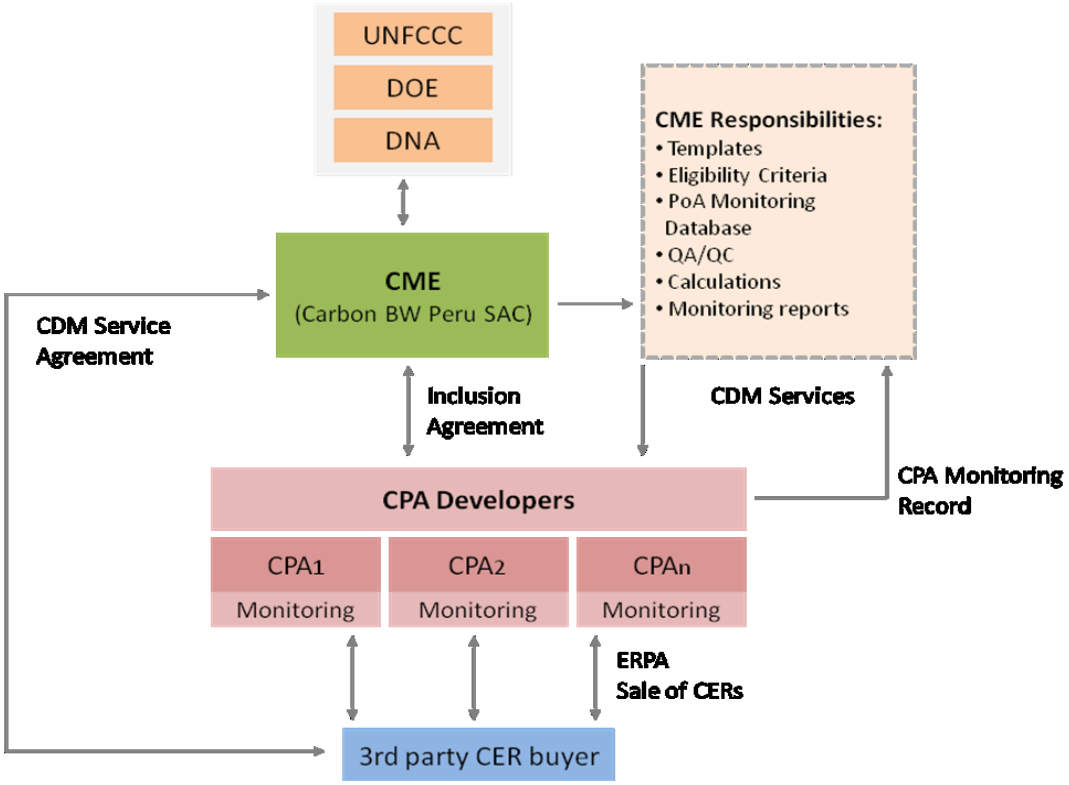


Figure 2: Illustration of PoA's business model.

**A.4.4.2. Monitoring plan:**

**(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.**

The PoA implementing hydro power projects is applying the monitoring methodology ACM0002 that does not use statistical sampling. All CPAs will be monitored and verified.

**(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;**

The CME will implement a monitoring protocol that allows the Designated Operational Entity (DOE) to verify all CPAs in the PoA. As described previously a PoA Monitoring database will be established that contains all the CPA specific data required to identify and locate each CPA. Each CPA will comprise one or several project activities, and hence the data will be monitored directly and submitted to the CME.

Monitoring will be carried out by each CPA developer. For each CPA, all parameters included in E.7.1 will be monitored and recorded in the CPA monitoring records by the CPA developer according to the procedures established in E.7.2. Each CPA is responsible to appropriately measure the net electricity supplied to the grid and assuring the correct operation and maintenance of the measuring equipment. This will be done by respecting the calibration frequency as per methodology ACM0002 and fulfilling the specifications of the host country national standards[7]. Moreover, each CPA will make a cross-check of its measurement with COES meters and electricity bills.

All the aforementioned information will be submitted to the CME in writing. The CME will store all the data submitted by the CPA developer in an electronic database (PoA monitoring database). Primary data will be stored by the developer as back-up.

Verification initiated by the CME will occur either separately for each CPA or for several CPAs at the same time. The CME will be responsible for the preparation of the monitoring reports, based on the CPA monitoring records using the monitoring report form, and communication with the DOE during verification activities. The monitoring reports will aggregate all required monitoring information, i.e. CPA monitoring records, in order to allow the DOE to verify the emission reductions for each monitoring period of each CPA. Each monitoring report will unambiguously set out the data on emission reductions generation by each CPA during the monitoring period consistent with the requirements of this PoA-DD and the corresponding CPA-DD.

The start and end date of each monitoring period for each individual CPA, together with the CPA monitoring records attributable to that monitoring period will be recorded in the PoA monitoring database. It will also be stated the verification status (i.e. periods verified, amount of CERs issued, etc.) of each CPA. These record keeping procedures undertaken by the CME will ensure that the CPA monitoring records attributed to a monitoring period can be clearly attributed to an individual CPA and will furthermore prevent double counting of emission reduction data.

The monitoring plan for parameters included in section E.7.1 will be implemented for each CPA with assistance from the CME as follows:

- CPA developer will implement each CPA individually and monitor and record all parameters included in section E.7.1 (CPA monitoring record).
- The CME will provide guidance to the CPA developer on how the monitoring should be conducted and data should be collected with regards to emission reduction calculations.

[7] See: Annex C - Operation and Measurement Equipment, page 20 of the "Technical Procedure of the Committee of Economic Operation of SINAC (PR – 20) - Verification of Compliance with Requirements for being a member of COES SINAC". http://www.coes.org.pe/coes/Procedimientos/procedimiento_n20.pdf (accessed 09/11/11).

- The CPA developer will provide data on monitored parameters included in section E.7.1, required calculations, if any, and any documentary evidence to the CME.
- The CME will document and store all data related to parameters included in section E.7.1 provided by CPA developer in a central electronic database (PoA monitoring database) , while primary data will be stored by each CPA developer. The data for each CPA will be kept for at least two years after the end of the last crediting period for the CPA.
- The CME will review relevant CPA monitoring records, prepare the monitoring report, and provide the monitoring report to the DOE.

**A.4.5. Public funding of the programme of activities:**

The proposed PoA will not receive any public funds resulting from official development assistance from Parties included in Annex I to the Convention.

## SECTION B. Duration of the programme of activities

### B.1. Starting date of the programme of activities:

The starting date of the PoA is the date of registration, which is the date of submitting a complete request for registration (EB 59, Annex 12). It is anticipated that the starting date of the PoA will be 07/01/2013 .

### B.2. Length of the programme of activities:

28 years

## SECTION C. Environmental Analysis

**C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:**

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at CPA level x

The PoA consists of individual hydro power project activities potentially implemented in different geographical regions throughout the boundary of the PoA. Hence it is deemed inappropriate to conduct an environmental impact assessment at the PoA level. The type and size of CPA activity and the regional/national requirements will determine whether or not a full scale EIA process will be required.

