**Programme design document form for CDM programmes of activities**

**(Version 04.1)**

*Complete this form in accordance with the Attachment "Instructions for filling out the programme design document form for CDM programmes of activities" at the end of this form.*

| PROGRAMME DESIGN DOCUMENT (PoA-DD) | |
|---|---|
| **Title of the PoA** | Renewable Energy CDM Programme of Rwanda (RECPR) |
| **Version number of the PoA-DD** | Version: 07 |
| **Completion date of the PoA-DD** | 08/03/2015 |
| **Coordinating/ managing entity** | DG Works Ltd |
| **Host Party(ies)** | Rwanda |
| **Sectoral scope(s) and selected methodology(ies), and where applicable, selected standardized baseline(s)** | Sectoral scope 01<br>Methodologies:<br>ACM0002 version15.0: Grid-connected electricity generation from renewable sources;<br>AMS-I.D version 17.0: Grid connected renewable electricity generation;<br>AMS-I.F version 2.0: Renewable electricity generation for captive use and mini-grid; |

# PART I. Programme of activities (PoA)

## SECTION A. General description of PoA

### A.1. Title of the PoA

**>> Title:** Renewable Energy CDM Programme of Rwanda (RECPR)

**Version:** 07

**Date:** 08/03/2015

### A.2. Purpose and general description of the PoA

**>>1, Policy/measure or stated goal that the PoA seeks to promote**

The purpose of Renewable Energy CDM Programme of Rwanda (RECPR)is to support the development and implementation of renewable energy projects in Rwanda. Renewable energy technologies implemented under the programme will include hydropower, solar photovoltaic power and geothermal power. The stated goal of the PoA is to displace fossil fuel based electricity generation through the promotion of renewable energy based power generation in the country, which leads to greenhouse gas (GHG) emission reductions.

**2, Framework for the implementation of the proposed PoA**

DG Works Ltd will act as the Coordinating/Managing Entity(CME) for the PoA. The PoA is a voluntary action being coordinated and managed by DG Works Ltd. The CME will also work closely with CPA entities, which are developers of the renewable energy power plants (including hydro/solar PV/geothermal) to facilitate the development of renewable energy power plants/expansion of renewable energy power plants and their inclusion in the PoA.

CPA entities will be responsible for the implementation of individual CPAs under the PoA. The CME will enter into agreement with all CPA entities. The agreements will ensure that the CME will have control of all records and information related to the implementation of individual CPAs.

**3, Confirmation that the PoA is a voluntary action by the CME**

There are no laws or mandatory requirements in Rwanda stipulating the implementation of renewable energy power plants. The proposed PoA is a voluntary action by the CME.

**4, How the proposed PoA contributes to sustainable development?**

The proposed PoA will contribute to sustainable development, including:

- ✧ Provide clean and reliable electricity to the grid system or end users;
- ✧ Provide local employment opportunities during the construction and operation of the CPAs included in the PoA;
- ✧ Contribute to the fiscal revenues through payment of taxes.
- ✧ For some renewable energy projects, such as hydro power projects, feeder roads are constructed that make access to markets and other facilities easier for the local population

### A.3. CMEs and participants of PoA

**>>** DG Works Ltd will act as the CME, which is also the project participant of the PoA.

### A.4. Party(ies)

| Name of Party involved (host) indicates host Party | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Rwanda | DG Works Ltd (Private entity) | No |

### A.5. Physical/ Geographical boundary of the PoA

**>>** Rwanda

### A.6. Technologies/measures

**>>** CPAs under the PoA will use renewable energy technologies to generate electricity. Renewable energy technologies include hydro, solar photovoltaic and geothermal.

**Hydro Power:**

Hydropower project activity is to use the energy of the falling water for electricity generation. The accumulative reservoir type and run-of-river type hydropower project are both included in the PoA.

**Solar Photovoltaic Power:**

The Solar Photovoltaic power project activity is to use solar energy to generate direct current from photo voltaic modules that will be converted into alternating current by inverters.

