Programme of activities design document form
(Version 09.0)

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

BASIC INFORMATION	
Title of the PoA	**Ecoener Small Hydro Programme of Activities**
Version number of the PoA-DD	02.0
Completion date of the PoA-DD	24/10/2019
Coordinating/managing entity	Ecoener Ingeniería, Sociedad Anónima
Host Parties	Guatemala
Applied methodologies and standardized baselines	AMS-I.D. Grid connected renewable electricity generation (Version 18).
Sectoral scopes	01

PART I. Programme of activities (PoA)

SECTION A. Description of PoA

A.1. Purpose and general description of PoA

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The **Ecoener Small Hydro Programme of Activities** aims to develop a series of small hydroelectric projects in the Republic of Guatemala as host country. The projects to develop are run of the river (ROR) with or without daily reservoir, but always enclosed as small scale renewable energy projects with total installed capacity below 15 MW.

1. **General operating and implementing framework of PoA**
   The Ecoener Small Hydro Programme of Activities (hereafter "Ecoener PoA")[1] will support the development of new small
   -scale hydropower plants in the Republic of Guatemala that supply electricity to the national grid. Each SSC-CPA under this SSC-PoA will comprise one or more than one hydropower plant with a combined installed capacity of no more than 15 MW - the threshold for small-scale CDM projects. The projects included in this PoA are small-hydropower plants which technical characteristics are defined and included in the methodology AMS-I.D. Grid connected renewable electricity generation approved by CDM Executive Board (Version 18, Sectoral Scope 01, EB 81). The PoA, is a voluntary action being coordinated and managed by *Ecoener Ingeniería, Sociedad Anónima*[2] (hereinafter *Ecoener Ingeniería, S.A.*), which will work closely with the developers of the hydropower plants and other organizations active in the hydropower sector in the host country to facilitate the development of new power plants and their inclusion in this SSC-PoA. Ecoener Ingeniería, S.A. was formally established on 20 May 2011 by a company that, during last years, had been developing hydroelectric projects in Guatemala. In the deed of incorporation is listed among others the following objects and purposes of society: *the provision of consulting services and advice on energy projects*; *providing consultancy and advice on environmental impact studies and clean development; the provision advisory services and consulting projects related to the Kyoto Protocol and carbon credit trading*. Thus, the CME has been promoting the development of hydroelectric projects under the CDM to reduce GHG emissions in the host country, and this development will be established through the framework of this PoA. As support documentation, the CME made available to DOE the "*PoA Timeline*" and the "*chronogram with estimated schedule of the program of activities*".

2. **Policy/measure or stated goal of the PoA**
   The goal of the PoA is to develop a platform for overcoming institutional, financial and structural hurdles for the construction of a series of small hydro projects. All projects are new, small-scale, grid-connected, run- of-river hydropower plants with or without daily regulation reservoir, which will help to stabilize voltage and electricity supply in the surrounding area.

   Economic benefits:
   - The SSC-PoA increases employment opportunities in the area where each SSC-CPA is located, leading to a general increase in local communities' income.
   - By generating additional electricity, the SSC-PoA/CPA enhances the local investment environment and improves the local economy.

[1] Also referred as Ecoener PoA in this document.

[2] The Cordinating and Managing Entity (CME)

- The SSC-PoA diversifies sources of electricity generation that are necessary to meet a growing demand for energy and facilitates the transition away from diesel/coal electricity generation.
- The SSC-PoA contributes to poverty alleviation through income and employment generation (local people will be employed throughout the project operation or each SSC-CPA).
- The decentralized electricity production through the PoA will help to enhance the grid stability and therefore decrease possible electricity interruptions.

Social benefits:

- The PoA supports the development of SSC-CPA hydropower renewable resources decentralized in several locations of the host country. Therefore, the PoA promotes sustainable development of the regions in which SCC-CPA is located, providing access to power for populations in remote areas that are socially disadvantaged.
- The SSC-CPA improves access to electrical power in rural regions by increasing access and quality of electricity in the distribution network.
- During civil work, the SSC-CPA generates employment opportunities for the local population (in addition, various types of mechanical work generate employment development and operation).

Technological benefits:

- The SSC-CPA under this POA will support technology/know-how transfer from other regions/countries via training and practical work experience. The Management Entity *Ecoener Ingeniería, S.A*. is a company with large experience, with more than 30 years developing renewable energy projects worldwide, and will support technology training through a contract with project implementer if required. Usually, the company responsible for the construction of the hydroelectric project, through an EPC contract, will provide training to local people hired for jobs. The CME is an entity with experienced and trained personnel for development of hydroelectric projects in all phases: design, licensing, financing, construction and commissioning. It has qualified staff who can train local people for all the jobs of construction of hydroelectric project, in civil works, the installation of turbines and electromechanical equipment, the operation and maintenance of SCADA systems, etc. In the chronogram with estimated schedule of the program of activities is included the training programs for each SSC-CPA.
- Because replacement parts are needed on a timely basis to ensure the smooth operation of the hydropower plants, the SSC-CPA encourages local production of spare parts in the region.

3. **Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.**
    - The PoA is a voluntary action being coordinated and managed by *Ecoener Ingeniería. S.A.*, also referred to as “the coordinating/managing entity”. There are no mandatory laws or regulations in place in the host country that require hydropower plants to seek CDM services. Likewise, no mandatory laws or regulations exist requiring the managing entity or any other party to develop a SSC-PoA for hydropower plants in the host country.

A.2. Physical/geographical boundary of PoA

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The SSC-PoA will be developed throughout the departments in the country listed as Host Party.

The republic of Guatemala is a country in Central America bordered by Mexico to the north and west, the Pacific Ocean to the southw.3est, Belize to the northeast, the Caribbean to the east,

and Honduras and El Salvador to the southeast. Its area is 108,890 km^2 (42,043 mi^2). Guatemala is organized in 22 departments (departamentos) y 333 municipalities.

Figure 1: Departments of Guatemala

A.3. Technologies/measures

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In accordance with the procedural guidelines, the CDM-AP adopted this list of sectoral scopes which is based on the list of sectors and sources contained in Annex A of the Kyoto Protocol. Scopes 1 to 9 are industrial sectors and 10 to 13 are sectors based on sources of GHG emissions. The Managing Entity of this PoA choose to apply for one sectoral scope: ***Sectoral Scope 1. Energy industries (renewable - / non-renewable sources).*** More specifically, the projects included in this PoA are small-hydropower plants which technical characteristics are defined and included in the methodology AMS-I.D. Grid connected renewable electricity generation approved by CDM Executive Board (Version 18, Sectoral Scope 01, EB 81).

Therefore, the SSC-CPAs under this SSC-PoA shall be small run-off-river hydro power plants with an installed capacity below or equal to 15 MW connecting to the national electricity grid of the host country. Though, detailed technical characteristics will differ the following general conditions will apply for all SSC-CPAs.

- The projects shall be **run-of-the-river with no more than a daily control reservoir, if any.** The power density should be always bigger than 4W/m2, but to avoid project emissions from water reservoir they shall be always bigger than 10W/m2 as an eligibility requirement detailed in the relevant section. According to the methodology and eligibility criteria, **the projects under this SSC-PoA shall belong to one of the following option**s:
  - **(a) A new power plant in a site where there was no renewable energy power plant operating 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).**

- Water will be diverted to the power plant through the most environmentally-friendly alternative while ensuring a minimum ecological flow remains (under the requirements of the competent environmental authority).
- The water is conducted through a penstock to the power house.
- In the power house one or more turbines[3] and suitable generator(s) are located.
- From there the plant connects to the closest sub-station through a new or modified existing power line. The substation or interconnection point to the grid will be defined by the national authority in electrical issues of the host country.
- A discharge channel returns the water to the natural river bed.

There is a technology transfer, because a hydropower project requires very specific, high-tech equipment to run it such as a special turbine, generator and alternator. Operational success demands specific knowledge on how to design and operate the plant. Because most of the equipment and know-how cannot be secured locally, the bulk of the equipment required for the SSC-CPA's construction will be imported from abroad (from Annex-I and non Annex-I countries), resulting in a transfer of technology.

A.4. Coordinating/managing entity

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Ecoener Ingeniería, Sociedad Anónima, will be the Coordinating/Managing Entity (CME4) for the project activities under the Programme of Activities (PoA). Ecoener Ingeniería, Sociedad Anónima, will communicate with the CDM Executive Board.

A.5. Parties and project participants

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Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Guatemala (host)	Ecoener Ingeniería, Sociedad Anónima	No

A.6. Public funding of PoA

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The PoA Ecoener Small Hydro Programme of Activities does not receive public funding.

SECTION B. Management system

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The proposed SSC-PoA involves a range of operational activities in order to implement and manage each SSC-CPA by the managing entity, Ecoener Ingeniería, S.A, and SSC-CPA owner (or the CPA Implementer) within the Ecoener PoA.

As per CDM Project Standard for Programmes of Activities (Version 02.0, EB 101, Annex 3), the CME shall have the competencies to check the features of potential CPAs and ensure that each CPA meets all requirements and eligibility criteria before inclusion in the registered PoA.

[3] Turbine type may include technologies (but not limited to) such as Pelton, Kaplan, Turgo, Francis turbines, etc.

[4] Hereafter, the coordinating/managing entity is also referred as “CME”

Ecoener Ingeniería, S.A. as the coordinating/managing entity of the PoA will be in charge of coordinating the CPA Implementers, collecting the monitoring data and communicating with DOEs and CDM Executive Board. The CME will build appropriate in-house CDM capacity for PoA management and CPA inclusions and it will ensure proper capacity building for CPA implementers, too.

Entity	Management Responsibilities and Arrangements
ECOENER INGENIERÍA, S.A. (the Managing Entity)	• Maintain existing relationship with the project implementers (e.g. conduct training for data monitoring) • Set a framework for the implementation of the PoA and define the CDM programme activity (CPAs) to be included under the PoA. • Communicate with UNFCCC (as focal point). • Management System: establish operational and management arrangements for the implementation of the PoA, including a record keeping system for each SCC-CPA under the PoA, a system/procedure to avoid double accounting (e.g. to avoid the case of including a new SCC-CPA that has been already registered either as CDM project activity or as a SCC-CPA of another PoA). • Ensure that those operating the SCC-CPA are aware and agree that their activity is being subscribed to the PoA. • Obtain letters of approval for the implementation of the PoA from each host country and Annex I country involved in the PoA. • Obtain letters of authorization of its coordination of the PoA from each Host Party. • Submit to the DOE the documents for validation. • Forward, after having ensured all the requirements determined in the PoA and its specific CDM-CPA-DD are met, the completed CDM-CPA-DD form to any DOE for consistency checking. • Collect (periodically) monitoring data of all SCC-CPAs. • Prepare monitoring reports for emission reduction verification. • Maintain all monitoring reports of all SCC-CPAs in accordance with the record-keeping system identified in the CDM-POA-DD. • Make available all monitoring reports requested by a DOE for verification purposes. • Submit a request for forwarding of CERs issued in accordance with the modalities of communication as agreed between CPA Implementers. • Support the developers who wish to participate in the programme by developing their financing models (optional).
CPA Implementer	• Implement hydropower plant project activity according to definitions and eligibility requirements of this SSC-PoA. • Operating the small hydro power plant • Monitoring, recording and storing the data • Reporting the data to the CME • Arranging the maintenance and calibration of the monitoring equipment, as will be described in the monitoring plan of the CPA.

The CME shall develop and implement a **management system** that includes the following made available to the DOE at the time of validation of the PoA:

(a) **A clear definition of roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;**

The CPA Implementers shall sign a contract that includes among others, all the services of this management plan, cessation of rights, training and the trading of CERs that will be distributed among

all the CPA with a formula defined in the contract. Therefore, the CME has plenty of competencies and the responsibility to define this management system and also include measures for continuous improvements of the PoA management system.

In the following diagram there is a schema of the communication channels within a PoA.

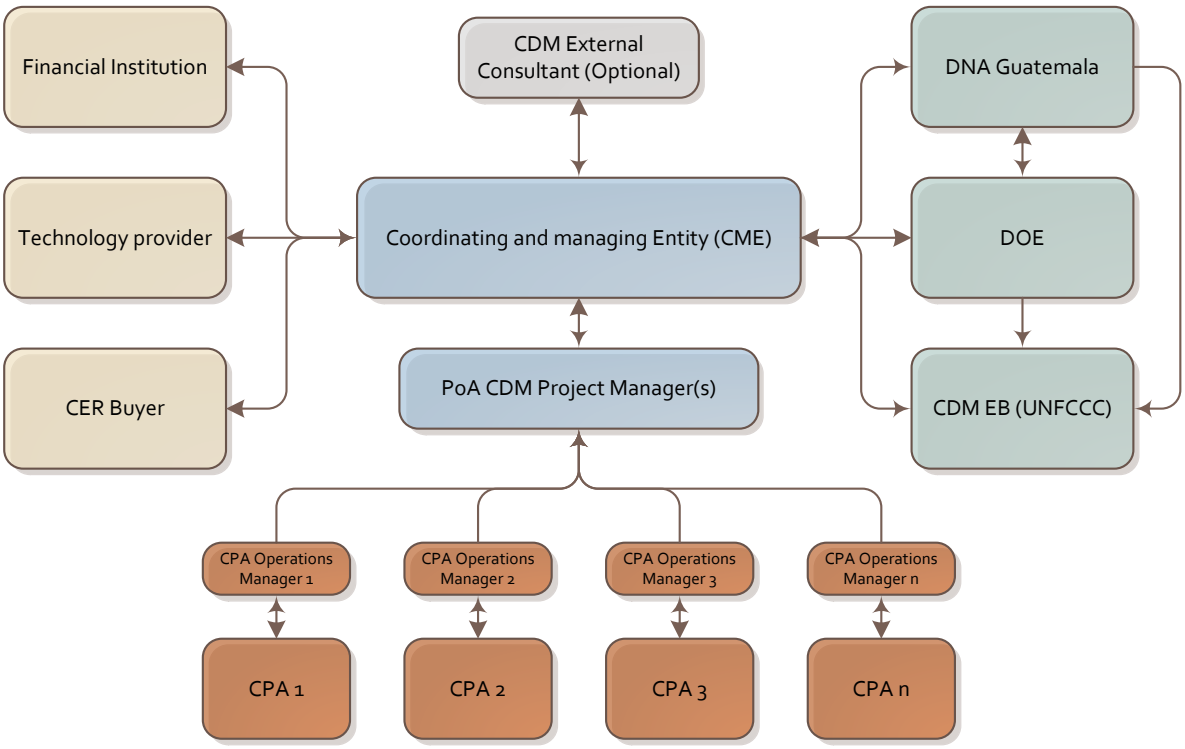

Figure 2: Communication channels within a PoA

The CME of this PoA is a single company. Therefore, Ecoener Ingeniería S.A. will be responsible for management implementation of the PoA.

The CME will assign the tasks to individual personnel and/or hire new (internal employees or external consultants) if needed after the PoA gets registered at UNFCCC. Some of the positions or tasks may be outsourced by external experts[5] or developed by trained internal project managers.

CDM team within the CME shall be established and tasks assigned as described in the following table:

Position	Responsibilities & competencies
Ecoener Ingeniería, S.A. General Management	▪ Secures Training for the CDM team ▪ Secures the legal and economic issues (contracts, invoices, etc.) ▪ Secures external CDM consultant (optional) ▪ Keep personal files of the staff (on training and education) ▪ Trades the CERs
PoA CDM Project Manager	▪ Identifies and evaluates new CPAs ▪ Ensures that all requirements and eligibility criteria are met by all assigned CPAs

[5] CME will hire additional CDM Project Managers when needed

	▪ Record keeping a database of CPAs (PoA database) ▪ Communicates with the Operations Manager of the CPA Implementer ▪ Provides training for Operations Manager of the CPA Implementer ▪ Collects monitoring data from CPAs ▪ Prepares monitoring reports for emission reductions verification ▪ Supports and creation of documents for validation, registration and verification of the CPA(s). ▪ Ensures that all requirements, applicability criteria are met by the PoA ▪ Controls the methodology & tools changes, makes amendments to PoA-DD as required ▪ Quality control, reporting to management, suggestions and improvements

Responsibilities: Key personnel involved in each project share responsibility for maintaining consistency and ensuring collection of data of acceptable and verifiable quality through the implementation of a QA/QC program. Responsibility for data verification and validation rests with the PoA/CPA monitoring networks, operations control center, field personnel, and data processing staff. If deficiencies in the data are identified, then those deficiencies should be documented, and whenever possible, resolved by corrective action.