**C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

The EIA or environmental analysis as required by the host country will be done at a CPA level. All CPAs within the PoA will consist of hydro power facilities. By replacing electricity from fossil fuel based power plants, these projects will directly contribute to reduce greenhouse gas (GHG) emissions. The positive environmental benefits of the implemented CPAs at a PoA level may include:

- Decreased air pollution linked to the use of the fossil fuels;
- Displacement of fossil fuels and GHG emission reductions; and
- Decreased dependency on fossil fuels.

**C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:**

According to the Peruvian Electric Concessions Law (Law No. 25844)[8], only a General Authorization is required for the development of hydroelectric power plants of less than 10 MW. The completion of an Environmental Impact Assessment (EIA) or its approval is not a requirement. Subsequently, with the introduction of the Law to Assure the Efficient Development of Electric Generation (Law No. 28832)[9], the limit for a Generation Authorization was increased to 20 MW. As the PoA focuses on hydro projects with an installed capacity of less than 20MW, individual CPAs are not legally required to present an EIA. (Also refer to section A.4.2.2, General eligibility criteria, para 'b').

## SECTION D. Stakeholders' comments

**D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:**

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at CPA level x

Each CPA operates within a geographically defined boundary and within the host country(-ies). For this reason local stakeholder consultation is done on a CPA level to ensure that the stakeholders actually affected by the project activity are adequately informed and consulted.

However a national conference has been conducted at the 20/01/2012 in Lima. The documentation on the national conference will be made available to the DOE upon request.

*Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.*

**D.2. Brief description how comments by local stakeholders have been invited and compiled:**

Local Stakeholder consultation is performed at CPA level.

**D.3. Summary of the comments received:**

n.a.

**D.4. Report on how due account was taken of any comments received:**

n.a.

[8] Source: http://www2.osinerg.gob.pe/MarcoLegal/pdf/LEYCE-DL25844.pdf (accessed 15/11/2011).

[9] Source: http://www2.osinerg.gob.pe/MarcoLegal/pdf/LEY%2028832.pdf (accessed 15/11/2011).

## SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical - CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form used to define and include a CPA in this PoA (PoA specific CDM-CPA-DD).

### E.1. Title and reference of the approved baseline and monitoring methodology applied to each CPA included in the PoA:

The approved consolidated baseline and monitoring methodology ACM0002 version 13.0.0, "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", is applied to each CPA included in the PoA.

**Applied methodology:**

- Version 13.0.0 of ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

**Related tools:**

- "Tool to calculate the emission factor for an electricity system" (version 02.2.1 of EB 63 Annex 19)
- "Tool for the demonstration and assessment of additionality" (version 06.0.0 of EB 65 Annex 21 )

### E.2. Justification of the choice of the methodology and why it is applicable to each CPA:

As stated in the eligibility criteria, each CPA must be applicable to and need to apply the latest version of the CDM baseline and monitoring methodology "ACM0002: Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 13.0.0 as per validation date).

Version 13.0.0 of ACM0002 methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

Since the CPAs included in the PoA are new, grid-connected hydro power projects, they fall under option (a) above.

The applicability conditions in version 13.0.0 of ACM0002 are shown below.

| Applicability conditions in version 13.0.0 of ACM0002 | Characteristics of the project activity | Applicability criterion met? |
|---|---|---|
| The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit […] | The CPA will consist of new, grid-connected hydro power projects. | Applicable |
| In the case of capacity additions, retrofits or replacements (except for hydro, solar, wave or tidal | The CPA will consist of a hydro power generation project that is | Not Applicable |

| | | |
|---|---|---|
| power capacity addition projects which use Option 2 […] to calculate the parameter $EG_{PJ,y}$): the existing plant 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 or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity | grid-connected and falls under option (a) mentioned above. | |
| In the case of retrofits, replacements, or capacity additions, the methodology is only applicable if the most plausible baseline scenario is P2: "The continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance." | The CPA will consist of a hydro power generation project that is grid-connected and falls under option (a) mentioned above. | Not Applicable |
| In case of hydro power plants, one of the following conditions must apply:<br>• The project activity is implemented in an existing reservoir, with no change in the volume of reservoir<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density (installed power generation capacity divided by the surface area at full reservoir level) of the project activity, is greater than 4 $W/m^2$<br>• The project results in new reservoirs and the power density of the power plant is greater than 4 $W/m^2$ | The CPA will consist of a hydro power generation project that results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 $W/m^2$. . | Applicable |
| In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 all the following conditions must apply:<br>• The power density calculated for the entire project activity using equation 5 is greater than 4 W/m2;<br>• Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant;<br>• Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br>• Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m2, is lower than 15 MW;<br>• Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m2, is less than 10% of the total installed capacity of the project activity from | The CPA will consist of a hydropower generation project that is fulfilling all the following conditions in case multiple reservoirs are used where the power density of any of the reservoirs is lower than 4 $W/m^2$:<br>• The power density calculated for the entire project activity using equation 5 is greater than 4 W/m2;<br>• Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant;<br>• Water flow between multiple reservoirs is not used by any | Applicable |

| | | |
|---|---|---|
| multiple reservoirs. | other hydropower unit which is not a part of the project activity;<br>• Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m2, is lower than 15 MW;<br>• Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 $W/m^2$, is less than 10% of the total installed capacity of the project activity from multiple reservoirs. | |
| The methodology is not applicable to the following:<br>• Project activities that involve switching from fossil fuels to renewable energy at the site of the project activity<br>• Biomass fired power plants<br>• Hydro power plants that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m². | The CPA is a renewable energy project, only hydro power projects that are either run-of-river or with a single reservoir with a power density greater than 4 $W/m^2$ will be considered. The CPA may consist of a hydropower plant using multiple reservoirs by fulfilling all criteria of applicability referred to above. | Applicable |

Table 1: Comparison of CPAs' characteristics and applicability conditions of version 13.0.0 of ACM0002

This comparison shows clearly that version 13.0.0 of ACM0002 is applicable to the proposed PoA and all CPAs to be included.

In the following the procedures of ACM0002, version 13.0.0, are described considering the latest version of related tools, which are:

- Version 2.2.1 of the "Tool to calculate the emission factor for an electricity system"
- Version 06.0 of the "Tool for the demonstration and assessment of additionality"

## E.3. Description of the sources and gases included in the CPA boundary

According to version 13.0.0 of ACM0002, the spatial extent of the project boundary includes the project activity and all power plants connected physically to the same grid to which the proposed projects (CPAs) are also connected.

According to version 13.0.0 of ACM0002, the spatial extent of the project boundary includes the project activity and all power plants connected physically to the same grid to which the proposed projects (CPAs) are also connected. The energy generated by the Project will be supplied to the Peru's National Interconnected System, SEIN, which spans all across the country.