**Geothermal Power:**
Geothermal electricity is electricity generated from geothermal energy. The geothermal power station is to use the heat from the core of the Earth to heat water or another working fluid, and then the fluid is used to turn a turbine of a generator, thereby producing electricity.

All the technologies described above could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users. The CPAs under the PoA will only involve the installation of a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPAs (Greenfield plant).

The renewable energy power generation technology employed in each CPA may differ from one CPA to the next, although each CPA will in general consist of components using similar technology. For each component of the CPA a specific methodology will be used however the CPA may use a single or a combination of the methodologies (AMS I.D and/or AMS I.F and/or ACM0002).

### A.7 Public funding of PoA

>> There is no public funding involved in the PoA.In cases where public funding from Parties included in Annex 1 is involved in CPAs, project participants shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance, is separate from, and is not counted towards the financial obligations of those Parties.

## SECTION B. Demonstration of additionality and development of eligibility criteria

### B.1. Demonstration of additionality for PoA

**>>** The PoA would facilitate project proponent's access to carbon revenues which are essential to feasibility of proposed large and small scale renewable energy project activities. As stated in section A.2, the PoA is a voluntary action being coordinated and managed by DG Works Ltd. And there are no mandatory laws or regulations existing in Rwanda requiring DG Works Ltd or any other entity to develop a programme for renewable generation plants.

Rwanda's current installed capacity of renewable energy projects is just 41.39MW, it can be observed that there has not been significant investment in development of renewable energy projects in the country. This can in part be attributed to the low rates of return on investment of such projects as compared to the benchmark rate of return expected from projects in the power sector and in part to various barriers such as financial and institutional barriers. Thus the PoA seeks to provide additional revenue from CDM to alleviate existing barriers.

Additionality will be demonstrated on the CPA level for each CPA separately. For large scale CPA cases, additionality will be proven based on "Tool for the demonstration and assessment of additionality (version 07)". When an investment analysis will be carried out to demonstrate that the project activity is not the most economically or financially attractive choice of investment; Common practice will be carried out to demonstrate that the project activity is not a common practice.

For small scale CPA cases, additionality will be proven based on "Guidelines on the demonstration of additionality of small scale project activities" (version 09)". If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies, the project activity is considered automatically additional.

Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries3 it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries".

If the project activity does not involve technologies which are listed under the positive list of renewable electricity generation technologies then the project participants shall provide a transparent description/explanation to show that the project activity would not have occurred due to at least one of the following barriers: a) Investment Barrier; b) Technological Barrier; c) Barrier due to prevailing practices; d) first-of-its-kind barrier; e) access to finance barrier.

For micro scale CPA cases, additionality will be proven based on "Guidelines for demonstrating additionality of micro scale project activities (version 05)". According to the Guidelines, project activities up to 5MW that employ renewable energy technology in LDCs are additional. Hence, project participants shall provide the evidence to show that the project activity would not have occurred because the installed capacity of the project activity is not greater than 5MW in Rwanda.

In the absence of CDM, none of the CPAs under the PoA would have occurred due to the additionality.

Further, the eligibility criteria for inclusion of a CPA in the PoA as provided in section B.2 also includes the additionality-related eligibility criteria that ensure all the relevant additionality-related guidelines and tools embedded in the methodologies are met.