(b) **Records of arrangements for training and capacity development for personnel;**

The CPA Implementers shall sign a contract that includes and will support technology training through a contract with CME. In the chronogram with estimated schedule of the program of activities is included the training programs for each SSC-CPA.

Regarding the training for CME project manager's employees or external consultants there is a foreseen training program that can be dynamically update if required by new scenarios in CDM projects.

Position	Training and capacity development
General Management of CME	To develop the responsibilities & competencies detailed in previous table, it's foreseen to have competences through own experience or courses in the given disciplines: Mandatory: • Portfolio management • CDM and CER Markets Knowledge: ▪ The Kyoto flexibility mechanisms (CDM) ▪ Carbon Markets ▪ Trading in sport markets ▪ Risk Management CDM Projects ▪ CDM Procedures and Overview project cycle (Project formulation, National approval by DNA, Validation by DOE, Registration by EB, Monitoring verification by DOE, Certification by DOE, Issuing of CERs) ▪ Key issues CDM projects (Additionally and Baseline) Desirable: • International Master in business and administration (MBA)
PoA CDM Project Manager	To develop the responsibilities & competencies detailed in previous table, it's foreseen to have competences through own experience or courses in the given disciplines: Mandatory:

Position	Training and capacity development
	• Host country regulatory laws and norms (electrical, renewable energy, environmental,…) • Course on run of the river Hydroelectric plants: ▪ General layout. ▪ Civil Works. ▪ Turbine types. ▪ Generator types. ▪ Electrical installation infrastructure (high and low voltage equipment such switchgears, distribution lines, earth and grounding, etc…). ▪ Mesurement equipment (types, local normative). • CDM and particular knowledge in Programme of activities: ▪ The Kyoto flexibility mechanisms (CDM). ▪ Carbon Markets. ▪ CDM Procedures and Overview project cycle (Project formulation, National approval by DNA, Validation by DOE, Registration by EB, Monitoring verification by DOE, Certification by DOE, Issuing of CERs). ▪ Key issues CDM projects (Additionally and Baseline). ▪ CDM PoA and CPA formulation. Desirable: • Certified as Project Management Professional (PMP)® by Project Management Institute (PMI). • Course on ISO 9000 or another family of standards related to quality management systems.

Training and Personnel Qualification: all personnel involved in CDM PoA management and data collection activities must have the necessary education, experience, and skills to perform their duties. Training activities and demonstration of capabilities must be documented. The training must include expectations on ethical behavior, safety, and data integrity. Employers have the responsibility to promote an awareness of hazards and work practices to minimize them and to provide an appropriate level of safety equipment and training. All personnel should be properly trained in the required quality control procedures and the specific field procedures to be conducted for each task. Training in new skills or methods may be conducted via a mentoring procedure or by working with experienced colleagues and must be properly documented. Training procedures, training records, and demonstration of capabilities must be documented indicating the specific field task, date of training, and proper signatures.

All training and education records of the employees are stored in personal employee´s file of the company in a database available to DOE "Record Keeping System of arrangements for training and capacity development for personnel under the PoA".

(c) **Procedures for technical review of inclusion of CPAs;**

The responsible person for technical review of inclusion of CPAs is the *PoA CDM Project Manager*.
PoA CDM Project Manager shall verify that the CPA complies with conditions and justifies the compliance by documentation/evidence, as listed in the CDM-PoA-DD-Form.
There shall be an exhaustive review of the following documentation:

- CPA Implementer company's documentation
- Environmental Impact Assessment and permits
- Technical documentation of the project (final approved by Ministry of Energy and Mines MEM or feasibility studies).
- Investment analysis of the project.
- Stakeholder consultation (methodology, surveys, results, etc…)

In particular, the CME will check the evidences that confirm that the project SSC-CPA meets the eligibility criteria for its inclusion in the PoA and detailed in the right column of the table of the "elegibility criteria" section of this SSC-PoA-DD-FORM.

(d) **A procedure to avoid double counting (e.g. to avoid the case of including a new CPA that has already been registered either as a CDM project activity or as a CPA of another PoA);**

To avoid double counting (the case of including a new CPA that has already been registered either as a CDM project activity or as a CPA of another PoA), the CME will confirm, as per CDM Project Standard for Programme of Activities (Version 02.0, EB 101, Annex 3), that the project activity included in the CPA is not registered in any other CPA of the PoA or any other registered CDM Project activity through the following procedure:

- At the time of CPA eligibility check, CME (*PoA CDM Project Manager*) will perform thorough control to identify any double counting conflict on internal PoA level and external CDM level, as follows:
  - *Internal double counting check*: The PoA database as described above will not enable duplicate entries of the GPS coordinates which are unique for each CPA. Thus it will be ensured that one turbine is not included in more than one CPA and that one CPA is not included in the PoA more than once.
  - *External double counting check*: CME (CDM Project Manager) will perform a control using the public information sources such as UNFCCC website data, UNEP Risoe CD4CDM data, the VCS website, etc. and confirm that the CPA is not registered as a CPA of other PoA or as any other registered CDM project activity.
- At the time of inclusion, CPA implementer shall sign a contract with CME, amongst other confirming that the CPA implementer will not register the particular SSC-CPA or its turbine/s as a single CDM project activity or as a CPA under another PoA.

Moreover, as shown below, the project implementers will be made aware of the double accounting principle and will certify that the proposed SSC-CPA is not registered under the CDM of the UNFCCC or any voluntary scheme. If a SSC-CPA is registered (or under validation) under the CDM or any voluntary scheme, the coordinating entity will not proceed with inclusion of the corresponding SSC- SCC-CPA in the proposed SSC-PoA.

Should a case occur that the turbine and/or the CPA is registered in other CPA of the PoA or other registered CDM project activity or that the CPA implementer fails to sign the contract then the CME will not proceed with inclusion of the corresponding CPA into the proposed PoA.

(e) **Records and documentation control process for each CPA under the PoA;**

In order to ensure transparency and high quality of the information and documentation managed by CME the record keeping system for every CPA and the overall PoA database is specially designed.

In order to unambiguously identify each small hydro power plant enrolled in the PoA the CME shall develop a serial number system and assign a unique serial number to each CPA. The serial number shall consist of letters and/or numbers and it will uniquely distinguish each CPA from the others. This serial coding system shall be used to keep the PoA database. The database will be used to record the baseline and monitoring data continuously and to track the emission reductions of each CPA during the crediting period(s). CME will be responsible for management of records and data related to each CPA.

The database will be kept electronically and on paper if appropriate (e.g. documentation and evidence) and it will constitute the basis for the verification by the DOE.

The managing entity shall create a record keeping system to record and document SSC-CPA detail information as follows:

- Serial number of the CPA
- Name of the CPA implementer, address, contacts
- Exact CPA Location: City/State/Province, GPS coordinate/s of the turbine/s (powerhouse)
- Commissioning date of the small hydro power plant
- Start date and number of years chosen for each crediting period
- Technical specification of each SSC-CPA (type, make, model, installed capacity, year, etc.)
- Monitored parameters ($\mathbf{EG_{facility,y}}$, Cap_{PJ} , A_{PJ})
- The verification status (number of verification and associated monitoring report). Also Certification report data shall be included.

A detailed database file "Record Keeping System for a SSC-CPA under the PoA Ecoener Small Hydro Programme of Activities" is available to DoE. This database has the complete record keeping system data.

A similar record-keeping system will be established by *CPA Operations Manager each CPA* implementer, too. CPA implementer shall monitor and record the plant data. The plant data monitoring will primarily include the measurement of electricity supplied to the grid and electricity imported from the grid (consumed) by each CPA. The CPA implementer will report the monitored parameters to the *PoA CME Project Manager*.

This information will be stored on a continuous basis using any database or spread sheet widely available. This tool will be used by the SSC-PoA coordinating entity to record baseline and monitoring data, and to track the emission reduction of each hydropower plant over the full duration of the crediting period. The database or spread sheet will be stored in CME computer servers in two different locations with automatic backups, to ensure data security, availability and integrity of the data.

The Coordinating Entity will be responsible for the management of records and data associated with each SSC-CPA. The Excel database will be updated manually by *PoA CDM Project Manager* or standard method using the data supplied by the participating hydropower plants (*CPA Operations Manager*). It will form the basis for the verification of SSC-CPAs and be available for inspection by the DOE at any point in time.

(f) **Measures for continuous improvements of the PoA management system;**

Based on the initial experience of the first SSC-CPA, continuous improvements are foreseen to the management system in order to get better competencies to check any new features of potential CPAs and ensure that each CPA meets all requirements and eligibility criteria before inclusion in the registered PoA.

All personnel will be encouraged to raise their comments and suggestions to the CDM Project Manager or to the management board directly. *PoA CDM Project Manager* or selected representative of the company management shall then execute detailed discussion with all involved in order to find the solution. If necessary, he will assign financial and/or human resources identify the responsible person to perform the actions and report about the results.

The CPA Implementers (CI) shall sign a contract that includes among others, all the services of this management plan, training and the trading of CERs that will be distributed among all the CPA with a formula defined in the contract. Therefore, the CME has plenty of competencies to include improvements in mutual agreement with CI. The main changes are expected to be implemented for

the second crediting period. Thus, the measures for continuous improvements of the PoA management system have a good framework and the training of the project managers in charge of the PoA management will ensure this goal.

Management system of the PoA shall be continuously reviewed by all involved personnel in order to identify any potential weaknesses, threats and their elimination as well as opportunities for improvement.

(g) **Any other relevant elements.**

1. **Justification that the SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity**
   As per CDM Project Standard for Programme of Activities (Version 02.0, EB 101, Annex 3) that in version 01.0 supersedes "Assessment of debundling for small-scale project activities"), only hydropower projects with a size greater than 150 kW will perform the de-bundling check. The database described above will be used to perform the de-bundling check. Every new hydropower plant above the 150 kW included as an SSC- SCC-CPA will be compared to the already existing database and the list of project activities under validation or registered at the UNFCCC to check whether there is already an activity that satisfies both of the following conditions:
   - The CME (*PoA CDM Project Manager*) shall check and confirm that it is not managing a large scale PoA of the same technology/measure within 1 km of this CPA´s project boundary, in the same project category and with the same technology, and
   - The CME (*PoA CDM Project Manager*) shall check and confirm that CPA implementer is not already implementing a project activity of the same technology/measure within 1 km of this CPA´s project boundary, in the same project category and with the same technology.

   Moreover as shown below, the project implementers will be made aware of the de-bundling rules and will certify that the proposed SSC-CPA is not a de-bundled part of a bigger large scale project. Should a case occur that any of the two requirements is not met then the CME will not proceed with inclusion of the corresponding CPA into the proposed PoA. Thus it shall be ensured for each CPA included under the PoA that it is not a debundled component of a large scale project activity.

2. **The CPA implementers are aware and have agreed that their activity is being subscribed to the PoA**
   In order to avoid double accounting and to ensure that those operating the SSC-CPA are aware of and have agreed that their activity is being subscribed to the SSC-PoA, the project implementer of a SSC-CPA shall enter into a contractual arrangement with the coordinating entity including respective provisions that:
   - The SSC-CPA has not been and will not be registered as a single CDM project activity or as a SCC-CPA under another PoA.
   - The project implementer is aware that the SSC-CPA will be subscribed to the present PoA.
   - The project implementer is not undertaking (or has not or will not undertake) another hydropower project within one kilometer of the proposed SCC-CPA[6].
   - A contract of services and cessation of rights will be made between Managing Entity of the SSC-PoA and the hydropower developers, defining the CME Ecoener Ingeniería, S.A. as the owner of the emission reductions under the CDM of the UNFCCC or any voluntary scheme to the managing entity of the present SSC-PoA.

[6] Only for hydro plants with capacity above the 150kW threshold. Source: "Guidelines on Assessment of De-bundling for SSC Project Activities issued version 3" (EB54 annex 13)

The project implementer certifies that the SSC-CPA is not registered under the CDM of the UNFCCC or any voluntary scheme.

3. **Provisions in case of withdrawal or held of the applied methodology, and updating on eligibility criteria:** According the CDM project standard for programme of activities (Version 02.0, EB 101, Annex 3) project participant will take into account the following provisions regarding updating on eligibility criteria:
   - If the version of methodologies applied by the PoA is revised or replaced, subsequent to being placed on hold, the CME shall update the eligibility criteria to the requirements of the revised or new methodologies with immediate effect. A new version of the PoA DD (e.g. version 1.1) and generic CDM-CPA-DD containing updated eligibility criteria validated by a DOE shall be submitted to the Board for approval.
     - (a) Once changes have been approved by the Board, the inclusion of all new CPAs shall be based on the updated eligibility criteria applying the new generic CDM-CPA-DD;
     - (b) CPAs that were included before the methodology was put on hold shall apply the revised version of the generic CDM-CPA-DD only at the time of the renewal of the crediting period.
   - No action is required if the version of methodologies applied by the PoA is revised without being placed on hold or is withdrawn for the purpose of inclusion in a consolidated methodologies, unless otherwise indicated in the respective report of the meeting of the Board that has approved the new methodologies.
   - If the boundary of the PoA is amended post-registration to expand the geographic coverage or to include one or more additional host Parties, the CME shall update the eligibility criteria to reflect the consequent changes. A new version of the PoA DD (e.g. version 1.2) and generic CDM-CPA-DD containing updated eligibility criteria validated by a DOE shall be submitted to the Board for approval.
     - (a) Once changes have been approved by the Board, the inclusion of all new CPAs shall be based on the updated eligibility criteria applying the new generic CDM-CPA-DD;
     - (b) CPAs that were included before the boundary of the PoA was amended shall apply the revised eligibility criteria only at the time of the renewal of the crediting period.
   - The revision of eligibility criteria of a registered PoA may be initiated by the Board at any time during the lifetime of the PoA if an issue related to environment integrity is identified, as follows:
     - (a) In the event that the revision of the eligibility criteria of a PoA is requested by the Board, the CME shall update the eligibility criteria to reflect the consequent changes. A new version of the PoA DD (e.g. version 1.3) and generic CDM-CPA-DD validated by a DOE shall be submitted to the Board for approval;
     - (b) Once changes have been approved by the Board, the inclusion of all new CPAs shall be based on the updated eligibility criteria applying the new generic CDM-CPA-DD;
     - (c) CPAs that were included before the revision of the eligibility criteria shall apply the revised eligibility criteria only at the time of the renewal of the crediting period.
   - At the renewal of the crediting period of a PoA (at the renewal of the first CPA), the CME shall update the eligibility criteria as per the latest revised applicable methodologies. A new version of the PoA DD (e.g. version 1.4) and generic CDM-CPA-DD validated9 by a DOE shall be submitted to the Board for approval.
     - (a) Once changes have been approved by the Board, the inclusion of all new CPAs shall be based on the revised eligibility criteria;
     - (b) The subsequent CPAs requesting the renewal of the crediting period shall apply the revised version of the generic CDM-CPA-DD.

A document so-called "***Management System of the MDL PoA Ecoener Small Hydro Programme of Activities***" has been written my Coordinating and Managing Entity (CME) with the associated databases, and is available to DOE for validation.

SECTION C. Demonstration of additionality of PoA

According to paragraph 285 of the CDM Project Standard for Programme of Activities (Version 02.0, EB 101, Annex 3) for renewal of the PoA period of a registered CDM PoA, the coordinating/managing entity **is not required to reassess the additionality of the PoA nor update the section of the PoA-DD relating to additionality**. Therefore, information included in the sections below related to additionality is exactly the same as the original PoA-DD originally registered.

>>

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

The proposed SSC-PoA is a voluntary and coordinated action, which will promote the development of small run-of-the-river hydroelectric power plants by facilitating access to CER-based funding. In doing so, the PoA will encourage renewable energy electricity generation in the host countries. There are no mandatory laws or regulations in the host countries stipulating to have resort to CDM to develop hydropower facilities. Likewise, no obligation exists for private entities to utilize or develop run-of-river hydropower projects. The proposed SSC-PoA can be, therefore, regarded as a voluntary coordinated action.