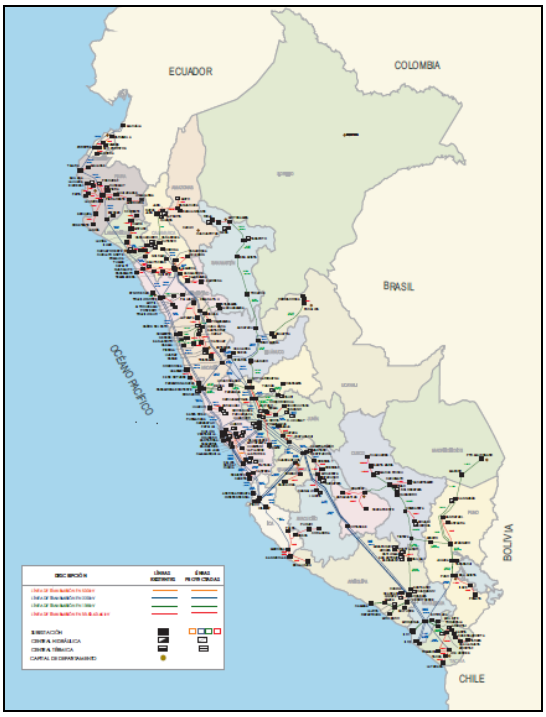


Figure 3: National Interconnected System, Peru. *Source: COES SINAC, 2011.*

The GHGs and emission sources included in the project boundary are shown in the following table.

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| Baseline | $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | $CO_2$ | Yes | Main emission source |
| | | $CH_4$ | No | Minor emission source |
| | | $N_2O$ | No | Minor emission source |
| Project activity | For hydro power plants, emissions of $CH_4$ from the reservoir | $CO_2$ | No | Minor emission source. |
| | | $CH_4$ | Yes | Main emission source. |
| | | $N_2O$ | No | Minor emission source. |

Table 2: Emissions sources included in or excluded from the project boundary

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

Identification of the baseline scenario

The baseline scenario for each CPA will be identified among the three alternatives described in the methodology, ACM0002 version 13.0.0.

The CPA will be the installation of new grid-connected renewable power plant/unit; hence according to ACM0002, the baseline scenario is the following:

> "Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".

**E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the CPA being included as registered PoA (assessment and demonstration of additionality of CPA):**

Each CPA will be a grid-connected hydro power generation project activity according to ACM0002 version 13.0.0. The most likely scenario under the PoA is that the CPA project activity is the installation of new grid-connected hydro power plant/unit, therefore 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 (CM) calculations described in the "Tool to calculate the emission factor for an electricity system"*.

**E.5.1. Assessment and demonstration of additionality for a typical CPA:**

Additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CDM Project Activity (CPA) would occur. The proof of additionality is based on the eligibility criteria as outlined above and considering to the latest the 'STANDARD FOR DEMONSTRATION OF ADDITIONALITY, DEVELOPMENT OF ELIGIBILITY CRITERIA AND APPLICATION OF MULTIPBLE METHOLOGIES FOR PROGRAMME OF ACTIVITIES', Version 01.0.[10] The actual proof of additionality following the methodology ACM0002 and the related tools will be done on CPA level as follows.

According to ACM0002, version 13.0.0., the additionality of each CPA shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Board, which is available on the UNFCCC CDM website.

The currently latest version, version 06.0, of the additionality tool includes the following steps:

[10] See EB 65, Annex 3(accessed 28/01/2012).

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

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

According to the CDM Validation and Verification Manual (EB 55 – Report – Annex 01 – Version 01.2 - clause 105), "the PDD shall identify credible alternatives to the project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required" [11].

According to methodology ACM0002 version 13.0.0, in cases where the project activity is the installation of new grid-connected renewable power plant/unit, the baseline scenario is defined as follows:

> "Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the Combined Margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system"."

Hence, in accordance with methodology ACM0002, version 13.0.0, and the "Tool to calculate the emission factor for an electricity system", Version 2.2.1, baseline emissions are equal to power generated by the project activity and delivered to the grid, multiplied by the baseline emission factor. The baseline emission factor is equal to the combined margin (CM): a weighted average of the operating margin (OM) emission factor and the build margin (BM) emission factor. Therefore, no further analysis of the alternatives to the project activity is required.

***Sub-step 1b: Consistency with mandatory laws and regulations***
The alternative, electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants, is in compliance with all existing applicable legal and regulatory requirements.

This step will determine whether the proposed project activity is economically and/or financially feasible, or not.

***Step 2: Investment analysis***

***Sub-step 2a: Determine appropriate analysis method***

Three options can be applied for the investment analysis: the simple cost analysis, the investment comparison and the benchmark analysis.

The latest version of the "*Tool for the demonstration and assessment of additionality"* states:

> "If the CDM project activity and the alternatives identified in Step 1 generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option

[11] Source: http://cdm.unfccc.int/Reference/Manuals/accr_man01.pdf (accessed 15/11/2011).

I). Otherwise, use the investment comparison analysis (Option II) or the benchmark analysis (Option III)".

The simple cost analysis is not applicable for the proposed CPAs because the project activities will produce economic benefit other than the CDM related income, notably from electricity sale. Instead, the the investment comparison analysis (Option II) or benchmark analysis (Option III) shall be used.

***Sub-step 2b: Option II. Apply investment comparison analysis***

The GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS (EB 62, Annex 5)[12], para19 states *"If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used. If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate."*

The investment comparison analysis (Option II) is not applicable to the project because the alternative of the project is "Equivalent electricity service provided by the grid", which is not a single project.

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

The GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS (EB 62, Annex 5)[13], para13 states *"In the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market."*

When applying Option III, the financial/economic analysis shall be based on parameters that are standard in the market, considering the specific characteristics of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer. Only in the particular case where the project activity can be implemented by the project participant, the specific financial/economic situation of the company undertaking the project activity can be considered.

Discount rates and benchmarks shall be derived from:

(a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;

(b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds. required return on comparable projects;

(c) A company internal benchmark (weighted average capital cost of the company), only in the particular case referred to above in paragraph 5. The project developers shall demonstrate that this benchmark has been consistently used in the past, i.e. that project activities under similar conditions developed by the same company used the same benchmark;

[12] Source: http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf (accessed 15/11/2011).

[13] Source: http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf (accessed 15/11/2011).

(d) Government/official approved benchmark where such benchmarks are used for investment decisions;

(e) Any other indicators, if the project participants can demonstrate that the above Options are not applicable and their indicator is appropriately justified.

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

Calculate the suitable financial indicator for the proposed CDM project activity,. include all relevant costs (including, for example, the investment cost, the operations and maintenance costs), and revenues (excluding CER revenues, but possibly including *inter alia* subsidies/fiscal incentives,[14] ODA, etc., where applicable), and, as appropriate, non-market cost and benefits in the case of public investors if this is standard practice for the selection of public investments in the host country.

Present the investment analysis in a transparent manner and provide all the relevant assumptions, preferably in the CPA-DD, or in separate annexes to the CPA-DD, so that a reader can reproduce the analysis and obtain the same results. Refer to all critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital). Justify and/or cite assumptions in a manner that can be validated by the DOE. In calculating the financial/economic indicator, the project's risks can be included through the cash flow pattern, subject to project-specific expectations and assumptions (e.g. insurance premiums can be used in the calculation to reflect specific risk equivalents).

In Peru electricity prices for renewable energy projects are contractually determined by means of a bid and/or spot price. The bid price is fixed by a PPA and will 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. 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 ±5%[15]. Therefore, fluctuations over the established limits are considered highly improbable.

The energy that is not sold through the PPA contract is sold in the spot market at a price 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. The price of natural gas is Peru is low due to the nature of the Camisea contract[16], which also guarantees that the price will be kept at a similar level.