### B.2. Eligibility criteria for inclusion of a CPA in the PoA

**>>** The eligibility criteria consists of general eligibility criteria as provided in the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities (version 03.0)"and one of the following eligibility criteria for the demonstration of additionality:

- Micro scale CPA criteria
- Small scale CPA criteria
- Large scale CPA criteria

General Criteria:

| Criteria | Example of Evidence |
|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | The CPA entity will provide evidence to prove:<br>• Specifications of technology/measure testing/certifications;<br>• Total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA is Greenfield project. | The CPA entity will provide evidence to prove that the project is a greenfield project. |
| 3. The proposed CPA is located in Rwanda. | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Contract with DG Works Ltd. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Signed confirmation from the entity implementing the CPA. The CME will also crosscheck with DNA before inclusion. The CPA will have unique identification and serial number. The CME will also check carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA“dd/mm/yyyy” is on or after the start date of the PoA“06/05/2013”. | Contracts for equipment or construction/operation services or any other documents as stated in the Glossary of CDM terms. |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel,or individual users | Power purchase agreement, or other relevant project documents |
| 8. If Environmental Impact Assessmentis required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Environmental Impact Assessment report, if applicable |
| 9. The CPA has carried out a local stakeholder consultation. | Local stakeholder consultation report |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from | Confirmation letter from CPA entity, in cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties |

| | |
|---|---|
| Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | The CPA entity will provide the relevant documents as per application of the relevant methodology as defined below. |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Feasibility study report (FSR) or other relevant documents for CPA mentioning the surface area of reservoir, technology, etc. and calculation of power density in the CPA-DD. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Confirmation that recording keeping system is in place and the CPA does not lead to double accounting of emission reductions. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria if listed in the letter of approval from host country DNA. | Monitoring plan or other relevant documents |

Micro scale CPA criteria:

In case the SSC-CPA is a microscale project activity, and additionality will be demonstrated using the Guidelines for demonstrating additionality of microscale project activities (version 05). Then the following criteria shall be fulfilled.

| | |
|---|---|
| 1. Installed capacity of the SSC-CPA is not greater than 5MW. | Feasibility study report or other relevant project documents. |
| 2. In order to determine the occurrence of de-bundling in accordance with the “Guidelines on assessment of de-bundling for SSC project activities” version 03, the CPA shall satisfy the conditions as per the guidelines. | Feasibility study report, or GPS coordinates or other relevant project documents |
| 3. The energy generating equipment employed by the CPA is not transferred from another activity. | Feasibility study report and its approval; purchase contract of main equipment. |

Small scale CPA criteria:

In case the SSC-CPA is not a microscale project activity, and additionality will be demonstrated using the “Guidelines on the demonstration of additionality of small scale project activities” (version 09), then the following criteria shall be satisfied.

| | |
|---|---|
| 1. The installed capacity of the CPA is not greater than 15MW threshold throughout the crediting period of the CPA in accordance with the “General Guidelines to SSC CDM methodologies” and relevant methodologiesAMS-I.D.version 17.0; | Feasibility study report, or nameplate of the generator, or general project information material such as internal memos or exchanges with a financing institution, or other relevant project documents |

| | |
|---|---|
| AMS-I.F.version2.0; | |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Feasibility study report, or GPS coordinates, or general project information material such as internal memos or exchanges with a financing institution, or other relevant project documents |
| 3. If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies of Guidelines on the demonstration of additionality of small scale project activities (version 09), the project activity is considered automatically additional. | Feasibility study report, or general project information material such as internal memos or exchanges with a financing institution, or other relevant project documents |
| 4. If the project activity involves technologies which are not listed under the positive list of renewable electricity generation, additionality shall be demonstrated using one of the following methods as per the Guidelines on the demonstration of additionality of small scale project activities (version 09):<br>• Investment barrier;<br>• Access to finance barrier;<br>• Technology barrier;<br>• Barrier due to prevailing practice;<br>• First-of-its-kind barrier<br>• Other barriers.<br>Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries". | Describe how the additionality of the project activity is demonstrated as per the "Guidelines on the demonstration of addtionality of small scale project activities", (version 09) taking in to consideration "Guidelines for objective demonstration and assessment of barriers" Version 01. |
| 5. The energy generating equipment employed by the CPA is not transferred from another activity. | Feasibility study report and its approval; purchase contract of main equipment. |

Large scale CPA criteria:

In case the CPA is a large scale project activity, additionality will be demonstrated as per "Tool for the demonstration and assessment of additionality "version 7.0.0. The following criteria shall be satisfied:

| | |
|---|---|
| 1. The CPA shall comply with the applicability conditions of ACM0002 version15.0. | Feasibility study report, or grid connection approval, general project information material such as internal memos or exchanges with a financing institution, or other relevant project documents |

| | | |
|---|---|---|
| 2. The CPA is additional in accordance with the "Tool for the demonstration and assessment of additionality" version 7.0.0.<br>When investment analysis is used for the demonstration of additionality option (i) of paragraph 13 (a) of the Standard "Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of Activities"_eb74_repan 05 EB 74 Annex 5 will be applicable.<br>The benchmark analysis as per "Tool for the demonstration and assessment of additionality" version 7.0.0 will be used to conduct the investment analysis.<br>The following parameters are defined by CME for the investment analysis.<br>IRR calculation parameters: | | Calculation of financial indicators in line with the "Guidelines on the assessment of investment analysis" or evidence to demonstrate the barrier analysis and first of its kind analysis etc. |
| Parameter | Unit | Source |
| Electricity generation | MWh | (Pre-) Feasibility Study Report (FSR), Power Purchase Agreement) PPA |
| Total investment | USD | Quotation, or Engineering and Procurement Contract (EPC) |
| Energy price | USD/MWh | PPA, or nationally published tariffs, or external tariffs estimation |
| Power price | USD/MW | PPA, or nationally published tariffs, or external tariffs estimation |
| Installed capacity | MW | Pre-FSR; FSR |
| Load factor | % | Pre-FSR; FSR |
| Transmission costs | USD/MWh, or USD/Year | Pre-FSR; FSR, or external report |
| O&M (fixed and variable) | USD/Year | Quotation, or estimated standard value on the market |
| Applicable Taxe(s) | USD/Year | Local tax laws |
| Insurance | USD/Year | Quotation, or estimated standard value on the market |
| Technical lifetime of equipment | # of Years | Manufacturer spec, or external source/spec/study |
| Exchange Rate | RWF/USD | Exchange rate as per date of investment |
| Residual value | USD | Calculated as per local accounting regulations, or international best practice |
| Additional parameters might be additionally defined and used if applicable in case of specific CPA. All values used must be valid at the time of investment decision-making. | | |
| Benchmark: | | |
| Benchmark | Value | Source |
| Commercial lending rate | % | Standard parameters in the market appropriate to the project activity and a project IRR calculation, sourced from:<br>Central bank, private banks, or other private institutions. |
| Weighted average costs of capital (WACC) | % | Standard parameters in the market appropriate to the project activity and a project IRR |

| | | |
|---|---|---|
| | | calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of "Guideline on the Assessment of Investment Analysis", or<br>b) Calculated using the best financial practices:<br>Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Required expected return on equity | % | Standard parameters in the market appropriate to the project activity and equity IRR calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of "Guideline on the Assessment of Investment Analysis", or<br>b) Calculated using the best financial practices:<br>Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Benchmarks supplied by relevant national authorities | % | Standard parameters in the market applicable to the project activity and the type of IRR calculation supplied from:<br>Government bond rates, or other relevant national authority. |

### B.3. Application of technologies/measures and methodologies

>> The following methodologies can be used in the PoA:

- ACM0002 version15.0: Grid-connected electricity generation from renewable sources;
- AMS-I.D version 17.0: Grid connected renewable electricity generation;
- AMS-I.F version 2.0: Renewable electricity generation for captive use and mini-grid;

The combination of ACM0002, AMS.I.D and AMS.I.F has been approved by Meth Panel (response to AM_CLA_0241 by Meth Panel), which is in line with "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities"(version 03.0)
http://cdm.unfccc.int/methodologies/PAmethodologies/clarifications/93590
As per paragraph of 88-90 of Tool to calculate the emission factor for an electricity system, the project activity under this PoA follows below steps if the project involves applying emission factor of power grid:

1. The electricity system(s) covered by the PoA is Rwanda national grid.
2. Sources of data used to determine the emission factor for the national grid to be covered in the PoA are from Rwanda DNA.
3. Equations and options used to calculate the emission factor are the same for each CPA, which are described in details for each generic CPA below.
4. The choice of calculating BM and OM is ex ante option and the selected options are consistently applied to all CPAs connected to national grid.