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

The "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities (version 2.0, EB70 Annex 05)" replaces the requirements in "Procedures for approval of the application of multiple methodologies to a Programme of Activities (EB 47 report, annex 31)". This standard also consolidates and thus supersedes the "Standard for demonstration of additionality of GHG emission reductions achieved by a Programme of Activities (version 01.0, Annex 02, EB 63 meeting report). The requirements of the standard for demonstration of additionality concerning the scope of the present PoA are:

- *PoAs that consist of one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of attachment A of Appendix B*[7] *of the Simplified modalities and procedures for small-scale CDM project activities*: this is a mandatory eligibility criteria in the table of the section describing the "Eligibility criteria for inclusion of a SSC-CPA in the PoA" and included in section "E.5.1 Assessment and Demonstration of additionality for a typical SCC-CPA".
- *The CME shall demonstrate that compliance with the additionality-related eligibility criteria set in the PoA design document will ensure that all the relevant additionality-related guidelines, tools or any requirements embedded in the methodologies are met*: this is achieved by getting the evidences required in the table of the section describing the "Eligibility criteria for inclusion of a SSC-CPA in the PoA" and later, by the validation process of each SSC-CPA.
- *Additionality shall be demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur*: this will be developed and explained in the following paragraphs.

Section E.5.1 Assessment and Demonstration of additionality for a typical SCC-CPA" lays down the guidelines to demonstrate additionality to be followed by each SCC-CPA proposed to be registered under this PoA. Section E.5.2 "Key Criteria and data for assessing additionality of a SCC-CPA" lays down the key criterion to assess the additionality of a SCC-CPA under this PoA.

As per paragraph 73 of the 47th EB meeting report "additionality is to be demonstrated either at the PoA level or at SCC-CPA level". The project participants choose to demonstrate additionality at the SCC-CPA level.

[7] Currently known as "Guidelines on the demonstration of additionality of small-scale project activities (version 09.0 EB68 Annex 27)"

The project participants reserve the choice of applying either: (a) barrier analysis (investment, technological, etc), in accordance with Attachment A to Appendix B[8] of the simplified modalities and procedures for small scale CDM project activities and the latest version of "Non-binding best practice examples to demonstrate additionality for SSC project activities" approved in Annex 34, EB 35; or (b) the "*Guidelines for demonstrating additionality of microscale project activities (version 04.0 EB68 Annex26)"* which creates a platform for CDM projects located in "special underdeveloped zones" which are taken into account in this PoA.

Hence, implementation of this PoA and avoidance of anthropogenic GHG emissions are additional to those that would have occurred in absence of this PoA. Thus, the PoA as a whole, once implemented, is expected to lead to greater promotion of small-scale renewable energy generation.

Otherwise, is very interesting to comment the additionality of the PoA since it will support the introduction of more SSC-CPA projects in the national grid and that will reduce the amount of CHG emissions of the host country. In the absence of the PoA some small scale projects could have difficulties to be implemented with success, because PoA will help the project implementers in financial and technological barriers.

The Managing Entity, through the voluntary coordination and development of this Programme of Activities, will provide the frame for small promoters to joint together under a PoA scheme will be able to join other promoters and reach the critical size required for accessing large consuming facilities supply. The Managing Entity will establish the framework for the generation of carbon credits creating a critical amount of CERs which could be bankable. Otherwise, small promoters will not be able to face the administrative costs related with the Clean Development Mechanism in a project-by-project structure and, moreover, will handle a low amount of CERs, thus with a low banking potential. The proposed PoA will constitute an additional incentive for small promoters for whom the absence of any national policy promoting the small hydropower constitutes a difficult barrier to be overcome.

The possibility of inclusion under the Programme of Activities and the potential obtaining of Certified Emission Reductions are the required incentive for small promoters, who shall face, with better expectations, the bureaucratic and time consuming process of licences and permits approval. Otherwise, this process will constitute a strong barrier for small promoters.

The proposed PoA will also create the framework in which the renewable ROR hydroelectric energy technology could become reinforced and promoted. With this configuration, any small promoter of a small scale project in compliance with the eligibility criteria set in this SSC-PoA-DD, may take advantage of the proposed Programme of Activities.

The explanation of the operation of the electricity sector of the host country and the prospective of the evolution of this market is the background of this Programme of Activities. In the absence of the PoA, the proposed voluntary coordinated action would not occur and the individual project activities would not be implemented.

In the following paragraphs will be described the energy generation mix of the host country, and some barriers and why this PoA is additional to help to introduce SSC-CPA projects and reduce CHG emissions.

The sustained increase in oil prices as from 2004 and considerations on the energy sector's sustainability led Central American countries to jointly reformulate their policy in this field, an effort reflected in the document "*Estrategia Energética Sustentable Centroamericana 2020*" (Central American Sustainable Energy Strategy 2020), presented in November 2007.

[8] Currently known as "Guidelines on the demonstration of additionality of small-scale project activities (version 09.0 EB68 Annex27)"

Document	**2020 Central American Sustainable Energy Strategy**
Source	**SG-SICA, San Salvador, El Salvador, December 10, 2007. -** http://www.sica.int/
Web link:	/http://www.sica.int/busqueda/busqueda_archivo.aspx?Archivo=odoc_20153_1_10122007.p/df
Last time accessed:	**01/11/2011**

The overall lines of this Central American Sustainable Energy Strategy 2020 were established on the basis of macroeconomic forecasts and the analysis of the situation and prospects of the oil and electricity sub-sectors until year 2020. In the first case, an annual consumption growth of 3.7% was estimated while in the second case, it is worth highlighting a strong incorporation of coal and gas in thermal-fired electricity. Six scenarios for the development of the Central American energy sector in the long term were designed on the basis of the above prospects.

The first scenario maintains the current trend of the Central American energy industry, while in the next four scenarios measures are applied increasingly to make a rational use of energy (for instance, less consumption of charcoal, use of energy-efficient lamp bulbs, stoves and engines, etc.) while augmenting the share of renewable sources. The **sixth scenario** includes **all these measures and gives rise to a lower-cost electricity plan**, which is **the one with the greatest share of hydroelectric plants**.

Among the parameters used to compare the outcome of these scenarios in 2020, it is worth underscoring total fuel consumption, total energy consumption, the share of renewable sources in electricity generation, the level of greenhouse gas (GHG) emissions in 2020 and the investments required in 2007-2020.

If both extreme scenarios are compared -the trend-based scenario and the **one including all improvements in the use and supply of energy**- **several positive impacts appear in the second case**, such as: i) reduction in the import of 28 million oil barrels, four million tons of coal and 1.3 billion cubic meters of natural gas; ii) reduction of 28 million tons of GHG and other primary and secondary pollutants; iii) increase in electricity coverage to around 700 thousand dwellings; iv) fulfillment of the Johannesburg commitments with regard to the percentage of primary energy supply met with renewable sources.

There are two statistical documents published by the Department of Energy of the Ministry of Energy and Mines (Republic of Guatemala) contains relevant information about the electric generation mix in the country.

Document	**Electrical Energy Subsector Statistics 2010**
Source	**MEM (Ministry of Energy and Mines) - http://www.mem.gob.gt**
Web link:	http://www.mem.gob.gt/Portal/memdocuments/DGE/DE/ESTADISTICAS_ENERGETICAS_SE2010.pdf
Last time accessed:	**01/11/2011**

Document	**Electric Energy Subsector Statistics 2001-2007**
Source	**MEM (Ministry of Energy and Mines) - http://www.mem.gob.gt**
Web link:	http://www.mem.gob.gt/Portal/Documents/ImgLinks/2008-09/392/INFORME%20ESTADISTICO%202007.pdf
Last time accessed:	**01/11/2011**

The following key plots contains data of the document “Electric Energy Statistics 2010” (2003-2010 data) and it’s completed with data from previous document 2001-2007 published by MEM.

In the following Figure 3, we can appreciate that the energy generated by hydroelectric plants is increasing a mean of 7% per year. Having in mind, that the total mean yearly increase is 3,81%

and the mean thermal plants increase is 3,14% we can conclude that in the last decade there is an increase in hydroelectric generation that is positive, but not enough to mitigate the increase of the fossil fuel generation to match the increasing energy demand.

ELECTRICAL GRID SYSTEM of GUATEMALA (SIN)										
Type of Plant	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Hydroelectric	2.276,6	2.122,0	2.186,5	2.565,4	2.939,0	3.302,5	3.030,6	3.674,8	2.941,9	3.849,1
Geothermal	222,1	150,4	219,7	219,1	165,8	163,2	263,1	294,2	386,6	271,0
THERMAL PLANTS	3.884,0	4.699,7	4.877,9	4.906,8	4.943,9	4.699,4	5.462,6	4.748,4	5.717,5	4.772,9
Total	**6.382,7**	**6.972,2**	**7.284,1**	**7.691,3**	**8.048,8**	**8.165,1**	**8.756,2**	**8.717,4**	**9.046,0**	**8.893,0**

											Mean
Hydroelectric yearly increase		*-6,79%*	*3,04%*	*17,33%*	*14,56%*	*12,37%*	*-8,23%*	*21,26%*	*-19,94%*	*30,84%*	*7,16%*
Geothermal yearly increase		*-32,28%*	*46,05%*	*-0,27%*	*-24,33%*	*-1,57%*	*61,21%*	*11,82%*	*31,41%*	*-29,90%*	*6,90%*
THERMAL PLANTS yearly increase		*21,00%*	*3,79%*	*0,59%*	*0,76%*	*-4,95%*	*16,24%*	*-13,07%*	*20,41%*	*-16,52%*	*3,14%*
Total yearly increase		*9,24%*	*4,47%*	*5,59%*	*4,65%*	*1,44%*	*7,24%*	*-0,44%*	*3,77%*	*-1,69%*	*3,81%*

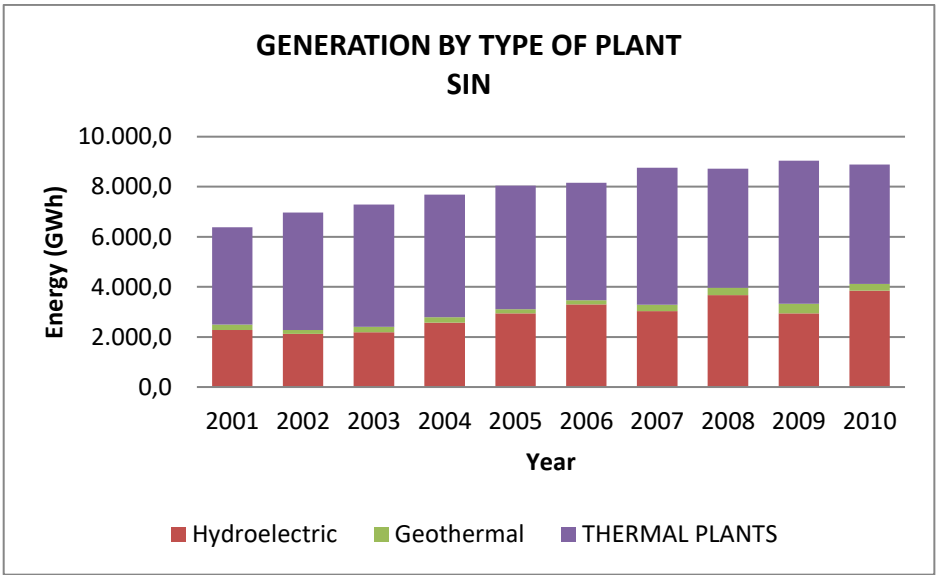

Figure 3: Generation by type of plant

In the following Figure 4 the quantity of each fuel used for the generation of electric energy is shown.

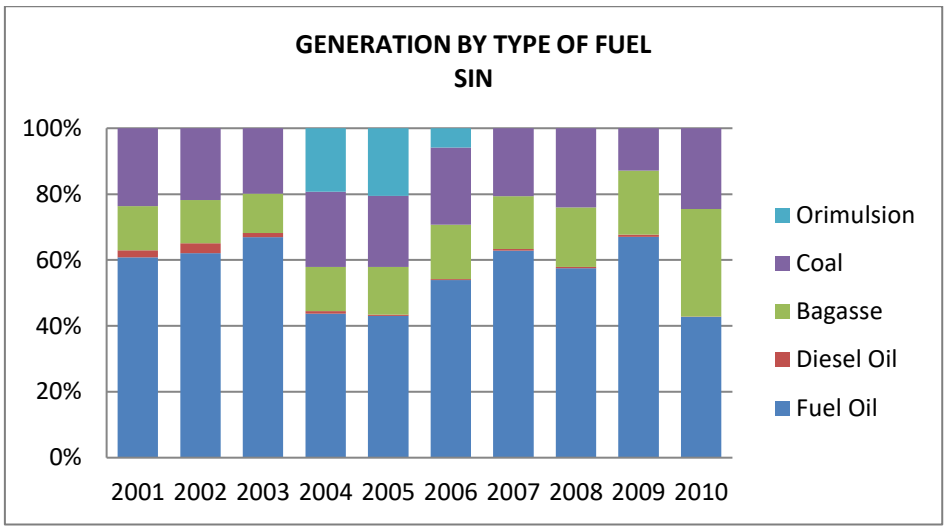

Figure 4: Generation by type of fuel

In the Investor's Guide Document published by Department of Energy of MEM the hydroelectric potential is analyzed. Guatemala has estimated the gross theoretical potential of the country's rivers which reach 10.900 MW and technically usable potential is close to 5.000 MW, of which only 14.1% is used, as shown in Figure 5.

Document	**Investor's Guide**
Source	**MEM (Ministry of Energy and Mines) - http://www.mem.gob.gt**
Web link:	http://www.mem.gob.gt/Portal/Documents/ImgLinks/2009-12/1361/Gu%C3%ADa%20del%20Inversionista.pdf
Last time accessed:	**01/11/2011**

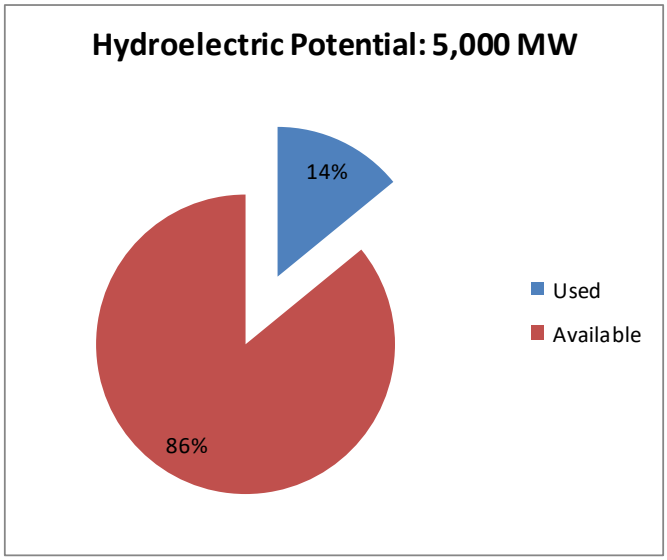

Figure 5: Hydroelectric potential

The huge potential for hydro-generation which is not being utilized, in addition to the increasing energy demand that can't freeze the use of fossil fuel, suggest that in the absence of the proposed PoA the total amount of electricity generation from hydro resources will continue to be not enough to mitigate CHG emissions in the energetic matrix of the host country.

In the absence of the proposed PoA, the voluntary coordinated actions outlined above will not be implemented. Virtually no change will take place with regard to the utilization of the abundant amount of hydro resources in the host country.

Information from the Ministry of Energy and Mines of Guatemala states that the share of the hydro sector decreased from 92% in 1990 to 40% in 2005, whereas the share of fossil fuels increased from 8% to 60% within the same period. The last decade has not presented a significant increase in the share of the hydro resource in the electric sector. In 2001, the share of hydro was 35.67%; in 2008 it was 42.15%. The fact is that the need for carbon revenues are needed to develop small scale ROR hydropower plants in the Republic of Guatemala since all the projects undertaken in the last decade needed the financial support of a CDM mechanism to be additional. The proposed PoA will support the introduction of more SSC-CPA projects in the national grid and that will reduce the amount of CHG emissions of the host country.