[14] See EB guidance on the consideration of national/local/sectoral policies and measures for the baseline setting. The Executive Board at its 22nd meeting (Annex 3) clarified the treatment of national and sectoral policies. See also Information note on the implementation of E+/E- in the context of projects on the agenda of the fifty-third meeting of the CDM Executive Board (accessed 17/11/2011).

[15] Source: http://data.bls.gov/timeseries/WPSSOP3500?include_graphs=false&output_type=column&years_option=all_years (accessed 17/11/2011).

[16] Source: "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.e 19. "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.

The CPA-PDD will present a clear comparison of the financial indicators and if the CDM project activity has a less favourable indicator (e.g. lower IRR) than the benchmark, then the CDM project activity cannot be considered as financially attractive.

***Sub-step 2d: Sensitivity analysis***

| | |
|---|---|
| Project / equity IRR < Benchmark | Proceed with step 2d: Sensitivity analysis |
| Project / equity IRR > Benchmark | Proceed to step 3: Barrier analysis |

Include a sensitivity analysis that shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in favour of additionality only if it consistently supports (for a realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially/economically attractive (as per Step 2c) or is unlikely to be financially/economically attractive (as per Step 2c).

The objective of the sensitivity analysis is to quantify the impact of reasonable variations of critical variables in the financial indicator (e.g. IRR) of the proposed project activity:

According to the UNFCCC "Guidance on the Assessment of Investment Analysis" (version 5)[17] variables that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation.

The typical main variables to be considered in the sensitivity analysis may include:

1. CAPEX
2. OPEX
3. Plant load factor
4. Electricity sales prices

The financial analysis shall be performed by modifying each of the parameters by at least up to +/-10%, and assessing the impact on the financial indicator (without revenues from selling CERs). If the financial indicator (e.g. IRR) for any of the above variables is above the benchmark, the activity is deemed to be economically feasible without the sale of CERs. Therefore the investment analysis does not provide a valid argument in favour of additionality and the CPA-PDD shall provide a "Barrier Analysis" (Step 3).

If the additionality criteria are met, then the Barrier Analysis is optional and CPA-PDD shall proceed in providing a "Common Practice Analysis" (Step 4)

| | |
|---|---|
| Sensitivity analysis < Benchmark | Step 3 optional, proceed to Step 4 |
| Sensitivity analysis > Benchmark | Proceed to step 3: Barrier analysis |

When performing the investment analysis, the CDM "Guidelines on the Assessment of Investment Analysis" (Version 05, EB62, Annex 5)[18] should be considered. It is recommended to check that all guidance are met and followed.

[17] Source: http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf (accessed 17/11/2011).

***Step 3: Barrier Analysis***

If Barrier Analysis is carried out then the CPA-PDD will provide argumentation that the project faces barriers that:

(3a) Prevent the implementation of this type of proposed project activity; and

(3b) Do not prevent the implementation of at least one of the alternatives.

The identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed activity undertaken without being registered under this PoA. Typical barriers include: investment barriers, technological barriers, political barriers, and barriers due to prevailing practice. The latest version (at the time of drafting the CPA-DD) of "Guidelines for objective demonstration and assessment of barriers"[19] shall be used to demonstrate applicable barriers to the CPA.

***Step 4. Common Practice Analysis***

Unless the proposed project type has demonstrated to be first-of-its kind, the above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region. This test is a **credibility check** to complement the investment analysis (Step 2). Identify and discuss the existing common practice through the following steps.

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

Based on the installed capacity (MW) of the proposed project activity, the applicable output range will be calculated at +/- 50% (in MW) of the proposed activity.

***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 $N_{all}$. Registered CDM project activities shall not be included in this step;***

CPA PDD will provide a database of projects in the applicable geographical area that are operational prior to the start date of the proposed project activity that lie within the output range as defined in step 1. The database will include the installed capacity of individual projects and will be cross checked with the UNFCCC CDM pipeline to identify the registered projects. The registration number of the projects will be noted in the database and excluded from the calculation of $N_{all}$.

***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 $N_{diff}$***

'Different technologies' will be applied to the database to identify projects/plants that apply technologies not concurrent with the proposed project activity. Other CDM project activities (project activities which

[18] Source: Guidelines on the assessment of investment analysis (accessed 19/11/2011).
[19] Source for guidelines for barriers: http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid38.pdf (accessed 19/11/2011).

have been published on the UNFCCC website for global stakeholder consultation as part of the validation process and/or projects that have acquired host country approval for the purpose of pursuing CDM) will not be included for the purpose of defining $N_{diff}$.

***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***

Once $N_{all}$ and $N_{diff}$ have been identified, the factor shall be calculated and project activity will be concluded as a common practice in the geographical area if the factor F, which as per the guidelines is greater than 0.2 and the value of $N_{all} - N_{diff}$ is greater than 3.

If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive or faces barriers. Therefore, if similar activities are identified as described above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially/economically unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially/economically attractive (e.g., subsidies or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject. If necessary data/information of some similar projects are not accessible for PPs to conduct this analysis, such projects can be excluded from this analysis. In case similar projects are not accessible, the PDD should include justification about non-accessibility of data/information.

Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects were carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable.

### E.5.2. Key criteria and data for assessing additionality of a CPA:

Each CPA is expected to assess and demonstrate additionality using an investment analysis approach following the approach described in the latest "*Tool for the demonstration and assessment of additionality*" as described in A.4.3 and E.5.1.

## E.6. Estimation of Emission reductions of a CPA:

### E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical CPA:

Each CPA under the PoA will use ACM0002 "*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*" version 13.0.0.

The methodology is applicable for CPAs that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b)

involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).

Every CPA under the PoA will consist of a hydro power generation project that is grid-connected and falls under option (a) Greenfield projects

**E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a CPA:**

The typical CPA is a hydro power generation project connected to a national or/sub-national grid. The reduced emissions are calculated in accordance with the approved consolidated baseline methodology version 13.0.0 of ACM0002 along with the "Tool to calculate the emission factor for an electricity system" (version 02.2.1), as follows:

**Project emissions ($PE_y$)**

According to ACM0002 (Version 13.0.0):

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

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

*Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)*

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for $CH_4$ and $CO_2$ emissions from the reservoir, estimated as follows:

(a) If the power density of the project activity (PD) is greater than 4 $W/m^2$ and less than or equal to 10 $W/m^2$:

$$PE_{HP,y} = \frac{EF_{Res} \cdot TEG_y}{1000}$$

Where:
$PE_{HP,y}$ = Project emissions from water reservoirs ($tCO_2e/yr$)
$EF_{Res}$ = Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$). 90 $kgCO_2e/MWh$, as per EB 23 decision.
$TEG_y$ = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

(b) If the power density of the project activity (PD) is greater than 10 W/m$^2$:

$$PE_{HP,y} = 0$$

The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:
$PD$ = Power density of the project activity (W/m$^2$)
$Cap_{PJ}$ = Installed capacity of the hydro power plant after the implementation of the project activity (W)
$Cap_{BL}$ = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
$A_{PJ}$ = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m$^2$)
$A_{BL}$ = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m$^2$). For new reservoirs, this value is zero

**Baseline emissions ($BE_y$)**

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

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

Where:

$BE_y$ = Baseline emissions in year y ($tCO_2e/yr$)
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid,CM,y}$ = Combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2/MWh$)

*Calculation of $EG_{PJ,y}$*
The calculation of $EG_{PJ,y}$ is different for (a) greenfield plants, (b) retrofits and replacements, and (c) capacity additions. Since all the CPA under this PoA will consist in the installation of new grid-connected renewable power plants/unis at a site where no renewable power plant was operated prior to the implementation of the project activity, the calculation option (a) is used.