For the project, the grid emission factor is ex ante determined at PoA level and fixed during the 1st crediting period of PoA. The grid emission factor calculation presented below in each generic CPA is following this rule, i.e. fixed during the 1st crediting period of PoA.

### B.4. Date of completion of application of methodology and standardized baseline and contact information of responsible person(s)/ entity(ies)

>> 22/08/2013
Tricorona Carbon Asset Management PTE LTD
susanne@tricorona.se

Tricorona Carbon Asset Management PTE LTD is not a CME of the project and is not listen in Appendix 1 of the PoADD.

## SECTION C. Management system

>> DG Works Ltd is the overall in-charge of operational and management arrangements for the implementation of the PoA. Individual CPAs involved in the PoA will be developed by CPA entities. The CPA entities will be responsible for the operation and maintenance of the renewable energy power plants and will enter into power purchase agreement, wheeling agreement or similar contractual arrangement with the electricity off-taker, and relevant ender users, for the supply of electricity. And a CPA entity will also enter into a PoA participation agreement with DG Works Ltd for participation in the proposed PoA. DG Works Ltd will establish the following operational and management arrangements for the implementation of the PoA:

1. Personnel involved in the inclusion of CPAs into the PoA:

A CDM PoA team shall be constituted by DG Works Ltd to check compliance of new CPAs proposed for inclusion into the PoA. All eligibility criteria for inclusion of new CPAs shall be checked thoroughly against the documentary evidence sources. The team shall consist of professionals with sufficient competence to assess eligibility of CPAs for inclusion into the PoA. The team includes CPA manager, PoA manager, QA/QC team, and the CME can hire consultants, if necessary, for this purpose.

2. Training and capacity building for personnel involved in the inclusion of the CPAs into the PoA:

DG Works Ltd shall conduct training and capacity building for its own personnel to ensure that continuous improvements of the PoA management system are taking place. The training would include information on the latest EB guidelines on PoA development, CPA inclusion, monitoring, verification and issuance.

3. Procedure to avoid double accounting:

DG Works Ltd will ensure that each CPA proposed for inclusion in the PoA does not result in double counting of emission reductions. The following steps should be used:

- ✓ Check the CPA plant details against the record keeping system of PoA;
- ✓ Check the CPA plant details against the project activities already under validation or registered as a CDM project activity or part of another PoA;
- ✓ Confirm that project activity is not an individual CDM project or part of any other PoA;
- ✓ DG Works Ltd shall also ensure that the CPA entity has entered into a contract with it. The same also forms a part of eligibility conditions for inclusion under the PoA. It shall also confirm that CPA or any part of CPA has not been and will not be registered as a single CDM project activity or as a CPA under another PoA and the implementing entity is aware that the CPA will be subscribed to the present PoA.

4. Record keeping system for each CPA under the PoA:

DG Works Ltd shall establish and maintain a record keeping system for each CPA under the PoA. It would include:

- ✓ CPA name;

- ✓ Serial number of the CPA;
- ✓ GPS coordinates of the CPA power house;
- ✓ Name of the CPA implementing entity;
- ✓ Name and contact details of the authorized representative of the CPA;
- ✓ Technology employed by the CPA and Capacity of plants/units in the CPA;
- ✓ Date of inclusion of the CPA into the PoA;
- ✓ Start date and Duration of crediting period of the CPA;
- ✓ Start date and Commissioning date of the CPA;
- ✓ Operational lifetime of the CPA;
- ✓ Number of verification and associated monitoring period;
- ✓ Emission reductions monitored and issued in each monitoring period;

DG Works Ltd will be responsible for the management of records and data associated with each CPA under the PoA. The database will be updated manually using the data supplied by the CPAs under the PoA and will form the basis for the verification of CPAs. Supporting evidence for each eligibility criterion to demonstrate that the CPA meets all the eligibility criteria for inclusion into the PoA and data and information regarding the monitoring of emission reductions achieved by the CPA under the PoA will be kept by DG Works Ltd.