Technological barrier

Considering the information presented above, we can see that in the last decade the participation of fossil fuels in the electricity generation sector has increased while the renewable generation doesn't have the expected growth according to the hydric resources available. This pattern also suggests strongly that technological know-how and expertise has been oriented towards non-renewable fossil fuel plants. The lack of representativeness in the Interconnected National System coupled with the lack of experience in hydroelectric projects has led to the technological, professional and standardization barriers.

Investment barriers

The developers of renewable energy projects (particularly small-scale projects) face strong investment barriers, mainly due to the high cost of the initial investment compared to the relatively low initial investment cost for non-renewable energy projects (e.g. fuel oil).

Table 1: Comparison of investment costs for different technologies in the region[9]

Technology	Gas turbine	Combined cycle	Medium speed motor	Coal	Geothermal	Hydro	Wind	Biomass
Investment costs (USD/kW)	1,100 - 1,300	1,400 - 1,600	1,500 - 1,700	2,500 - 2,900	4,000 - 4,500	2,000 - 3,000	2,000 - 2,500	200 - 1,200

In addition, they must comply with the same technological, environmental and legal requirements that larger projects must comply with. In general, these requirements are the same with regard to resources invested for both small and large projects. In the case of small projects, these fixed costs increase the total investment per productive unit (MW) and compromise their feasibility.

In some countries the contribution of the project developer will be a considerable percentage of the total investment amount (for example, in Guatemala the banks require no less than 30%)[10]. Therefore, increasing the growth of renewable, small-scale energy generation is limited by the insufficient capacity of some developers to cover the share of the capital requested by the financial institutions.

Financial barrier

Financial institutions tend to consider the attributes of the project developer in the analysis of the financing proposal. Some of the key parameters of the evaluation are capacity of execution, economic ability to comply with their capital contribution, and ability to overcome overrun costs. If the project developer lacks previous experience (as is often the case with small producers of renewable energy) the possibility to fulfill the financial requirements decreases. In order to receive financing, the valuation of the attributes of the project developer is linked to the valuation of the warranties provided.

[9] South Pole elaboration with information of "Analysis of the Renewable Energy Market in El Salvador, Guatemala, Nicaragua and Panama". ARECA Project. 2009

[10] "Analysis of the Renewable Energy Market in Guatemala". ARECA Project. 2009.

According to a study issued by the ARECA Project[11], one way to gather the equity that banks require is to incorporate "mezzanine" financing in the financing structure of the project. Nevertheless, the sources to provide such financing are not common in the region.

On the other hand, in host countries the commercial banking system lacks experience in financing energy projects, especially small-scale renewable energy.

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

The PoA is **not** implementing a mandatory policy/regulation.

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

Not a mandatory policy/regulation is enforced.

SECTION D. Start date and duration of PoA

D.1. Start date of PoA

The **Starting Date of this SSC-PoA-DD is set to March 23, 2012** as the date when this SSC-PoA-DD was submitted to make it publicly available on the UNFCCC CDM website.

D.2. Duration of PoA

28 years 0 months

SECTION E. Environmental impacts

E.1. Level at which environmental impacts analysis is undertaken

1. Environmental Analysis is done at PoA level ☐
2. **Environmental Analysis is done at SSC-CPA level** ☑

The individual nature of each hydropower project -location, capacity, and type of construction (a dam, reservoir or not,…) - justifies a separate environmental assessment for each SSC-CPA. Environmental analysis will, therefore, be conducted for each hydropower plant included in a SSC-CPA according to the applicable environmental policies at the time of inclusion of SSC-CPA in the SSC-PoA.

E.2. Analysis of environmental impacts

>>

Not applicable. Environmental EIA is carried out at CPA level.

E.3. Environmental impact assessment

>>

Not applicable. Environmental EIA is carried out at CPA level.

The degree of complexity and detail required for each individual SCC-CPA may vary depending on installed capacity and local regulations but in all cases includes some form of environmental impact assessment is legally required of all potential SCC-CPA activities for the Ecoener Small Hydro Programme of Activities. Therefore, environmental impact assessments will be conducted for each SSC-CPA according to the applicable laws and regulations at the time of inclusion of SSC-CPA to SSC-PoA.

[11] http://www.proyectoareca.org

At the time/date this PoA-DD was written, the rules governing Environmental Impact Assessments of the host countries were laid out in the following documents:

• Decree 68-89, Law of Environmental Protection and Improvement (Ley de Protección y Mejoramiento del Medio Ambiente), approved by the Congress of the Republic of Guatemala.
The Decree specifies in the Article 8 that any project or activity that given its characteristics may impact the natural resources, or the environment, or modify in a notorious and/or negative way the landscape or cultural vestiges, must submit an Environmental Impact Assessment.

• Decree 93-96, approved by the Congress of the Republic of Guatemala on October 16th, 1996.
Article 10 of the Decree refers to the electric generation and transportation and states that hydroelectric projects with an installed capacity greater than 5 MW must apply for a water and land use license.

SECTION F. Local stakeholder consultation

F.1. Level at which local stakeholder consultation is undertaken

1. >> Local stakeholder consultation is done at PoA level ☐
2. **Local stakeholder consultation is done at SSC-CPA level** ☑

Local and focalized impacts of each hydro project (depending on the location, capacity, and construction or not of dam among others) justify a local stakeholder consultation at SCC-CPA level.

A local stakeholder consultation at PoA level is not required by any of the DNAs involved in this PoA.

F.2. Modalities for local stakeholder consultation

Not applicable, since the local stakeholder consultation will take place at SCC-CPA level.

F.3. Summary of comments received

Not applicable, since the local stakeholder consultation will take place at SCC-CPA level.

F.4. Consideration of comments received

Not applicable, since the local stakeholder consultation will take place at SCC-CPA level.

SECTION G. Approval and authorization

The Letter of Approval for the current PoA was raised at the Ministerio de Ambiente y Recursos Naturales de Guatemala on 02/07/2012 (nº AND-035-2012), authorizing ECOENER INGENIERÍA, SOCIEDAD ANÓNIMA to be the CME for this PoA.

PART II. Generic component project activity (CPA)

SECTION H. Description of generic CPA

H.1. Title of generic CPA

CPA[CPA_ID] - [CPA_entity_name]

Version: [DOC_vv.v]
Date: [DOC_dd/mm/yyyy]

H.2. Reference number of generic CPA

Generic CPA 1, 2, 3…

H.3. Purpose and general description of generic CPA

CPA_[entity_name] is a small run-of-river hydro power plant with an installed capacity of [Installed_capacity_CPA] connecting to the national electricity grid of Guatemala.

The project is located at the [Name_of_the_River] river in [City_Town_Community] Municipality, [Region_State_Province] Department, in the Republic of Guatemala.

The Project is expected to displace [TotalERCP_tCO2e] tons of carbon dioxide equivalents (tCO_2e) in the first [LengthCP_7years_or_10years] years crediting period, generating an equivalent amount of Certified Emission Reductions (CERs).

This project will contribute to the reduction of greenhouse gas emissions, since it generates a clean energy alternative to fossil fuel fired power plants, which are widespread across the host country. This energy generation project is set upon the following principles:

- It does not require fossil fuel; instead, it uses a renewable resource which is supplied by nature on a permanent basis.
- Energy generation is clean, polluting neither air nor water.
- As ROR hydropower projects produce no end products in the form of solid waste, they address the problem of solid waste disposal encountered by most other sources of power.
- ROR projects are dramatically different in design and appearance from conventional hydroelectric projects. Traditional hydro dams store enormous quantities of water in reservoirs, necessitating the flooding of large tracts of land. In contrast, most run-of-river projects do not require a large impoundment of water, which is a key reason why such projects are often referred to as environmentally-friendly.

The project is expected to contribute to the sustainable development of the local area as well as the host country through the following ways:

- The project leads to more development in the rural region, given that the project will contribute to minimize losses in the distribution system and will improve the voltage on the region. Improving electricity supply for residential and commercial uses in the project area, and thus helping promote local economic development.
- Small scale energy projects contribute to the distributed generation of the host country. They generate electricity from many small energy sources implemented with small-scale power generation technologies used to provide an alternative to or an enhancement of the traditional electric power system. Existing large centralized facilities, such as fossil fuel or big hydropower plants have excellent economies of scale, but usually transmit electricity long distances and negatively affect the environment. Distributed generation reduces the amount of energy lost in transmitting electricity because the electricity is generated very near where it is used. This also reduces the size and number of power lines that must be constructed. The distributed generation plant proposed in this small scale hydro project also helps to the introduction to the future Smart Grid technologies (smart meters, energy storage, smart power generation, load adjustment, demand response support, decentralization of power generation, …).
- Creating short-term and long-term job opportunities in the project area during the periods of project construction and operation, and thus helping alleviating local poverty.
  The project activity leads to diversification of the regional energy supply, which is dominated by conventional fuel based generating units.

[CPA_Implementer_name] is the responsible project implementer of the CPA.

H.4. Technologies/measures

The [CPA_entity_name] is a small-scale run-of river (ROR) hydroelectric power station with an installed capacity of [Installed_capacity_CPA] [12] , which uses water from the river [Name_of_the_River] to generate electricity. The SSC-CPA hydroelectric project belongs to ***Sectoral Scope 1. Energy industries (renewable / non-renewable sources)*.**

The project includes the construction of an intake that can divert a flow[13] of [Nominal_Flow] m^3/s through this intake to the powerhouse, always leaving a minimum residual flow in the natural river bed named environmental flow (under the require of the competent environmental authority). The water is conducted to the powerhouse, through a concrete channel of [Channel_Length] meters[14] length.

The project is provided with a grit chamber in order to prevent the entering of the sands and solids dragged by the river into the turbine, causing irreparable damages. This structure will also serve to channel the water towards the derivation pipeline.

The water is conducted to the powerhouse, through a penstock pipe of [Penstock_Length] meters[15] length.

After the water is diverted through a pipe and/or tunnel leading to electricity-generating turbines, a discharge channel returns the total water diverted to the natural river bed. Thus, the water is returned back to the river downstream.

From the water intake to the discharge, there is a gross head of [Gross_Head] meters[16] high.

[One or more] [Turbine_Type][17] turbine(s) and the suitable generator(s) are located in the power house.

The project includes the construction of an electric substation within the power house. From here, the hydroelectric plant connects to the nearby power sub-station through a new or modified existing power line.

SECTION I. Application of methodologies and standardized baselines

I.1. References to methodologies and standardized baselines

(a) The selected methodologies are:

- AMS-I.D: “Small-scale Methodology: Grid connected renewable electricity generation” (Version 18.0)[18]

[12] Source: [Source_data_Installed_capacity_CPA]

[13] Source: [Source_data_Nominal_Flow]

[14] Source: [Source_data_Channel_Length]

[15] Source: [Source_data_Penstock_Length]

[16] Source: [Source_data_Gross_Head]

[17] Source: [Source_data_Turbine_Type]

[18] https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

(b) Any other methodologies or methodological tools to which the selected methodologies refer:

- "Methodological Tool: TOOL07: Tool to calculate the emission factor for an electricity system" (Version 07.0)[19]
- "Methodological Tool: Assessment of the validity of the original/current baseline at the renewal of the crediting period" (Version 03.0.1)[20]
- "Methodological Tool: Demonstration of additionality of microscale project activities" (Version 09.0)[21]
- "Methodological Tool: Demonstration of additionality of small-scale project activities" (Version 12.0[22])

I.2. Applicability of methodologies and standardized baselines

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

Name of approved baseline and monitoring methodology:

AMS-I.D.: Grid connected renewable electricity generation --- Version 18.0 approved by CDM Executive Board (I.D./Version 18, Sectoral Scope 01, EB 81).

The applicability criteria will be complied by each individual CPA in a case-by-case basis.

The applicability criteria of AMS-I.D.[23] are the following:	Methodology AMS I.D. is applicable to an SSC-CPA under the proposed SSC-PoA because:
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	SSC-CPA will consist of a renewable energy generation unit (hydro) that supplies electricity to a national/regional grid within the host countries, or to an identified consumer facility via national/regional grid through a contractual arrangement.
This methodology is applicable to project activities that: (a) Install a Greenfield plant; (b) Involve a capacity addition in (an) existing plant(s)[24];	A SSC-CPA of this SSC-PoA, falls always under any of the mentioned options, and shall meet at least one option. Nevertheless, it's expected that the future plants will be newly built greenfield plants, this means under option (a).

[19] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[20] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

[21] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v9.pdf

[22] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v1.pdf

[23] AMS-I.D.: Grid connected renewable electricity generation --- Version 18.0 approved by CDM Executive Board (I.D./Version 18, Sectoral Scope 01, EB 81).

[24] A capacity addition is an increase in the installed power generation capacity of an existing power plant through: (i) The installation of a new power plant besides the existing power plant/units; or (ii) The installation of new power units, additional to the existing power plant/units. The existing power plant/units continue to operate after the implementation of the project activity.

The applicability criteria of AMS-I.D.[23] are the following:	Methodology AMS I.D. is applicable to an SSC-CPA under the proposed SSC-PoA because:
(c) Involve a retrofit[25] of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement [26] of (an) existing plant(s).	
Hydro power plants with reservoirs[27] that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir[28], 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/m2; • 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/m2.	As per eligibility requirements, if the hydropower plant comprises a reservoir, the power density of the power plant shall be greater than 10 W/m2 as defined in ACM0002 [29] (referred from AMS-I.D. small scale methodology) to avoid CH_4 and CO_2 emissions from the reservoirs.
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	A SSC-CPA included in this SSC-PoA are hydropower plants of installed capacity below or equal to 15MW, and have only renewable components.
Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable, the proposed SSC-PoA does not include combined heat and power systems.
In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[30] from the existing units.	If applicable, the added capacity will be lower or equal to 15MW installed capacity.

[25] Retrofit (or rehabilitation or refurbishment). It involves an investment to repair or modify an existing power plant/unit, with the purpose to increase the efficiency, performance or power generation capacity of the plant, without adding new power plants or units, or to resume the operation of closed (mothballed) power plants. A retrofit restores the installed power generation capacity to or above its original level. Retrofits shall only include measures that involve capital investments and not regular maintenance or housekeeping measures.

[26] Replacement. It involves investment in a new power plant or unit that replaces one or several existing unit(s) at the existing power plant. The installed capacity of the new plant or unit is equal to or higher than the plant or unit that was replaced.

[27] A reservoir is a water body created in valleys to store water generally made by the construction of a dam.

[28] A reservoir is to be considered as an existing reservoir if it has been in operation for at least three years before the implementation of the project activity.

[29] ACM0002 / Version 19.0 (Sectoral Scope 01, EB 100) at the time of writing this document

[30] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered “physically distinct”.

The applicability criteria of AMS-I.D.[23] are the following:	Methodology AMS I.D. is applicable to an SSC-CPA under the proposed SSC-PoA because:
In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.	If applicable, the retrofitted or replaced capacity will be lower or equal to 15MW installed capacity.
In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	Not applicable, since the proposed SSC-PoA is not a landfill gas, waste gas, or agroindustry project
In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	Not applicable, since the proposed SSC-PoA is not a biomass project

I.3. Application of multiple methodologies

Not applicable, since no multiple methodologies will be applied.

I.4. Project boundary, sources and greenhouse gases (GHGs)

The delimitation system for [CPA_entity_name] is determined by Guatemala's National Power Grid. The baseline boundary includes direct emissions produced by Guatemala's fossil fuel power stations, to which the hydropower project represents an alternative method of electricity production based on a clean, non-polluting energy source. The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system[31] that the CDM project power plant is connected to.

- **Specific project boundaries:**

As per the methodology **AMS.I.D.[32]**, the project boundary is defined as follows: "*The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to*". Hence, the project boundary encompasses the small hydropower plant where the electricity is generated and all the power plants connected to the national electrical grid of the host country.

The inclusion of the grid is effective through the consideration of the grid emission factor required for calculating emission reductions. With the consideration of the grid, all power sources connected are also considered in the spatial extent of the project boundary.

- **Sources and gases included in the SSC CPA boundary:**

[31] The latest approved version of the "Tool to calculate the emission factor for an electricity system (Version 07.0)" defines a **project electricity system** as: a grid/project electricity system is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that are covered by either single or layered dispatch area.