(a) Greenfield renewable energy power plants
$EG_{PJ,y}$ is calculated as follows:

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

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

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

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

According to the "Tool to calculate the emission factor for an electricity system" (version 02.2.1) the baseline emission factor ($EF_{grid,CM,y}$) is calculated as combined margin (CM), consisting of the combination of the operating margin (OM) and the build margin (BM) factors.

Application of procedures provided in "Tool to calculate the emission factor for an electricity system" (version 02.2.1) for determining the grid emission factor are as follows:

STEP 1. Identify the relevant electricity systems.
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin (BM) emission factor.
STEP 6. Calculate the combined margin (CM) emissions factor.

***Step 1: Identify the relevant electricity systems***

The energy generated by the CPAs will be supplied to the Peru's National Interconnected System (*Sistema Eléctrico Interconectado Nacional*, SEIN).

Electricity imports from other grids have not been reported, neither by the SEIN dispatch center nor MINEM. Even if there were imports, for the purpose of determining the OM emission factor, the assumed emission factor for net electricity imports is 0. Electricity exports to other grids have been reported by the SEIN dispatch center. Therefore, exports should not be subtracted from electricity generation data used in calculating and monitoring the electricity emission factors.

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

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

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

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

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

The aforementioned Tool to calculate the EF for an electricity system, provides four methods to calculate the operating margin emission factor ($EF_{grid,OM,y}$):

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

For the emission factor calculation of the interconnected system of Peru Option (c) "**Dispatch data analysis OM**" has been chosen.
The option (a) Simple OM method cannot be used since low cost, must-run resources constitute more than 50% of total grid generation in Peru. Furthermore, it was not necessary to use either the (b) Simple Adjusted OM approach or the (d) Average OM approach because detailed dispatch data is available.

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

***(c) Dispatch data analysis OM***

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

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

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

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

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

Where:
$EF_{EL,DD,h}$ = $CO_2$ emission factor for grid power units in the top of the dispatch order in hour *h* in year *y* ($tCO_2/MWh$)
$EG_{n,h}$ = Net quantity of electricity generated and delivered to the grid by grid power unit *n* in hour *h* (MWh)
$EF_{EL,n,y}$ = $CO_2$ emission factor of grid power unit *n* in year *y* ($tCO_2/MWh$)
n = Grid power units in the top of the dispatch (as defined below)
h = Hours in year y in which the project activity is displacing grid electricity

The $CO_2$ emission factor of the grid power units *n* ($FE_{EL,n,y}$) should be determined as per the guidance for the simple OM, using the Option A2.

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

Where:

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

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

To determine the set of grid power units *n* that are in the top of the dispatch, obtain from a national dispatch centre:

- The grid system dispatch order of operation for each grid power unit of the system including power units from which electricity is imported; and
- The amount of power (MWh) that is dispatched from all grid power units in the system during each hour h that the project activity is displacing electricity.

At each hour *h*, stack each grid power unit's electricity generation using the merit order. The group of grid power units *n* in the dispatch margin includes the units in the top x% of total electricity dispatched in the hour *h*, where x% is equal to the greater of either:

a) 10%; or
b) The quantity of electricity displaced by the project activity during hour *h* divided by the total electricity generation by grid power plants during that hour *h*.

For the calculation, use the hourly generation from the most recent data available.

Information on the hourly generation of all plants in the SEIN[20] and their associated emission factors are to be entered using Excel software and organized in columns where the position of the columns is determined by the grid dispatch merit order.[21] This process will enable identification of the plants that fall within the top X % of grid dispatch each hour of the year. If in the *ex-ante* calculations, the quantity of electricity displaced by the project activity during hour, *h,* divided by the total electricity generation in the grid during that hour, *h* is smaller than 10.00%; then, 10.00% is used to determine the plants that fall within the top X % of grid dispatch each hour of the year.

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

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

[20] Data provided by COES, the dispatch center.
[21] This can be done by the merit orders assigned to each unit of the SEIN, as published by COES in its annual statistics.

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

In terms of data vintage, there are two options according to "Tool to calculate the emission factor for an electricity system" (version 02.2.1). Option 1 is recommended.

**Option 1:** For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CPA-DD submission to the DOE for validation. 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. This option does not require monitoring the emission factor during the crediting period.

Therefore, the calculation of the Build Margin (BM) emission factor $EF_{grid,BM,y}$ *ex-ante* is based on the most recent information available on plants already built for sample group *m* at the time of CPA-DD submission is carried out.

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

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities ($AEG_{total}$, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20.00% of $AEG_{total}$ (if 20.00% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

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

Identify the date when the power units in $SET_{sample}$ started to supply electricity to the grid.

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

Otherwise:

(d) Exclude from $SET_{sample}$ the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20.00% of the annual electricity generation of the project electricity system (if 20.00% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

If the annual electricity generation of that set is comprises at least 20.00% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20.00% 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 ($SET_{sample\text{-}CDM}$->10yrs).

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

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

Where:

| | | |
|---|---|---|
| $EF_{grid,BM,y}$ | = | Build margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$) |
| $EG_{m,y}$ | = | Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh) |
| $EF_{EL,m,y}$ | = | $CO_2$ emission factor of power unit *m* in year *y* ($tCO_2/MWh$) |
| m | = | Power units included in the build margin |
| y | = | Most recent historical year for which power generation data is available |

The $CO_2$ emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM, using option A2, using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.
If the power units included in the build margin *m* correspond to the sample group $SET_{sample\text{-}CDM\text{->}10yrs}$, then, as a conservative approach, only option A2 from guidance in Step 4 (a) can be used and the default values provided in Annex 1 shall be used to determine the parameter $\eta_{m,y}$.

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

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

(a) Weighted average CM;

(b) Simplified CM;

The weighted average CM method (Option a) is used. Therefore, the combined margin emissions factor is calculated as follows:

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

Where:

| | |
|---|---|
| $EF_{grid,BM,y}$ | = Build Margin $CO_2$ emission factor in year $y$ (t $CO_2$/MWh) |
| $EF_{grid,OM,y}$ | = Operating Margin $CO_2$ emission factor in year $y$ (t $CO_2$/MWh) |
| $w_{OM}$ | = Weighting of operating margin emissions factor (%) |
| $w_{BM}$ | = Weighting of build margin emissions factor (%) |

The following default values should be used for $w_{OM}$ and $w_{BM}$: ("Tool to Calculate the Emission Factor for an Electricity System", version 02.2.1, p. 14):

> *Other projects than wind and solar power generation project activities, e.g. hydro power generation projects: $w_{OM}$ = 0.5 and $w_{BM}$ = 0.5 for the first crediting period. For the second and third crediting period, $w_{OM}$ = 0.25 and $w_{BM}$ = 0.75, unless otherwise specified in the approved methodology which refers to the Tool.*

As the CPAs are hydro power generation project the weight applied to the operating and build margin emissions factors are $w_{OM}$ = 0.5 and $w_{BM}$ = 0.5 for calculating of the CM.