[32] Current version when writing this document: v18.0 (EB 81, Annex 24, 28 November 2014)

According to **AMS-I.D.**, the project emissions for most renewable energy project activities, PEy = 0. However, for the following categories of project activities, project emissions have to be considered following the procedure described in the most recent version of ACM0002[33]. Having in mind, that the small hydro projects does not have reservoir, or have a small reservoir with power density greater than 10 W/m2, the GHG emission sources included in or excluded from the project boundary are as follows:

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

Source		Gas	Included?	Justification / Explanation
Baseline	CO2 emissions from electricity generation in power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source. According to AMS.I.D[34], only CO_2 emissions from electricity generation should be accounted for.
		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	No	Minor emission source. As per eligibility requirements, if the hydropower plant comprises a reservoir, the power density of the power plant shall be greater than 10 W/m2 as defined in ACM0002[35] to avoid CH_4 and CO_2 emissions from the reservoirs.
		N_2O	No	Minor emission source

[CPA_entity_name] is located within the boundaries of the Republic of Guatemala as specified in A.4.1.2., therefore it's locate within the boundary of the registered PoA.

I.5. Establishment and description of baseline scenario

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The baseline scenario is the generation of electricity in the host country by its existing power plants. The baseline scenario is, therefore, in line with all laws and regulations of the host countries. In the *Figure 3: Generation by type of plant* and *Figure 4: Generation by type of fuel* of this document, it is graphically shown the energetic mix of the host country.

The project activity, as per eligibility criteria, shall be new power plant (Greenfield plant), retrofit, capacity addition or replacement. In the following paragraphs are described the baseline scenario for each option.

As per AMS-I.D. paragraph 19, for **new grid connected, renewable power plant/unit**, the baseline scenario is that the 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 into the grid.

As per AMS-I.D. paragraph 20, for **project activities that involve retrofits or replacements** of an existing facility the baseline scenario is the continuing operation of the existing plant. The

[33] ACM0002 / Version 19.0 (Sectoral Scope 01, EB 100, Annex 6) at the time of writing this document

[34] Current version when writing this document: v18.0 (EB 61, Annex 17, 3 June 2011)

[35] ACM0002 / Version 19.0 (Sectoral Scope 01, EB 100, Annex 6) at the time of writing this document

methodology uses historical electricity generation data to determine the electricity generation of the existing plant in the baseline scenario, assuming that the historical situation observed prior to the implementation of the project activity would continue. In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid at historical average levels until the time at which the electrical generation facility would be likely to be replaced or retrofitted in the absence of the CDM project activity. From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity supply is assumed to equal the project's net electricity supply and no emission reductions are assumed to occur.

As per AMS-I.D. paragraph 21, for **project activities that involve the capacity** addition, the baseline scenario is the existing facility that would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$) and electricity delivered to the grid by the added capacity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur.

As per paragraph 287 of the "CDM Project Standard for Project Activities", version 02.0, the coordinating/managing entity shall demonstrate the validity of the original baseline or how to update it in accordance with paragraphs 288−291.

Paragraph 288 says that to demonstrate the validity of the original baseline or its update, the **coordinating/managing entity is not required to re-assess the baseline scenario**. Instead, the coordinating/managing shall assess the GHG emission reductions or net anthropogenic GHG removals that would have resulted from that scenario.

At the same time, according to paragraph 289, the coordinating/managing shall assess and incorporate the impact of national and/or sectoral policies and circumstances, existing at the time of requesting the renewal of the PoA period, on the current baseline GHG emissions, without reassessing the baseline scenario.

Finally, according to paragraph 291, if data and parameters used for determining the original baseline, that were determined ex ante and not monitored during the crediting period, are no longer valid, the project participants shall update such data and parameters in accordance with the ***"Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (Version 03.0.1, EB66, Annex 47)".***
Therefore, for the second crediting period of the project activity, the continued validity of the original baseline has been assessed as per the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1), following the stepwise procedure as shown below:

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

Relevant mandatory national and sectoral policies which have come into effect after the submission of the project activity for validation, and that affect the Project Activity, are reviewed below:

• The National Energy Policy for the 2013-2027 term[36] pursues the sustainable energy development with inclusion and respect to the environment. One of its operative goals is to diversify the energy matrix through the prioritization of renewable resources.
• The General Electricity Law entered into force in 1996, hence is not included in the analysis.

[36] Ministry of Energy and Mines, Política Nacional de Energía (Energy National Policy), page 38. http://www.mem.gob.gt/wp-content/uploads/2013/02/PE2013-2027.pdf (last access 07/08/2019)

Because hydroelectric projects are not mandatory and the investment in fuel based technologies is not limited, in the absence of the CDM project activity, the 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. This is a likely scenario in compliance with the relevant mandatory national and/or sectoral policies. The installed capacity in Guatemala over the last 25 year has had continuous additions in renewable as in fuel based technologies[37]

Outcome of step 1.1: Since the current baseline complies with all relevant mandatory national and/or sectoral policies, Step 1.2 is followed.

Step 1.2: Assess the impact of circumstances

The circumstances of the Project Activity at the renewal of the crediting period are similar to the conditions at the registration time. Therefore, any deviation in the application of methodology respect to the baseline scenario is not necessary.

Outcome of step 1.2: Given that the new circumstances provide a continued validity of the current baseline, then the current baseline does not need to be updated for the subsequent crediting period.

Step 1.3: Assess whether the continuation of use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

As per the tool, this sub-step should only be applied if the baseline scenario identified at the time of validation of the project activity was the continuation of use of the current equipment(s) without any investment and, the projects proponents or third party (or parties) would undertake an investment later due, for example, to the end of the technical lifetime of the equipment(s) before the end of the crediting period or the availability of a new technology. Therefore, this step is not applicable to this project activity because that was not the baseline scenario identified for this project activity: there was no running equipment at the time and no investment was to be undertaken later on.

Outcome of step 1.3: Since the baseline scenario identified at the time of validation of the project activity was not the continuation of use of the current equipment(s), this step is not applicable.

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

Under this step, the tool indicates that data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period should be assessed to determine if they are still valid or whether they should be updated. Updates should be undertaken in the following cases:

• Where IPCC default values are used, the values should be updated if any new default values have been adopted and published by the IPCC, for example, in guidelines for national GHG inventories, IPCC assessment report or special reports by the IPCC;

• Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity.

[37] CEPAL, Estadísticas de la producción de electricidad de los países del Sistema de Integración Centroamericana (Statistics in Electricity Production of the Countries of the Central America Integration System), page 65. 2018. https://repositorio.cepal.org/bitstream/handle/11362/44358/1/S1801216_es.pdf (last access 07/08/2019)

For the renewal of the crediting period, the version of the applied methodology AMS I.D. shall be updated from version 17.0 to version 18.0 and therefore all the applied tools shall be updated too. Furthermore, the emission factor of the grid shall be updated too according to the latest version of the Tool to calculate the emission factor for an electricity system.

Outcome of step 1.4: Since data and parameters that were only determined at the start of the crediting period and not monitored during the crediting period are not valid anymore because the methodology and tools applied have been updated, the current baseline needs to be updated for the subsequent crediting period.

The application of Step 1.4 confirmed that data and parameters ex ante are not valid for the subsequent crediting period, therefore we proceed to Step 2.

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

Following the tool, the baseline emissions for the second crediting period have been updated, without reassessing the baseline scenario, as per methodology AMS-I.D (version 18.0). This update was applied in the context of the sectoral policies and circumstances that are applicable at the time of requesting the renewal of the crediting period. More details for the updated baseline emissions for the second crediting period can be seen in section B.6.

Step 2.2: Update the data and parameters

As mentioned on step 1.4 above the data and/or parameter(s) that were determined at the start of the crediting period and not monitored during the crediting period are not valid anymore, therefore all applicable data and parameters have been updated, following the guidance in Step 1.4 and as per methodology AMS-I.D: “Small-scale Methodology: Grid connected renewable electricity generation” (Version 18.0)

I.6. Estimation of emission reductions

I.6.1. Explanation of methodological choices

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At the time of writing, methodological choices, provided in the approved baseline and monitoring methodology applied this SSC-CPA are the following:

- Methodology for small scale grid connected hydropower: “AMS-I.D. Grid connected renewable electricity generation v18.0 (Sectoral Scope: 01, EB 81).
- Tool/Guidelines: Methodological Tool “Tool to calculate the emission factor for an electricity system” (Version 07.0, EB 100, Annex 4).

Baseline Emissions

The baseline emissions are the product of electrical energy baseline $EG_{PJ,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

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

Where:

BE_y	Baseline Emissions in year *y* (tCO_2)
$EG_{PJ,y}$	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)

$EF_{grid,y}$	Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO_2/MWh)

Calculation of baseline emission factor ($EF_{grid,CM,y}$):

The emission factor can be calculated in a transparent and conservative manner as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system"; or

(b) The weighted average emissions (in tCO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

In accordance with the methodology AMS-I.D. Grid connected renewable electricity generation[38] approved by CDM Executive Board (Sectoral Scope: 01, EB 81) the emission factor will be calculated using option (a):

"(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system"

The calculation of combined margin CO_2 emission factor has been done ex-ante at PoA level.

Calculation of Operating Margin CO_2 emission factor:

The calculation of Operating Margin CO_2 emission factor has been done ex-ante at SSC-PoA-DD level. The value obtained for the emission factor is the following:

	unit	$EF_{grid,OM-adj,2016}$	$EF_{grid,OM-adj,2017}$	$EF_{grid,OM-adj,2018}$
$EF_{grid,OM-adj,y}$	tCO_2/MWh	0.6961	0.4605	0.6051
$EF_{grid,OM-adj}$	tCO_2/MWh	**0.5872**		

Calculation of the build margin (BM) emission factor

The calculation of Build margin CO_2 emission factor has been done ex-ante at SSC-PoA-DD level. The value obtained for the emission factor is the following:

	unit	Value
$EF_{grid,BM,2018}$	tCO_2/MWh	**0.1065**

Calculation of the combined margin (CM) emission factor

The calculation of the combined margin CO_2 emission factor has been done ex-ante at SSC-PoA-DD level. The value obtained for the combined margin emission factor ($EF_{grid,CM,2018}$) is the following:

	unit	Value
$EF_{grid,OM-adj,2016-2018}$	tCO_2/MWh	**0.5872**
$EF_{grid,BM,2018}$	tCO_2/MWh	**0.1065**

[38] Current version when writing this document: v18.0

W_{OM}	--	**0.25**
W_{BM}	--	**0.75**
$EF_{grid,CM,2018}$	tCO_2/MWh	**0.2267**

Project Emissions

Calculation of the Power Density (If Reservoir):

If the SSC-CPA hydropower plant comprises a reservoir, the power density of the power plant shall be greater than 10 W/m2 as per eligibility criteria of the SSC-PoA-DD. This is defined in ACM0002 Version 19.0. Sectoral Scope, 01 EB 100 (referred from AMS-I.D. small scale methodology) to avoid CH4 and CO_2 emissions from the reservoirs.
In the chapter "*Emissions from water reservoirs of hydro power plants (PEHP,y)"* of the ACM0002 there is an option "*(b) If the power density of the project activity (PD) is greater than 10 W/m2:*" then

$PE_{HP,Y} = 0$

Where:
$PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year y (tCO_2e)

The power density of the project activity (PD) is calculated as follows and shall be greater than **10W/m2**:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = \frac{Cap_{PJ}}{A_{PJ}}$$ (for newly built hydropower plants)

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 single or multiple reservoirs 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 single or multiple reservoirs 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**.

The **SSC-CPA [CPA_entity_name]** [**doesn't/does**] have reservoir so **PD= [0/calculated value] W/m2** and therefore **$PE_{HP,Y}$=0.**

Leakage
According to methodology AMS-I.D., for renewable energy projects leakage are equal to 0.

Calculation of emission reductions:

In accordance with the methodology AMS-I.D. the emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	Emission reductions in year *y* (CO_2tCO_2/y)
BE_y	Baseline Emissions in year *y* (CO_2tCO_2/y)
PE_y	Project emissions in year *y* (CO_2tCO_2/y)
LE_y	Leakage emissions in year *y* (CO_2tCO_2/y)

For this SSC-CPA under the SSC-PoA, PE_y[39] and LE_y[40] are zero as mandatory per eligibility criteria 5.6 and 5.7 respectively, so only BEy must be calculated.

Using the values in this section the ex-ante calculation of emission reductions is:

ER_y = BE_y – PE_y – LE_y = **[ER₁tCO2e] tonnes of CO_2e.**

In the table of section I.6.2. is detailed the values per year.

I.6.2. Data and parameters fixed ex ante

Data/Parameter	**$EF_{grid,CM,y}$**
Data unit	tCO_2/MWh
Description	Combined margin emission factor of the grid in year y
Source of data	Own calculations based on data published by official organizations of the host country: ✓ AMM (*Wholesale Market Administrator*) - http://www.amm.org.gt/ MEM (*Ministry of Energy and Mines*) - http://www.mem.gob.gt
Value(s) applied	The value calculated with the current data vintage is: **$EF_{grid,CM,2018,Guatemala}$** = 0.2267
Choice of data or Measurement methods and procedures	The parameter is calculated as the combined margin (CM) according to the "Tool to calculate the emission factor for an electricity system" (Version 07.0.0, EB 100, Appendix 4). Data vintage from the years 2016, 2017 and 2018 as included in Appendix 4 is used.
Purpose of data	The purpose of data is the calculation of BE_y Baseline Emissions in year y (tCO_2)
Additional comment	Calculated ex-ante at SSC-PoA-DD level

[39] If SSC-CPA has reservoir, to avoid project emissions from water reservoir, the power density must be always bigger than 10W/m2 as eligibility criteria for this SSC-CPA under the SSC-PoA.

[40] SSC-CPA is hydropower renewable energy and leakage shall be zero as per eligibility criteria of this PoA.

Data/Parameter	$EF_{CO_2,i}$
Data unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type i used.
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2 chapter 1 (table 1.4)
Value(s) applied	The value applied with the current data vintage is in Appendix 4. ▪ 0.0726 tCO_2/GJ for diesel ▪ 0.0755 tCO_2/GJ for bunker ▪ 0.0895 tCO_2/GJ for bituminous coal ▪ 0.0693 tCO_2/GJ for orimulsion.[41]
Choice of data or Measurement methods and procedures	The IPCC Guidelines are the most reliable source for these values. The lower IPCC value of the uncertainty at a 95% confidence interval has been chosen, accordance with the methodological tool "Tool to calculate the emission factor for an electricity system" (Version 07.0.0).
//Purpose of data	The purpose of data is the calculation of $EF_{grid,OM,y}$
Additional comment	-

Data/Parameter	EG_y
Data unit	MWh
Description	Net electricity generated in the project electricity system in year y.
Source of data	Statistics provided by official organizations of the host country: AMM (*Wholesale Market Administrator*) - http://www.amm.org.gt/
Value(s) applied	The value applied with the current data vintage is in Appendix 4.
Choice of data or Measurement methods and procedures	Data vintage from the years 2016, 2017 and 2018 as included in Annex 4 is used. Based on the most recent data available at the time of submission of the CDM-PoA-DD-Form to the DOE for validation.
Purpose of data	The purpose of data is the calculation of $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$
Additional comment	-

Data/Parameter	EG_m
Data unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *m*
Source of data	Statistics provided by official organizations of the host country: AMM (*Wholesale Market Administrator*) - http://www.amm.org.gt/
Value(s) applied	The value applied with the current data vintage is in Appendix 4.
Choice of data or Measurement methods and procedures	Data vintage from the years 2016, 2017, 2018 as included in Appendix 4 is used. Based on the most recent data available at the time of submission of the SSC-PoA-DD to the DOE for validation.
Purpose of data	The purpose of data is the calculation of $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$
Additional comment	-

[41] 2006 IPCC: Guidelines for National Greenhouse Gas Inventories Volume 2 Energy, chapter 1 (table 1.2: DEFAULT NET CALORIFIC VALUES (NCVs) AND LOWER AND UPPER LIMITS OF THE 95% CONFIDENCE INTERVALS), https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf (last accessed 05/08/2019)

Data/Parameter	EG_k
Data unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *k*.
Source of data	Statistics provided by official organizations of the host country: AMM (*Wholesale Market Administrator*) - http://www.amm.org.gt/
Value(s) applied	The value applied with the current data vintage is in Appendix 4.
Choice of data or Measurement methods and procedures	Data vintage from the years 2016, 2017, 2018 as included in Appendix 4 is used. Based on the most recent data available at the time of submission of the SSC-PoA-DD to the DOE for validation.
Purpose of data	The purpose of data is the calculation of $\mathbf{EF_{grid,OM,y}}$
Additional comment	-

Data/Parameter	$EF_{EL,m}$
Data unit	tCO_2/MWh
Description	CO_2 emission factor of power unit m.
Source of data	Own calculations based on data published by official organizations of the host country: AMM (*Wholesale Market Administrator*) - http://www.amm.org.gt/
Value(s) applied	The value applied with the current data vintage is in Appendix 4 .
Choice of data or Measurement methods and procedures	The parameter is calculated according to “Option A2” of “Simple OM option A” (equation 5) in “Tool to calculate the emission factor for an electricity system” (Version 07.0.0, EB 100).
Purpose of data	The purpose of data is the calculation of $\mathbf{EF_{grid,OM,y}}$ and $\mathbf{EF_{grid,BM,y}}$
Additional comment	-

Data/Parameter	$EF_{CO_2,m,i}$
Data unit	tCO_2/GJ
Description	Average CO_2 emission factor of fuel type i used in power unit *m* in year y
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories, volume 2 chapter 1 (table 1.2) [42]
Value(s) applied	The value applied is: ▪ 0.0726 tCO_2/GJ for diesel ▪ 0.0755 tCO_2/GJ for bunker ▪ 0.0895 tCO_2/GJ for bituminous coal ▪ 0.0693 tCO_2/GJ for orimulsion.
Choice of data or Measurement methods and procedures	The IPCC Guidelines are the most reliable source for these values. The lower IPCC value of the uncertainty at a 95% confidence interval has been chosen, accordance with the methodological tool “Tool to calculate the emission factor for an electricity system” (Version 07.0.0).
Purpose of data	The purpose of data is to the calculation of $\mathbf{EF_{grid,BM,y}}$
Additional comment	

[42] 2006 IPCC: Guidelines for National Greenhouse Gas Inventories Volume 2 Energy, chapter 1 (table 1.2: DEFAULT NET CALORIFIC VALUES (NCVs) AND LOWER AND UPPER LIMITS OF THE 95% CONFIDENCE INTERVALS), https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf (last accessed 05/08/2019)

Data/Parameter	$\eta_{m,y}$
Data unit	%
Description	Average net energy conversion efficiency of power unit *m* in year y (ratio)
Source of data	According to the "Tool to calculate the emission factor for an electricity system" (Version 07.0.0, EB 100) (a) Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or (b) For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or (c) The default values provided in in Table 2, Appendix of TOOL09:"Determining the baseline efficiency of thermal or electric energy generation systems" (if available for the type of power plant). Option (c) is applied.
Value(s) applied	The value applied with the current data vintage is in TOOL09:"Determining the baseline efficiency of thermal or electric energy generation systems" (if available for the type of power plant), Annex 1. ▪ Coal Subcritical 39% ▪ Oil Steam turbine 44% ▪ Oil Open cycle 42%.
Choice of data or Measurement methods and procedures	Default values in table in "Annex 1: Default efficiency factors for power plants" of the "Tool to calculate the emission factor for an electricity system" (07.0.0, EB 100).
Purpose of data	The purpose of data is the calculation of $\mathbf{EF_{grid,OM,y}}$ and $\mathbf{EF_{grid,BM,y}}$
Additional comment	-

Data/Parameter	$\sigma_{historical}$
Data unit	MWh/year
Description	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity.
Source of data	Calculated from data used to establish $EG_{historical}$
Value(s) applied	[Defined at SSC-CPA level if retrofit or replacement]
Choice of data or Measurement methods and procedures	Parameter to be calculated as the standard deviation of the annual generation data used to calculate $EG_{historical}$ for retrofit or replacement project activities.
Purpose of data	The purpose of data is the calculation of BE_y Baseline Emissions in year y (tCO_2).
Additional comment	Only applicable if the SSC-CPA is a retrofit/capacity addition of hydropower plant.

Data/Parameter	$EG_{historical}$
Data unit	MWh
Description	Annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data	Project activity site
Value(s) applied	[Defined at SSC-CPA level if retrofit or replacement]
Choice of data or Measurement methods and procedures	Electricity meters
Purpose of data	-
Additional comment	-

Data/Parameter	$DATE_{BaselineRetrofit}$
Data unit	date
Description	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data	[Defined at SSC-CPA level if retrofit or replacement]
Value(s) applied	As per provisions in the Approved consolidated baseline and monitoring methodology ACM0002 (Version 19.0, Sectoral Scope 01, EB 100)
Choice of data or Measurement methods and procedures	-
Purpose of data	-
Additional comment	-

Data/Parameter	Cap_{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	Project site.
Value(s) applied	[Defined at SSC-CPA level if reservoir]
Choice of data or Measurement methods and procedures	Determine the installed capacity based on recognized standards (Nameplate of the electric generator or another official document of the electricity system operator/national authorities).
Purpose of data	-
Additional 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 (m2). For new reservoirs, this value is zero
Source of data	Project site.
Value(s) applied	[Defined at SSC-CPA level if reservoir]
Choice of data or Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Purpose of data	-
Additional comment	-

I.6.3. Modalities for ex ante calculation of emission reductions

Baseline Emission

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

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

Where:

BE_y	Baseline Emissions in year *y* (tCO_2)
$EG_{PJ,y}$	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)
$EF_{grid,y}$	CO_2 emission factor of the grid in year *y* (tCO_2/MWh)

Calculation of baseline emission factor ($EF_{grid,CM\ y}$):

The calculation of combined margin CO_2 emission factor is explained in Appendix 4.

$EF_{grid,CM,2018}$	tCO_2/MWh	**0.2267**

Project Emissions

Calculation of the Power Density (If Reservoir):

If the SSC-CPA hydropower plant comprises a reservoir, the power density of the power plant shall be greater than 10 W/m^2 as per eligibility criteria of the SSC-PoA-DD. This is defined in ACM0002 Version 19.0, (referred from AMS-I.D. small scale methodology) to avoid CH4 and CO_2 emissions from the reservoirs.
In the chapter "*Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)"* of the ACM0002 there is an option "*(b) If the power density of the project activity (PD) is greater than 10 W/m2:*" then

$PE_{HP,Y} = 0$

Where:
$PE_{HP,y}$ = Project emissions from reservoirs of hydro power plants in year y (tCO_2e)

The power density of the project activity (PD) is calculated as follows and shall be greater than **10W/m2**:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = \frac{Cap_{PJ}}{A_{PJ}}$$ (for newly built hydropower plants)

Where:
PD = Power density of the project activity (W/m2)
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 single or multiple reservoirs 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 single or multiple reservoirs 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**.

The **SSC-CPA [CPA_entity_name]** [**doesn't/does**] have reservoir so **PD= [0/calculated value] W/m2** and therefore **$PE_{HP,y}$=0.**

Leakage
According to methodology AMS-I.D., for renewable energy projects leakage are equal to 0.

Calculation of emission reductions:

In accordance with the methodology AMS-I.D. the emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	Emission reductions in year *y* (CO_2tCO_2/y)
BE_y	Baseline Emissions in year *y* (CO_2tCO_2/y)
PE_y	Project emissions in year *y* (CO_2tCO_2/y)
LE_y	Leakage emissions in year *y* (CO_2tCO_2/y)

For this SSC-CPA under the SSC-PoA, PE_y[43] and LE_y[44] are zero as mandatory per eligibility criteria 5.6 and 5.7 respectively, so only BEy must be calculated.

Using the values in this section the ex-ante calculation of emission reductions is:

ER_y = BE_y – PE_y – LE_y = **[ER_1tCO2e] tonnes of CO_2e.**

[43] If SSC-CPA has reservoir, to avoid project emissions from water reservoir, the power density must be always bigger than 10W/m2 as eligibility criteria for this SSC-CPA under the SSC-PoA.

[44] SSC-CPA is hydropower renewable energy and leakage shall be zero as per eligibility criteria of this PoA.

I.7. Monitoring plan

I.7.1. Data and parameters to be monitored

Data/Parameter	$EG_{facility,y}$
Data unit	MWh
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y
Source of data	Measured by electricity meter(s) installed at the project site.
Value(s) applied	[Energy_MWh] is the estimation based on the hydrological studies.
Measurement methods and procedures	The net electricity production will be measured continuously by meters and at least monthly recording will be implemented. The net electricity will be calculated by subtracting the electricity exported with the electricity imported by the SSC-CPA. A high level of accuracy of the measurements will be achieved due to the use of high-precision equipment calibrated and tested according to recognized standards in AMM resolution 307-0220[45]. A IEC 185/186/044-1 *0.2 accuracy* watt-hour meter will measure the net electricity production continuously. The net electricity production will be calculated by subtracting the electricity exported with the electricity imported by the SSC-CPA. The measurement of electricity generation will be conducted on a continuous basis, where total daily electricity measurement will be available. The measurement results will be summarized transparently in regular monthly production reports and crosschecked with sales electricity invoices. A high level of accuracy of the measurements will be achieved due to the use of high-precision equipment calibrated and tested according to international standards. Additionally, previous to the project commercial operation, the Administration of the Wholesale Market shall verify[46] the meter with the purpose of authorizing the inclusion of the project into the wholesale market.
Monitoring frequency	Continuously monitoring, hourly measurement and at least monthly recording.
QA/QC procedures	QA: The device will be recalibrated and tested according to the instructions (schedules, procedures) for QA based on the technology provider manual and/or government regulations. Sales record of electricity to the grid is used to ensure the consistency. Moreover, the measurement will be cross-checked with generation certificates issued by the AMM at the request of the project proponent. A backup meter is installed in accordance with the applicable norm (AMM resolution 307-02), in order to avoid data loss in case the main meter fails. As per the technical procedures established by the AMM (Technical Procedure 04), the electricity meters shall be calibrated at least once a year. In case both electricity meters fail, no emission reductions will be claimed during that period. QC: There will be strict compliance maintenance schedule organized by the project implementer.
Purpose of data	The purpose of data is the calculation of BEy Baseline Emissions in year y (tCO_2).
Additional comment	Data will be used for billing and therefore, checked by project owner and power company. Data will be archived electronically during the crediting period and be stored for at least two years afterwards according to "General Guidelines to SSC CDM methodologies (*Ver19.0 EB 69 annex 27*)".

[45] "Commercial Coordination Standard No. 14: resolution 307-0220 (Enabling to operate in the wholesale market and trade measurement system)": http://www.cnee.gob.gt/pdf/normas/ncc14.pdf (last time accessed:07/08/2019)

Data/Parameter	$\sigma_{historical}$
Data unit	MWH/year
Description	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data	Project site
Value(s) applied	[Defined at SSC-CPA level if retrofit/capacity addition of hydropower plant]
Measurement methods and procedures	Calculated from data used to establish $EG_{historical}$ Parameter to be calculated as the standard deviation of the annual generation data used to calculate $EG_{historical}$ for retrofit or replacement project activities.
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	The purpose of data is the calculation of BEy Baseline Emissions in year y (tCO_2).
Additional comment	Only applicable if the SSC-CPA is a retrofit/capacity addition of hydropower plant.

Data/Parameter	Cap_{PJ}
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project size
Value(s) applied	[Defined at SSC-CPA level if reservoir]
Measurement methods and procedures	Determine the installed capacity based on recognized standards (Nameplate of the electric generator or another official document of the electricity system operator/national authorities)
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	The purpose of data is the calculation of the power density of the reservoir of the SSC-CPA power plant
Additional 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	Project site
Value(s) applied	[Defined at SSC-CPA level if reservoir]
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	The purpose of data is the calculation of the power density of the reservoir of the SSC-CPA power plant
Additional comment	-

[46] "Technical Procedure 04: PERIODIC CHECKS FOR COMMERCIAL METERING POINT WHOLESALE MARKET OF GUATEMALA": https://www.amm.org.gt/portal/?wpfb_dl=86PROCEDIMIENTO%20PARA%20HOMOLOGAR%20UN%20MEDIDOR%20EN%20EL%20SISTEMA%20DE%20MEDICI%C3%93N%20COMERCIAL%20DEL%20MM.%20FEBRERO%202017.pdf (accessed: 07/08/2019)

I.7.2. Sampling plan

>>
Not applicable

I.7.3. Other elements of monitoring plan

>>
The Monitoring Plan of the project specifies the continuous monitoring of electricity generation of the project activity in order to ensure that the net electricity delivered to the grid is monitored completely within the crediting period. In each vintage year, the amount of emission reductions obtained by the project activity will vary in accordance with the total measured power generation.

1. **Monitoring Plan Objective and Organization**

The objective of the present plan is to assure the complete, consistent, clear, and accurate monitoring and calculation of the emission reductions within the project activity boundaries, during the crediting period.

Net electricity is the only parameter to be monitored to calculate the emission reductions is the amount of electricity supplied to the grid ($EG_{facility,y}$) since the baseline emission factor is fixed by ex-ante calculations.

The net electricity supplied to the grid will be calculated by subtracting the electricity exported with the electricity imported by the SSC-CPA.

The project implementer will monitor the electricity delivered to the Guatemalan Grid by the respective project. The project implementer personnel (operations manager, defined in the PoA Management System) will be trained adequately for this task. The data will be archived electronically and stored for at least 2 years after the end of the crediting period of the SSC-CPA (according to *"General Guidelines to SSC CDM methodologies" Ver19.0 EB69 annex27*).

To ensure that the data is reliable and transparent, the project implementer will also establish Quality Assurance and Quality Control (QA/QC) measures to effectively control and manage data reading, recording, auditing as well as archiving data and all relevant documents.

2. **Methodology:**

The methodology used is the approved consolidated baseline and monitoring methodology AMS.I.D.[47]. All data collected as part of monitoring, should be archived electronically and be kept at least for 2 years after the end of the last crediting period. Moreover, all measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

The Coordinating and Managing Entity (CME) will implement the monitoring measures described in the "General Guidelines to SSC CDM methodologies" (*Ver19.0 EB69 annex27*). Therefore, while monitoring the emission reductions from the small-scale project activity, the project implementer of the SSC-CPA [CPA_entity_name] shall:

(a) Electronically archive all data collected as part of monitoring for a period of two years from the end of the crediting period;
(b) Data variables that are most directly related to the emission reductions (e.g. quantity of the fuel inputs, the amount of heat or electricity produced, gas captured) should be measured continuously. Data elements that are generally constant and indirectly related

[47] Current version when writing this document: v18.0 (EB 81, Annex 24, 28 November 2014)

to the emission reductions (e.g. emission factors, calorific value, system efficiencies) should be measured or calculated at least once a year, unless detailed specifications are provided as part of the indicated methodology;

(c) Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years;

(d) The measured data with high levels of uncertainty or without adequate calibration should be compared with location/national data and commercial data to ensure consistency;

3. **Boundaries:**

The boundaries of the project activity will remain constant during the entire crediting period.

4. **Monitoring Data and Archiving:**

Data to be monitored to calculate the power density if there is a reservoir is:

- Cap_{PJ} (W): Installed capacity of the hydro power plant after the implementation of the project activity. This is fixed and determined by nameplate of the electric generator, or another official document of the electricity system operator/national authorities.
- A_{PJ} (m^2): 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. This data is measured from reliable engineering plans (topographical surveys, maps, satellite pictures, etc)

The SSC-CPA [CPA_entity_name] does [not] have a reservoir, so this data is [not] needed to be monitored.

Data to be monitored to calculate emission reductions is:

- $EG_{facility,y}$ (MWh): the net electricity delivered to the local grid by the SSC-CPA in year y. The net electricity production will be measured continuously by electricity meters, and the frequency, calibration and characteristics of equipment is described in this section.

For the SSC-CPA [CPA_entity_name], the monitoring of $EG_{facility,y}$ based on the host country regulations is described:

- Method to monitor the net electricity delivered to the grid: The net electricity will be calculated by subtracting the electricity exported with the electricity imported by the SSC-CPA .As per the national Standard (*NCC14 Commercial Coordination Standard No. 14: resolution 307-0220*), the Administrator of the Wholesale Market (AMM) shall receive automatically information on the generated electricity from the official meter. Additionally, each month the project implementer personnel will compile the data of the electricity generated and delivered to the Guatemalan grid. These compilations will be the basis to elaborate the annual monitoring report.
- Frequency of measurements: The measurement of electricity generation will be conducted on a continuous basis, where total daily electricity measurement will be available. The measurement results will be summarized transparently in regular monthly production reports and crosschecked with sales electricity invoices.