**Leakage ($LE_y$)**
As it is stated in ACM0002 version 13.0.0, no leakage emissions are considered.

**Emissions reduction ($ER_y$)**

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

| | | |
|---|---|---|
| $ER_y$ | = | Emission reductions in year $y$ (t $CO_2$e/yr) |
| $BE_y$ | = | Baseline emissions in year $y$ (t $CO_2$e/yr) |
| $PE_y$ | = | Project emissions in year $y$ (t $CO_2$/yr) |

**Estimation of emissions reductions prior to validation**

CPA developer should prepare as part of the CPA-DD an estimate of likely emission reductions for the proposed crediting period. This estimate should, in principle, employ the same methodology as selected above. Changes required for methodology implementation in 2nd and 3rd crediting periods

At the start of the second and third crediting period project proponents have to address two issues:

- Assess the continued validity of the baseline; and
- Update the baseline.

In assessing the continued validity of the baseline, a change in the relevant national and/or sectoral regulations between two crediting periods has to be examined at the start of the new crediting period. If at the start of the project activity, the project activity was not mandated by regulations, but at the start of the second or third crediting period regulations are in place that enforce the practice or norms or technologies that are used by the project activity, the new regulation (formulated after the registration of the project activity) has to be examined to determine if it applies to existing plants or not. If the new regulation applies to existing CDM project activities, the baseline has to be reviewed and, if the regulation is binding, the baseline for the project activity should take this into account. This assessment will be made available for the verifying DOE.

For updating the baseline at the start of the second and third crediting period, new data available will be used to revise the baseline scenario and emissions. Project participants shall assess and incorporate the impact of new regulations on baseline emissions.

**E.6.3. Data and parameters that are to be reported in CDM-CPA-DD form:**

| **Data / Parameter:** | **$LE_y$ Leakage emissions** |
|---|---|
| Data unit: | **$tCO_2$**/yr |
| Description: | GHG emissions produced by leakage of the project activity |
| Source of data used: | |
| Value applied: | 0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the Baseline Methodology, project participants do not need to consider leakage. |
| Any comment: | |

| **Data / Parameter:** | $Cap_{BL}$ |
|---|---|
| Data unit: | W |
| Description: | Installed capacity of the hydro power plant before the implementation of the project activity. |
| Source of data used: | Project site (as suggested in the Methodology) |
| Value applied: | |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | For new hydro power plants, this value is zero |
| Any comment: | - |

| Data / Parameter: | $A_{BL}$ |
|---|---|
| Data unit: | $m^2$ |
| Description: | Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full. |
| Source of data used: | Project site (as suggested in the Methodology) |
| Value applied: | |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | For new reservoirs, this value is zero according to ACM0002. |
| Any comment: | - |

| Data / Parameter: | $A_{PJ}$ |
|---|---|
| Data unit: | $m^2$ |
| Description: | Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full. |
| Source of data used: | Project site |
| Value applied: | - |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Measured from topographical surveys, maps, satellite pictures, etc. |
| Any comment: | Monitoring frequency: yearly |

| Data / Parameter: | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | BM $CO_2$ emission factor in year *y* ($tCO_2/MWh$) |
| Source of data used: | COES annual statistics. By comparing annual statistics, new additions were identified. The last annual statistics of COES was for 2010. (Data available in the internet: http://www.coes.org.pe) |
| Value applied: | |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the *Tool to Calculate the Emission Factor for an Electricity System (Version 02.2.1*), in terms of vintage of data, project participants have chosen option 1. For the first crediting period, the BM emission factor is calculated *ex-ante* based on the most recent information available on units already built for sample group, *m*, at the time of CPA-DD submission to the DOE for Validation. For the second crediting period, the BM emission factor will 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 BM emission factor calculated for the second crediting period will be used. This option does not require monitoring of the emission factor during the crediting period. |
| Any comment: | - |

| Data / Parameter: | $EF_{Res}$ |
|---|---|
| Data unit: | $kgCO_2e/MWh$ |
| Description: | Default emission factor for emissions from reservoirs |
| Source of data used: | Decision by EB 23 |
| Value applied: | 90 kgCO2e/MWh |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | - |
| Any comment: | - |

| Data/Parameter: | $TEG_y$ |
|---|---|
| Data unit: | MWh/yr |
| Description: | Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* |
| Source of data: | Project activity site |
| Measurement procedures (if any): | Electricity meters |
| Monitoring frequency: | Continuous measurement and at least monthly recording |
| QA/QC procedures: | - |
| Any comment: | Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 $W/m^2$ and less than or equal to 10 $W/m^2$ |

**E.7. Application of the monitoring methodology and description of the monitoring plan:**

All data collected as part of monitoring should be archived electronically and be kept for at least two years after the end of the last crediting period. 100% of the data should be monitored if not indicated otherwise in the tables below. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

In addition, the monitoring provisions in the tools referred to in this methodology apply.

Some parameters listed below under "data and parameters" either need to be monitored continuously during the crediting period or need to be calculated only once for the crediting period, depending on the data vintage chosen, following the provisions in the baseline methodology procedure outlined above and the guidance on "monitoring frequency" for the parameter. The calculation of the operating margin and build margin emission factors should be documented electronically in a spread sheet that should be attached to the CPA-DD. This should include all data used to calculate the emission factors accordingly to the methodology following the "Tool to calculate the emission factor for an electricity system" (Version 2.2.1):

- The following information for each grid-connected power plant/unit:
    - Information to clearly identify the plant;
    - The date of commissioning;
    - The capacity (MW);
    - The fuel type(s) used;

- The quantity of net electricity generation in the relevant year(s);[22]
- If applicable: the fuel consumption of each fuel type in the relevant year(s);
- In case where the simple OM or the simple adjusted operating margin is used: information whether the plant/unit is a low-cost/must-run plant/unit.

- Net calorific values used;
- $CO_2$ emission factors used;
- Plant efficiencies used, if applicable;
- Identification of the plants included in the build margin and the operating margin during the relevant time year(s);
- The quantity of electricity displaced by the project activity;

The data should be presented in a manner that enables reproducing of the calculation of the build margin and operating margin grid emission factor.