The entity responsible for monitoring, which is the CME, will provide the verifying DOE with meter readings for electricity delivered and calibration certificates.

5. **Metering equipment:**

Measurement of the electricity generated by the plant is done through a meter which measures the electricity that is produced within the boundaries of the project activity and exported net to the grid.

A high level of accuracy of the measurements will be achieved due to the use of high-precision equipment calibrated and tested according to recognized international standards in AMM resolution 307-0220[48].An IEC 185/186/044-1 *0.2 accuracy* watt-hour meter will measure the net electricity production continuously.

The meter complies with the Commercial Coordination Standard No. 14 (NCC14) of the Wholesale Market Administrator (AMM according to its Spanish abbreviation) and with IEC 687 or ANSI / IEEE 12.20, in regard to metering and taking into account that the kind of accuracy should be 0.2% and number of elements must be three (3).

According to Norm No. 14 (NCC14), the accuracy of measuring elements should be:

	IEC 185/186/044-1		ANSI/IEEE C57.13	
	Accuracy type (%)	Load (Burden)	Accuracy type (%)	Load (Burden)
PT	0.2	100 VA	0.3	75 VA
CT	0.2	50 VA	0.3	45VA

Whilst, the energy data record should be:

- The pulses generated by the energy meter may be stored in the same apparatus or be passed on to independent registrars collect information from different meters located on the same site. In both cases the pulses must be stored in separate channels for each scale to record, at times adjustable from 15 to 60 minutes.
- Registrars must have non-volatile memory that allows storing information from the past thirty-seven (37) days at least, for two-way considering the use of six (6) channels and capable of integrating the records every 15 minutes, unidirectional considering the use of three (3) channels and capable of integrating the records every 15 minutes. They should have built-in battery to keep data stored in memory for at least seven (7) days before the auxiliary power failure.

Previous to the project commercial operation, the Administration of the Wholesale Market shall verify[49] the meter with the purpose of authorizing the inclusion of the project into the wholesale market. Additionally, the meter accuracy will be checked by AMM in periodic verifications at the facilities, at least once a year and according to the technical procedure for periodic verifications (again “Technical Procedure 04”) at the commercial measurement points of the wholesale market in Guatemala. This **yearly** frequency of the calibration activities of the metering equipment is in accordance with the “General Guidelines to SSC CDM methodologies” (*Ver19.0 EB69 annex27*).

The verification is made by the Wholesale Market Manager or qualified companies for this purpose, which shall be approved by the Board of the AMM.

6. **Installation point of the electricity meter:**

[48] “Commercial Coordination Standard No. 14: resolution 307-0220 (Enabling to operate in the wholesale market and trade measurement system)”: http://www.cnee.gob.gt/pdf/normas/ncc14.pdf (last time accessed: 18/08/2019)

[49] “Technical Procedure 04: PERIODIC CHECKS FOR COMMERCIAL METERING POINT WHOLESALE MARKET OF GUATEMALA”: https://www.amm.org.gt/portal/?wpfb_dl=86PROCEDIMIENTO%20PARA%20HOMOLOGAR%20UN%20MEDIDOR%20EN%20EL%20SISTEMA%20DE%20MEDICI%C3%93N%20COMERCIAL%20DEL%20MM.%20FEBRERO%202017.pdf (accessed: 18/08/2018)

The electricity meter installation for [CPA_entity_name], is the point in the [Voltage_Level_BusBar_kV] kV bus bar of the interconnection substation with the national grid, as the limit point between private and public installations. The name of the substation is "[Name_interconection_Subestation]".

7. **Personnel responsible:**

According to the CME Management System the roles of communication and responsibilities regarding energy measurement are schematized in the following figure:

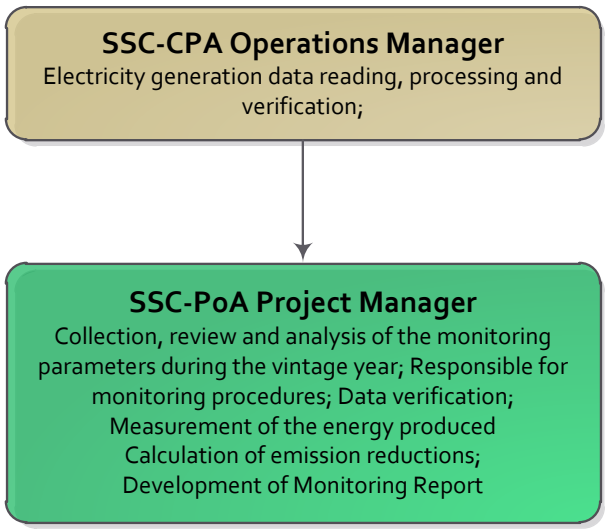

Figure 6. Roles of communication and responsibilities defined in the CME management system

Responsible personnel:

- The SSC-PoA Project Manager is responsible for:
  - The Monitoring Plan, ensuring its effective functioning, as well as corrective measures that would be necessary.
  - Verification of energy measurements; checking and verifying meter readings issued by the SSC-CPA Operations Manager and crosschecking with both the monthly measurements from the AMM and the energy invoices of the allocated energy.
  - To calculate the emission reductions of the monitoring period and preparing the monitoring report.
- The SSC-CPA Operations Manager is responsible for:
  - The electricity generation reading
  - The processing of the energy produced from the meter installed in substation metering point on a monthly basis. To download and record the meter readings in a spread-sheet for measurement control, thus the data discharged from the meter is stored electronically.
  - Verification of the downloaded meter readings.

Personnel who carry out any monitoring function are trained in CDM according to the Management System of the PoA.

8. **Measuring and calculation procedure:**

The first step is the measuring process, followed by verification of the measurement, calculation of the emission reductions, and finally, review and analysis of results.

- **Measurement**: The SSC-CPA Operations Manager obtains the information from the meters installed in the substation metering point on a monthly basis, recording those readings in the spread-sheet for measurement control and storing the data electronically discharged from the meter. This process takes place during the first week of the following month.
- **Calculation of energy produced and verification**: The SSC-PoA Project Manager will carry out the measurement crosschecking as shown in the following table which will be the basis for the electronic spread-sheets used for measurement and control.

SSC-CPA measurement control			**Year: [YYYY]**
A	**B**	**C**	**D**
Month	**SSC-CPA Measurement (MWh)**	**AMM Commercial measurement (MWh)**	**SSC-CPA validated generation (MWh)**
January			If B=C, measurement is validated. If not, AMM value will be used.
…	…	…	…
December			
Total Annual Energy			

The project implementer will install at least 2 meters at the interconnection point for the "*SSC-CPA Measurement*". One meter will be considered the official one and the second meter will be used as backup, as per the national Standard (*NCC14 Commercial Coordination Standard No. 14: resolution 307-0220*). If there is an inconsistency between data of the main meter and AMM commercial measurement, the backup meter should be used. In case there is a discrepancy between the measurement of the SSC-CPA substation metering point and the AMM commercial measurement, the SSC-PoA Project Manager will determine the cause of the problem. If a calibration error is found, the meter will be recalibrated. Other corrective actions will be undertaken, as needed, depending on the problem identified.

- **Calculation of emission reductions**: The SSC-PoA Project Manager calculates the emission reductions for each year of the crediting period using the emission factor determined by the ex-ante option for the current crediting period and defined on this document.

9. Quality Assurance and Quality Control:

The project entity will implement QA & QC measures to calibrate and guarantee the accuracy of metering and safety of the project operation.

The metering devices will be calibrated and inspected properly and periodically as per standard industry norms and requirements ("*Technical Procedure 04: PERIODIC CHECKS FOR COMMERCIAL METERING POINT WHOLESALE MARKET OF GUATEMALA*"). The grid company and the project owners are responsible for operation and maintenance of their respective electricity meters.

The installation of the meters will be at the first interconnection point with the national grid. The project implementer will implement QA&QC measures to calibrate and guarantee the accuracy of metering and the safety of the project operation, according to the manufacturer manual and recommendations. Moreover, the project implementer will install at least 2 meters at the interconnection point. One meter will be considered the official one and the second meter will be used as backup, as per the national Standard (NCC14 Commercial Coordination Standard No. 14: resolution 307-0220).

If the wholesale market administrator of the host country (AMM) does not receive information about the amount of energy generated by the project, due to failures in the communications or in the operation of the meter, the AMM will notify the project implementer, who shall provide the AMM with the requested information within the next 2 calendar days after the notification. Such measures shall be taken from the backup meter. If an inaccuracy is identified, then data from the backup meter will be registered. Otherwise, no CERs will be generated from the period in which the official meter presents inaccuracies or failures.

The CME Ecoener Ingeniería, Sociedad Anónima, signed a contract with [CPA_Implementer_name] (Project Implemeneter of this SSC-CPA), in which [CPA_Implementer_name] certifies that is aware and have agreed to subscribe to the PoA Ecoener Small Hydro Programme of Activities, and allows access to the SSC-CPA [CPA_entity_name] project installations among other things. The meter(s) reading will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data. This is certified through the mentioned contract to enable the accessibility of the DOE and CME to the installations, and in particular to the meter equipment.

10. **Verification of Monitoring Results:**

The project implementer (responsible, SSC-PoA Operations Manager), with support from the coordinating entity (responsible, SSC-PoA Project Manager) will carry the responsibility for providing the DOE with all required necessary information, before, during and in the event of queries, after the verification.

SECTION J. Crediting period type and duration

>>
Type: Renewable
Length of crediting period: 7 years and 0 month
Number of renewal of crediting periods: 1 time

SECTION K. Eligibility criteria for inclusion of CPAs

>>
The small-scale methodology applicable for this SSC-CPA under the SSC-PoA “Ecoener Small Hydro Programme of Activities” is AMS.I.D. “Grid connected renewable electricity generation”[50].

According to all the relevant requirement of “CDM Project Standard for Programme of Activities (Version 02.0, EB 101, Annex 3) (hereinafter SPoA), Methodological tool: Demonstration of additionality of microscale project activities (version 09.0 EB101 Annex15)”(hereinafter TA) and “Methodological tool: Demonstration of additionality of small-scale project activities (version 12.0 EB99 Annex27)” (hereinafter TA). the SSC-CPA [CPA_entity_name] is eligible to be included to the Ecoener Small Hydro Programme of Activities because it fulfils all eligibility requirement of the SSC-PoA listed below:

No.	Eligibility criterion - Category	Eligibility criterion - Required condition	Supporting evidence for inclusion
1	**The geographical boundary of the CPA** shall consistent with the geographical boundary set in the PoA.	SPoA	[CPA_entity_name] is located in Guatemala, thus included in the boundary of the host country. This is supported by [documentary_evidences].

[50] Current version when writing this document: v18.0 (EB 81, Annex 24)

2	**Conditions to avoid double counting of GHG emission reductions or net anthropogenic GHG removals** The CPA implementer shall certify: 1. The SSC-CPA has a unique identification and location and is not part of another CDM project 2. The SSC-CPA is not producing CERs in another CDM project activity to avoid double counting.	SPoA	[CPA_entity_name] has a unique identification and location. [documentary_evidences].
3	**Specification of the technology/measure, such as the level and type of service, as well as performance specification based on, inter alia, testing/certification** 1. The *Technology* shall be ROR hydropower plant[51]. 2. The *type of service* shall be to supply electricity to national grid. 3. The *Installed capacity* shall be below 15MW	SPoA	[CPA_entity_name] is a [greenfield_retrofit_capacityAddition_replacement] ROR hydropower plant with an installed capacity of [Installed_capacity_CPA] MW which is below the type I small-scale threshold (15MW). The hydroelectric project supplies electricity to the national grid (SNI). [documentary_evidences].
4	**Conditions to check the start date of the CPA**: The SSC-CPA must have a project start date in compliance with the definition of "Start date" as per the CDM Glossary of Terms (version 7) and after the PoA validation start date (which is the date in which the PoA-DD, generic SSC-CPA-DD, and specific SSC-CPA-DD were submitted to the UNFCCC for public comments, March 24, 2012).	SPoA	The expected date for starting the construction of the small-scale CPA project is [StartingDateCPA_dd/mm/yyyy] [documentary_evidences]. A project timeline and chronogram with more details is provided to DOE.
5	**Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs** The SSC-CPA shall fulfil all the eligibility requirements (technology/measure) according to the approved small scale methodology "AMS-I.D. Grid connected renewable electricity generation"[52]	SPoA	A list of AMS-I.D. requirements that are fulfilled by the project is detailed in the following sub-points.

[51] As characterized by the World Commission of Dams 2000.

[52] Current version when writing this document: v18.0

	5.1. **AMS-I.D Requirement:** This methodology comprises renewable energy generation units, such as hydro. (a) Supplying electricity to a national or a regional grid;	AMS-I.D	The SSC-CPA project is a ROR Hydropower plant that supplies electricity to the national grid of the host country. This is evidenced through the [documentary_evidences] made available to DOE.
	5.2. **AMS-I.D Requirement**: This methodology is applicable to project activities that: (a) Install a greenfield plant; (b) Involve a capacity addition in (an) existing plant(s); (c) Involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (d) Involve a replacement of (an) existing plant(s).	AMS-I.D	The SSC-CPA is a [greenfield_retrofit_capacityAddition_replacement] hydropower plant. This is evidenced through the [documentary_evidences] made available to DOE.
	5.3. **AMS-I.D Requirement**: If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	AMS-I.D	The installed capacity is [Installed_capacity_CPA] MW of renewable hydropower energy. This is evidenced through the [documentary_evidences] made available to DOE
	5.4. **AMS-I.D Requirement**: In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct [53] 1 from the existing units.	AMS-I.D	The SSC-CPA is a [greenfield_retrofit_capacityAddition_replacement] hydropower plant. This is evidenced through the [documentary_evidences] made available to DOE.
	5.5. **AMS-I.D Requirement**: In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.	AMS-I.D	The SSC-CPA is a [greenfield_retrofit_capacityAddition_replacement] hydropower plant. This is evidenced through the [documentary_evidences] made available to DOE.

[53] Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered “physically distinct”.

	5.6. **CME Requirement**: If the hydropower plant comprises a reservoir, the power density of the power plant shall be greater than 10 W/m2 as defined in the most recent version of the ACM0002 [54] (referred from AMS-I.D. small scale methodology) to avoid CH_4 and CO_2 emissions from the reservoirs.	CME	[CPA_entity_name] does not comprise a reservoir. This is evidenced through the [documentary_evidences] made available to DOE.
	5.7**. CME Requirement:** The SSC-CPA shall not consider the installation of existing equipment transferred from another hydropower plant, thus leakage is not to be considered and equal to zero.	CME	[CPA_entity_name] is not using equipment transferred from another project activity. This is evidenced through the [documentary_evidences] made available to DOE.

[54] Version 19.0 (Sectoral Scope 01, EB 100, Annex 6)

6	**The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality** All SSC-CPAs shall comply with one of the additionality tests outlined in section E.5.1 and detailed in section E.5.2 of the SSC-PoA-DD. 6.1. Test A: Demonstrating additionality using the Methodological tool: Demonstration of additionality of microscale project activities (version 09.0 EB101 Annex15)". Projects with installed capacity up to 5 MW (Test A.1.) and located in a Special Underdeveloped Zone (SUZ[55]) of the host country (Test A.2.1 and A2.2) or are additional. 6.2. Test B: Demonstrating additionality using the "Methodological tool: Demonstration of additionality of small-scale project activities (version 12.0 EB99 Annex27)". Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers: (a) Investment barrier: the equity IRR must be lower than a benchmark in order to be deemed additional; (b) Technological barrier (c) Barrier due to prevailing practice (d) Other barriers	TA	[CPA_entity_name] meet requirements of the simplified modalities and procedures for Small-scale CDM project activities, because it's a [small-scale (6.1) / microscale (6.2)] ROR hydropower plant with installed capacity of [Installed_capacity_CPA] MW. These specifications and more complete data are contained in the [documentary_evidences] made available to DOE. It also fulfills the requirements established in section E.5.1 and E.5.2 of the SSC-PoA-DD of the Ecoener Small Hydro Programme of Activities. Test A: [documentation of host country or UNFCCC that demonstrate the project is located in a Special Underdeveloped Zone (SUZ).] Test B: [documentation that demonstrate the existence of the selected barrier with solid arguments (e.g. Investment barrier: investment analysis and data sources that shows that the equity IRR must is lower than the benchmark in section E.5.1.)]