### E.7.1. Data and parameters to be monitored by each CPA:

| Data / Parameter: | $\mathbf{EF_{grid,CM,y}}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | Combined margin $CO_2$ emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" |
| Source of data to be used: | As per the "Tool to calculate the emission factor for an electricity system" |
| Value of data applied | Value to be determined at CPA level |
| Description of measurement methods and procedures to be applied: | Ex-post emission factor will be calculated as per the "Tool to calculate the emission factor for an electricity system" |
| QA/QC procedures to be applied: | As per the "Tool to calculate the emission factor for an electricity system" |
| Any comment: | |

| Data / Parameter: | $\mathbf{EG_{facility,y}}$ $\mathbf{(EG_{pj,y})}$ |
|---|---|
| Data unit: | MWh/yr |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* |
| Source of data to be used: | Information provided by COES based in electricity meters. |
| Value of data applied | Value to be determined at CPA level |

[22] In case of the simple adjusted OM, this includes the five most recent years or long-term averages for hydroelectricity production.

| | |
|---|---|
| Description of measurement methods and procedures to be applied: | Continuous monitoring, hourly measurement and monthly recording. Measurements are undertaken using energy meters. |
| QA/QC procedures to be applied: | Cross check measurement results with records for sold electricity and information from COES |
| Any comment: | If the transformer and transmission line are shared by other power plants not included in the CPA, the quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* will be extracted from the following measurements:<br>• Information provided by COES based in common electricity meters;<br>• Measurement of the electricity of each plant immediately before the transformer and transmission line.<br>This will guaranty that all projects connected to a common transformer and transmission line at the same conditions consider the same transformer and transmission line losses. |

| | |
|---|---|
| Data / Parameter: | **$EG_{m,y}$ and $EG_{n,h}$** |
| Data unit: | MWh |
| Description: | Net electricity generated and delivered to the grid by power plant / unit *m*, or *n* in year, *y* or hour, *h* |
| Source of data to be used: | COES |
| Value of data applied | COES data |
| Description of measurement methods and procedures to be applied: | For the *ex-ante* calculation, the latest publicly available information is used, which is the COES annual statistics of 2010. Directly measured based on the information provided by COES. This data will be measured every 15 minutes and recorded hourly. The proportion of data to be monitored is 100.00% and the data will be archived electronically. |
| QA/QC procedures to be applied: | - |
| Any comment: | |

| | |
|---|---|
| Data / Parameter: | **$EG_{PJ,h}$** |
| Data unit: | MWh |
| Description: | Electricity displaced by the project activity in hour h of year y |
| Source of data to be used: | COES |
| Value of data applied | Value to be determined at CPA level |

| | |
|---|---|
| Description of measurement methods and procedures to be applied: | Directly measured based on the information provided by COES. This data will be measured every 15 minutes and recorded hourly. The proportion of data to be monitored is 100% and the data will be archived electronically. The electric meter will be implemented according to the dispatch center (COES) requisites.[23] |
| QA/QC procedures to be applied: | |
| Any comment: | - |

| **Data / parameter:** | $\eta_{m,y}$ |
|---|---|
| Data unit: | - |
| Description: | Average net energy conversion efficiency of power unit ,*m* in year, *y* |
| Source of data to be used: | Data from the dispatch center, COES Annual statistics |
| Value of data applied | COES data |
| Description of measurement methods and procedures to be applied: | In the first monitoring report will be used the last available annual report of COES. |
| QA/QC procedures to be applied: | These calculations and measurements will be performed with a COES accredited consultants and the result are reviewed and supervised by COES experts. |
| Any comment | |

| **Data / Parameter:** | **Merit Order** |
|---|---|
| Data unit: | Text |
| Description: | The merit order in which power plants are dispatched by documented evidence |
| Source of data to be used: | COES |
| Value of data applied | COES data. |
| Description of measurement methods and procedures to be applied: | The merit order is publicly available in the annual statistics of COES. For each year, it displays the variable cost of thermal plants from the SEIN in effect at December. The proportion of data to be monitored is 100% of all plants in the merit order. The data will be archived electronically and in paper for original documents. |
| QA/QC procedures to be applied: | |
| Any comment: | |

| **Data / Parameter:** | **Cap $_{PJ}$** |
|---|---|

[23] See: Technical Procedure of the Committee of Economic Operation of SINAC PR – 20 – Verification of Compliance with requirements for being a member of COES SINAC, p.20; in the internet: http://www.coes.org.pe/coes/Procedimientos/procedimiento_n20.pdf (accessed 19/11/2011).

| | |
|---|---|
| Data unit: | W |
| Description: | Installed capacity of the hydropower plant after the implementation of the project activity. |
| Source of data to be used: | Project site. |
| Value of data applied | Determined at CPA level |
| Description of measurement methods and procedures to be applied: | Determine the installed capacity based on recognized standards. The monitoring frequency would be yearly. |
| QA/QC procedures to be applied: | - |
| Any comment: | - |

| **Data / Parameter:** | $\mathbf{A_{PJ}}$ |
|---|---|
| Data unit: | $m^2$ |
| Description: | Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full. |
| Source of data used: | Project sponsor |
| Value of data applied for the purpose of calculating expected emission reductions in section B.6.3 | The area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full. |
| Description of measurement methods and procedures to be applied: | The area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full. |
| QA/QC procedures to be applied: | - |
| Any comment: | - |

| **Data / Parameter:** | $\mathbf{EF_{CO2,i,y}}$ **and** $\mathbf{EF_{CO2,m,i,y}}$ | |
|---|---|---|
| Data unit: | $tCO_2/GJ$ | |
| Description: | $CO_2$ emission factor of fossil fuel type i in year y | |
| Source of data used: | Following data sources may be used if the relevant conditions apply: | |
| | Data source | Conditions for using data source |
| | Values provided by the fuel supplier of the power plants in invoices | If data is collected from power plant operators (e.g. utilities) |
| | Regional or national average default values | If values are reliable and documented in regional or national energy statistics / energy balances |
| | IPCC default values at the lower limit of the uncertainty at a 95.00% confidence interval as provided in table 1.4 of Chapter1 of Vol. 02 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | - |
| Value of data applied for the | IPCC default values: | |

| | |
|---|---|
| purpose of calculating expected emission reductions in section B.6.3: | Diesel Oil = 72,600<br>Residual Fuel Oil = 75,500<br>Natural Gas = 54,300<br>Coal = 87,300 |
| Description of measurement methods and procedures to be applied: | Dispatch data OM: Annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. Further guidance can be found in Step 3 of the Tool to calculate the emission factor for an electricity system; BM: For the first crediting period ex ante. For the second and third crediting period, only once *ex ante* at the start of the second crediting period |
| QA/QC procedures to be applied: | - |
| Any comment: | - |

### E.7.2. Description of the monitoring plan for a CPA:

The purpose of the monitoring plan will be to measure and record the net electricity delivered to the electrical grid. Details of the CPA monitoring plan will be described within each CPA, considering the following elements.