[55] Test A2.1: CPA is undertaken in a SUZ municipality under extreme poverty as identified by the host country Secretariat of Schedules and Planning of the Presidency of Guatemala (SEGEPLAN, Secretaría de Planificación y programación de la Presidencia) or other official documentation published. The data shall satisfy any of these conditions:

- The proportion of population with income less than USD 2 per day (PPP) in the region is greater than 50%.
- The GNI per capita in the country is less than USD 3000 and the population of the region is among the poorest 20% in the poverty ranking of the host country as per the applicable national policies and procedures.

7	**The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis**: 7.1. The CPA Implementer (CI) shall provide to CME local stakeholder consultations about the CPA project, providing surveys, summary results and collecting all comments. Also it must be noted how the local stakeholder consultations were collected. 7.2. The CPA Implementer (CI) shall provide the environmental instrument approved by the competent Ministry of Environment and Natural Resources (MARN)	TA	[documentary_evidences that demonstrate that CI has undertaken local stakeholder consultations and has provided the environmental instrument approved by the competent Ministry of Environment and Natural Resources (MARN)]
	7.3. **CME Requirement:** The CPA Implementer (CI) must have contract of services and cessation of rights with the Managing Entity (CME) that governs the CPA's participation in the Ecoener PoA, and must accept the code of conduct of the Managing Entity.	CME	The CI signed a contract of services and cessation of rights with the CME that governs the CPA's participation in the Ecoener PoA and it is available to DOE.
	7.4. **CME Requirement:** The SSC-CPA shall export the renewable electricity generated to a relevant and clearly identified grid within the geographical boundary of the host country.	CME	[CPA_entity_name] will deliver renewable electricity to the national grid SNI[56] of the Republic of Guatemala. This is certified by [documentary_evidences]
	7.5. **CME Requirement**: The SSC-CPA shall be in line with laws and regulations available at the time of inclusion of the SSC-CPA into the SSC-PoA.	CME	To certify that the SSC-CPA project is in line to laws and regulations [documentary_evidences]

Test A2.2: The SUZ in the host country has been approved by Executive Board of the clean development mechanism (CDM), the list of such SUZ is on the UNFCCC website, based on the recommendation of the designated national authority of the host country.

[56] *SNI "Sistema Nacional Interconectado" according to its abbreviation in Spanish.*

	7.6. **CME Requirement**: The SSC-CPA implementers shall provide a letter of acknowledgment for the project activity, issued by the DNA, if required by the internal procedures of the DNA of the host country.	CME	On July 2, 2012 the Ecoener PoA has received the Letter of Approval (LoA) issued by the DNA of Guatemala. On [CPA_LoA_Date] the [CPA_entity_name] has received the Letter of Acknowledgment issued by the DNA of Guatemala. These two documents are available to DOE
	7.7. **CME Requirement:** The SSC-CPA project implementer must not have seriously considered grid connected electricity generation with a different technology as an alternative to the project. The CI shall sign a written statement that no further alternatives are available to the project implementers of the SCC-CPAs under this SSC-PoA, thus the proposed SCC-CPA won't be undertaken without CDM contribution.	CME	This is supported by a [documentary_evidences e.g.(written statement or clause in contract with CME)]
	7.8. **CME Requirement:** The CPA Implementer must provide the economic feasibility studies and the data sources used at the time of investment decision.	CME	The economic feasibility studies and the data sources used at the time of investment decision are available to CME.
	7.9. **CME Requirement:** The Starting Date of the SSC-CPA-DD should be later than March 23, 2012 which is the date when the SSC-PoA-DD was submitted to make it publicly available on the UNFCCC CDM website.	CME	The Starting Date of this SSC-CPA-DD is [StartingDateCPA_dd/mm/yyyy] which is later than March 23, 2012.
08	**The SSC-CPA should not result into the diversion of official development assistance**	SPoA	No public funding is provided for the project. [evidences]
09	**The target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid)**.The CPA shall be grid-connected ROR small scale hydroelectric plants.	SPoA	The Target group is grid-connected electricity generation hydropower plant. This is supported by [documentary_evidences] and made available to DOE.

10	**If there is a CPA in aggregate, shall meet the small-scale threshold criteria and shall remain within that threshold throughout the crediting period of the CPA;**	SPoA	CPA_entity_name] is a [greenfield_retrofit_capacityAddition_replacement] hydropower plant with an installed capacity below the type I small-scale threshold (15MW) according to the CDM project standard for project activities", version 02.0 This is supported by [documentary_evidences] and made available to DOE.
11	**The requirements for the debundling check:** Certify that there is not another SSC-CPA registered as small-scale CDM project activity or an application to register another small-scale CDM project activity ▪ 1. With the same project participants; ▪ 2. In the same project category and technology/measure; and ▪ 3. Registered within the previous 2 years; and ▪ 4. Whose project boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point.	SPoA	The PP[57] confirm that [CPA_entity_name] is not a de-bundled component, because in the area[58] there is not another SSC-CPA registered or intend to register as small-scale CDM project of the same PP in the last 2 years. The PP has checked the CDM pipeline of projects to verify this, and included a clause that certifies this issue in [documentary_evidences].

[57] PP: Project Participant

[58] The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

Appendix 1. Contact information of coordinating/managing entity and project participants

Coordinating/managing entity and/or project participants	☒ Coordinating/managing entity ☒ Project participant
Organization name	ECOENER INGENIERÍA, SOCIEDAD ANÓNIMA.
Country	Guatemala
Address	13 Calle, 1-10 Zona 10, Dubai Center Oficina 606.
Telephone	+50223134502
Fax	
E-mail	asierra@ecoener.eu
Website	Not applicable.
Contact person	Álvaro Sierra / Luis Valdivia Castro

Appendix 2. Affirmation regarding public funding

The project does not receive public funding.

Appendix 3. Applicability of methodologies and standardized baselines

This section has been left blank intentionally.

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

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

The combined margin emission factor (emission factor of the Guatemalan electricity system) has been calculated using the "Tool to calculate the emission factor for an electricity system¨ (Version 07.0), using information published by AMM (*Wholesale Market Administrator)*. To check the complete calculation carried out please see the attached spreadsheet "ER Calculation – PoA Ecoener_v1"

According with the "Tool to calculate the emission factor for an electricity system" version 07.0 to calculate the Combined margin CO_2 emission factor for grid connected power generation in year y the project participants shall apply the following six steps:
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) emission factor.

Step 1. Identify the relevant electricity power systems
The electricity system of the project activity is defined by the spatial extent of the power plants that are physically connected to the grid through transmission and distribution lines belonging to the SNI. SNI is Guatemala National Interconnected System.

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

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

Step 3: Select an operating margin (OM) method
The calculation of operating margin emission factor ($EF_{OM, y}$) can be based on one of four options listed as follows:
a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch data analysis OM, or
d) Average OM

The method selected is the **ex-ante Simple adjusted OM** method adjusted because low-cost/must run resources, including CDM projects, constitutes more than 50% of total grid generation in average of the five most recent years.

Year	EG_{LCMR} (GWh)	EG_{total} (GWh)	% Low-cost/ Must-run
2014	6.459,53	9.780,64	66,04
2015	6.098,17	10.301,73	59,20
2016	6.529,16	10.877,90	60,02
2017	8.289,25	11.489,90	72,14
2018	7.871,68	12.522,39	62,86

$Share_{LCMR}$
64,05 %

Step 4: Calculate the operating margin emission factor according to the selected Method "Tool to calculate the emission factor for an electricity system" v07.0 provides two calculation alternatives with regard to the typology of the data used:

- Based on the net electricity generation and a CO_2 emission factor of each power unit (option A).
- Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option B).

The simple adjusted OM method is calculated based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit; because data on electricity generation and fuel types are known and also low-cost/must-run resources constitute more than 50% of total grid generation.

Option A is applied.

Assumptions:

- For Operating Margin emission factor calculation, the emission factor of imports from connected electricity systems in other countries (Mexico) is considered equal to 0 tCO_2 per MWh.
- The Operating Margin emission factor is calculated **ex-ante and fixed for the second crediting period.**
- Data vintages for the calculation ex-ante of the OM emission factor: 2016, 2017 and 2018, based on the most recent statistics available at the time of PoA-DD submission.

a) Calculation of the operating margin emission factor ($EF_{grid,OM,y}$): Simple Adjusted Method
Among the options of the "Tool used to calculate the emission factor of an electricity system", for the calculation of the emission factor, the simple adjusted method selected is applicable to electricity systems, where the % of the average generation during a period of five years for low-cost/must-run plants exceeds 50% of the total, as it is the case of the SNI in Guatemala. The simple method cannot be used in this case since, in Guatemala in accordance with data from AMM, the % of the average generation of low-cost/must-run power plants has represented more than 50%, as shown in the following table:

Year	EG_{LCMR} (GWh)	EG_{total} (GWh)	% Low-cost/ Must-run
2014	6.459,53	9.780,64	66,04%
2015	6.098,17	10.301,73	59,20%
2016	6.529,16	10.877,90	60,02%
2017	8.289,25	11.489,90	72,14%
2018	7.871,68	12.522,39	62,86%

Share $_{LCMR}$
64,05 %

1. The Operating Margin emission factor is calculated using the following equation and data vintages for a 3-year average. It is calculated as the generation-weighted average emissions per electricity units serving the system.

$$EF_{grid,OM-adj,y} = (1-\lambda_y)\times\frac{\sum_m EG_{m,y}\times EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y \times \frac{\sum_k EG_{k,y}\times EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

Where:
$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin CO2 emission factor in year y (tCO2 /MWh)

λ_y = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year y
$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EG_{k,y}$ = Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)
$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2 /MWh).
$EF_{EL,k,y}$ = CO_2 emission factor of power unit k in year y (tCO_2 /MWh)
M = All grid power units serving the grid in year y except low-cost/must-run power units
k = All low-cost/must run grid power units serving the grid in year y
Y = The relevant year as per the data vintage chosen

Determination of $EF_{EL,m,y}$:

The emission factor for subset of power plants, $FE_{EL,j,y}$ and $EF_{ELk,y}$, connected to Interconnected National System, SNI, is calculated by using **option A2** and the emission factor is determined based on the CO_2 emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{co2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:
$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (t CO2/MWh)
$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fuel type i used in power unit *m* in year *y* (t CO2/GJ)
$\eta_{m,}$ = 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 u nits
y = The relevant year as per the data vintage chosen in Step 3

Determination of λ_y

The value of λy must be calculated before calculating the operating margin emission factor with the following equation:

$$\lambda_y(per\ cent) = \frac{Number\ of\ hours\ \text{low} - \text{cost/must} - \text{run}\ are\ on\ the\ margin\ in\ year\ y}{8760\ hours\ per\ year}$$

The steps required to calculate λy are the following:

- Step (i) - Plot a load duration curve. Collect chronological load data (typically in MW) for each hour of the year y, and sort the load data from the highest to the lowest MW level. Plot MW against 8760 hours in the year, in descending order.
- Step (ii) - Collect electricity generation data from each power plant/unit. Calculate the total annual generation (in MWh) from low-cost/must-run power plants/units (i.e. $\sum EG_{k,y}$);
- Step (iii) - Find out the intersection on the load duration curve in order to determine a period LCMR sources are on the margin. To find the intersection, fill the area under the load duration curve by the total generation (in MWh) from LCMR power plants/units. To fill the area, plot a horizontal line across the load duration curve such that the area under horizontal line and the curve right from the intersection point (MW times hours) equals the total generation (in MWh) from low-cost/must-run power plants/units (i.e. $\sum EG_{k,y}$);
- Step (iv) - Determine the "Number of hours for which low-cost/must-run sources are on the margin in year y. First, locate the intersection of the horizontal line plotted in Step (iii) and the load duration curve plotted in Step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which lowcost/must-run sources are

on the margin. If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and ∑y is equal to zero.

Lambda calculation	2016	2017	2018
λy	0,0712	0,4136	0,2215
1 - λy	0,9288	0,5864	0,7785

According to Data Vintage used the $EF_{grid,OM,y}$ for the project during the second crediting period is equal to 0,5872 tCO2/MWh

Step 5. Calculate the build margin (BM) emission factor
According to the tool, **Option 1 was chosen**. 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.

The Build Margin emission factor represents the tendency of the mix of generation and is calculated similarly to the Operating Margin emission factor, considering the group of power units whose generation is at least 20% total generation.

Assumptions:
- The Building Margin emission factor is calculated ex-ante.
- Data vintages for the calculation ex-ante of the BM emission factor: 2017.

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

Where:
$EF_{grid,BM,y}$ = Build margin 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 (tCO2 /MWh)
m = Power units included in the build margin y = Most recent historical year for which power generation data is available (2018) at the moment to submit PDD to DOE.

According to Data Vintage used the $EF_{grid,BM,y}$ for the project during the second crediting period is equal to 0.1065 tCO_2/MWh

Step 6. Calculate the combined margin emissions factor
According with the "Tool to calculate the emission factor for an electricity system" v07.0, The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

a) Weighted average CM; or
b) Simplified CM.

The weighted average CM method (option A) is used as the chosen option.

The combined margin emissions factor is calculated as follows:

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

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 (tCO_2/MWh)
w_{OM} = Weighting of operating margin emissions factor (per cent)

w_{BM} = Weighting of build margin emissions factor (per cent)

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

- Wind and solar power generation project activities: ω_{OM} = 0.75 and ω_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

- All other projects: ω_{OM} = 0.5 and ω_{BM} = 0.5 for the first crediting period, and ω_{OM} = 0.25 and ω_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Therefore since this is the second crediting period for the project, ω_{OM} = 0.25 and ω_{BM} = 0.75 are applied.

$EF_{grid,CM,y}$ = 0.5872 x 0.25 + 0.1065 x 0.75 = 0,2267 tCO2/MWh

According to Data Vintage used the $EF_{grid,CM,y}$ for the project during the second crediting period is equal to 0,2267 tCO2/MWh

Appendix 5. Further background information on monitoring plan

Monitoring information is included under chapter I.7

Appendix 6. Summary report of comments received from local stakeholders

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Appendix 7. Summary of post-registration changes

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Document information

Version	*Date*	*Description*
09.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM project standard for programmes of activities" (CDM-EB93-A07-STAN); • Make editorial improvements.
08.1	28 June 2017	Revision to: • Remove a duplicated instruction; • Make editorial improvement.
08.0	7 June 2017	Revision to: • Improve consistency with the "CDM project standard for programmes of activities" and with the PDD and CPA-DD forms; • Make editorial improvement.
07.0	25 May 2017	Revision to: • Ensure consistency with the "CDM project standard for programmes of activities" (CDM-EB93-A07-STAN) (version 01.0); • Incorporate the "Programme design document form for small-scale CDM programmes of activities" (CDM-SSC-PoA-DD-FORM); • Make editorial improvement.
06.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
05.0	9 March 2015	Revision to: • Include provisions related to choice of start date of PoA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Add exception for generic CPA where technology is under positive lists; • Make editorial improvement.
04.1	5 August 2014	Editorial revision to correct the document information table.
04.0	25 June 2014	Revision to: • Include the Attachment: Instructions for filling out the project design document form for CDM programme of activities (these instructions supersede the Guideline: Completing the programme design document form for CDM programme of activities (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the PoA in B.4 and Appendix 1; • Add general instructions on post-registration changes in paragraphs 2 and 3 of general instructions and Appendix 6; • Change the reference number from F-CDM-PoA-DD to CDM-PoA-DD-FORM; • Make editorial improvement.

Version	*Date*	*Description*
03.0	3 December 2012	EB 70 Revision to reflect changes to the *Guideline: Completing the programme design document form for CDM programmes of activities* (EB 70, Annex 6).
02.0	13 March 2012	EB 66 Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, annex 12).
01.0	27 July 2007	EB 33, Annex 41 Initial publication.

Decision Class: Regulatory
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