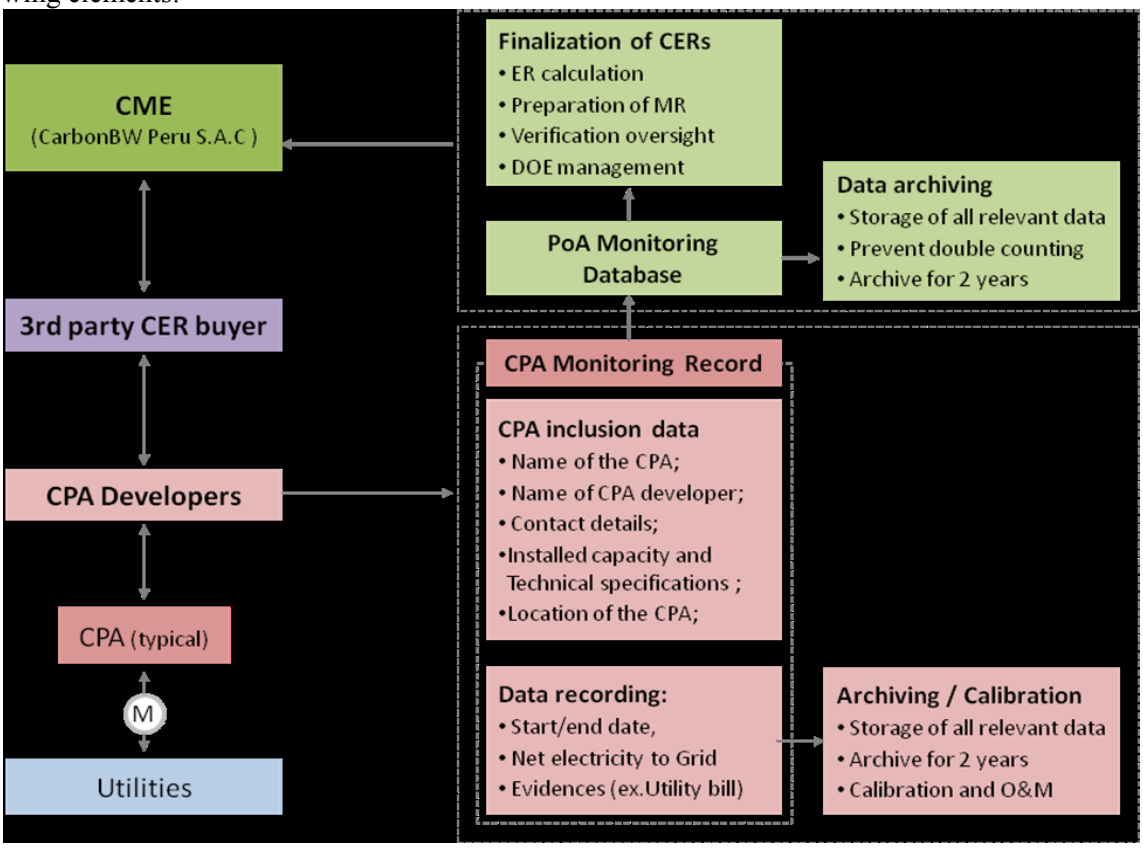


Figure 4: Outline for Monitoring Plan for CPA

**1. Management structure and responsibilities**

The CME will implement a monitoring protocol consolidating all individual monitoring reports allowing the Designated Operational Entity (DOE) to verify all CPAs in the PoA. Monitoring will be carried out by each CPA. For each CPA, all parameters included in E.7.1 will be monitored, if applicable, by the developer of the CPA. The main measure for the PoA is the measurement of net electricity supplied to the grid and assuring the correct operation and maintenance of the measuring equipment.

**Data collection**
The CME will establish and maintain a central PoA Monitoring Database covering information and data of each CPA. The following data will be recorded:

| | |
|---|---|
| Basic data for inclusion | • Name of the CPA;<br>• Name of the developer of the CPA;<br>• Contact details of the developer including contact person, address, telephone and/or email address;<br>• Installed capacity and other relevant technical specifications of each CPA;<br>• Location of the CPA (e.g. GPS coordinates); |
| Data during crediting period | • Verification status (i.e. periods verified, amount of CERs issued, etc.)<br>• CPA monitoring records and monitoring reports of each CPA. |

Each CPA will comprise a single project activity, and hence the data will be monitored directly at that CPA project site. Monitoring will be carried out by each CPA developer and recorded in the CPA monitoring records. The CME will provide guidance to the CPA developer on how the monitoring should be conducted and data should be collected with regards to emission reduction calculations. The start and end dates of each monitoring period for each individual CPA, together with the CPA monitoring records to that monitoring period will be recorded in the PoA monitoring database.

**Data recording**
For each CPA, all parameters included in E.7.1, if applicable, will be monitored by the CPA developer and recorded electronically in a CPA monitoring record. The CPA developer will provide the CPA monitoring records to the CME. The CME will document and store all data related to parameters included in section E.7.1 provided by CPA developer in an electronic PoA monitoring database, while primary data will be stored by each CPA developer.

**Measurement device calibration**
Data calibration will be done considering the calibration frequency as per host countries requirements and fulfilling the technology and performance specifications of the host country national standards[24].
The CME will store all the data in an electronic database (PoA monitoring database). Primary data will be stored by the implementing entities (CDP developer).

**Data reporting**
The CME will be responsible for the preparation of the monitoring report and communication with the DOE during verification activities. The monitoring report will compile all required monitoring

[24] The installed electronic measuring system should have mass storage and an accuracy of class 0.2 or higher. : "See: Annex C - Operation and Measurement Equipment, page 20 of the "Technical Procedure of the Committee of Economic Operation of SINAC (PR – 20) - Verification of Compliance with Requirements for being a member of COES SINAC". http://www.coes.org.pe/coes/Procedimientos/procedimiento_n20.pdf (accessed 09/11/11).

information, i.e. CPA monitoring records, in order to allow the DOE to verify the emission reductions for each monitoring period of each individual CPA. The monitoring report will unambiguously set out the data on emission reductions generation by each CPA during the monitoring period consistent with the requirements of this PoA-DD and the corresponding CPA-DD. Record keeping procedures for the PoA database undertaken by the CME will ensure that the data attributed to a monitoring period can be clearly attributed to an individual CPA and will furthermore prevent double counting of emission reduction data.

**Data archiving**
The CME will be responsible for the management of all CPA monitoring records associated with each CPA and the consolidated PoA monitoring database comprising of CPA specific data. All CPA monitoring records will be stored for a period of two years after the end of the relevant crediting period of the CPA. The CPA developer is responsible to keep a copy of the raw monitored data and the CPA monitoring record also for a period of two years after the end of the relevant crediting period of the CPA.

**2. Data quality control**
The data and reports provided by each CPA developer to the CME will be cross checked internally by the CME to ensure the accuracy and completeness of data. In case of mistakes, corrective action will be applied to avoid future similar mistakes.

**3. Training and monitoring personnel**
The CME will provide all necessary information and training material that enables CPA developers to conduct the monitoring process as required by the PoA. The CPA developer ensures that all persons that participate in the actual monitoring process for the CPA will be suitably qualified and trained in the operation and maintenance of the CPA project activity. If required, these persons will also receive training on the application of the monitoring plan by the CME.

**Leakage**
No leakage emissions are considered.

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

The date of completing the baseline study and applying the monitoring methodology: 25/11/2011

Responsible entity, which is not a project participant:
Perspectives GmbH, Baumeisterstrasse 2, 22099 Hamburg, Germany (www.perspectives.cc)

Contact persons:

- Marc André Marr (Head of Carbon Project Services; marr@perspectives.cc),
- Alberto Galante (Carbon Project Consultant; galante@perspectives.cc),
- Arindam Basu (Carbon Project Consultant; basu@perspectives.cc).

## Annex 1

## CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

| | |
|---|---|
| Organization: | Carbon BW Peru S.A.C. |
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## Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

## Annex 3

## BASELINE INFORMATION

## Annex 4

## MONITORING INFORMATION

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