5) A procedure for technical review of inclusion of CPAs
The CME is responsible for technical review of inclusion of CPAs. The steps for the technical review are shown as below:

- ✓ The CPA entities provide all the documents, such as FSR, EIA and other documents related to the CPA to the CME;
- ✓ The CME establishes a record keeping system to record CPA's information as above;

- ✓ The QA/QC team within the CME reviews all the documents and recording, and checks if assumptions and parameters applied are consistent and justified by sources transparently. If corrections are needed, QA/QC team will coordinate with the CPA manager. The outcome will be submitted to the PoA manager.
- ✓ The PoA manager checks the final outcome and confirm the inclusion.

6) Measures for continuous improvement of PoA management system

- ✓ The PoA manager should encourage all the persons involved in the PoA to raise any issues which should be corrected and improved;
- ✓ The PoA manager appoints relevant staff to ensure that solutions are tested and the results are monitored;
- ✓ The improvement of PoA management system should be checked and approved by the PoA manager.

## SECTION D. Duration of PoA

### D.1. Start date of PoA

>>06/05/2013
The start date of the PoA is the date of prior consideration notification to DNA.

### D.2. Duration of the PoA

>>28 years

## SECTION E. Environmental impacts

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

>> The environmental analysis will be undertaken at the CPA level, if the laws or regulations of Rwanda require environmental analysis, because each individual renewable energy project is

expected to have different impacts and environmental regulations will be different depending on the location and type of the project activity.

### E.2. Analysis of the environmental impacts

>> The environmental analysis will be undertaken at the CPA level, if environmental analysis is required by the laws or regulations of Rwanda.

### E.3. Environmental impact assessment

>> The environmental impact assessment of the CPA shall be conducted as per the applicable laws or regulations at the time of inclusion of CPA into the PoA.

## SECTION F. Local stakeholder comments

### F.1. Solicitation of comments from local stakeholders

>> Taking into account the scale and different technologies of the CPAs, the local stakeholder consultation will be held at the CPA level.

### F.2. Summary of comments received

>> The local stakeholder consultation will be held at the CPA level.

### F.3. Report on consideration of comments received

>> The local stakeholder consultation will be held at the CPA level.

## SECTION G. Approval and authorization

>> The letter of approval and authorization from the
Rwanda DNA was received on 12/12/2013.

# PART II. Generic component project activity (CPA)

## SECTION A. General description of a generic CPA

**Case 1: Large scale hydro project in Rwanda (Greenfield)**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>> The component project activity is the installation of a grid-connected large scale hydro power plant with the capacity of “XXX MW”. The CPA is located in “XXX (location)” by “XXX (CPA implementing entity)”.
The CPA will generate electricity, and the electricity will be fed into the Rwanda electricity grid or be supplied to identified consumer facilities via national/regional grid through a contractual arrangement such as wheeling. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.
The CPA will be implemented under the PoA “Renewable Energy CDM Programme of Rwanda (RECPR)” with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

## B.1. Reference of methodology(ies) and standardized baseline(s)

>> ACM0002 version 15.0: Grid-connected electricity generation from renewable sources.
The methodology ACM0002 also refers to the latest approved versions of the following tools:

- "Tool to calculate the emission factor for an electricity system"(Version 4.0);
- "Tool for the demonstration and assessment of additionality" (Version 7.0);

## B.2. Applicability of methodology(ies) and standardized baseline(s)

>>

| Applicability criteria | Project activity |
|---|---|
| 1. The methodology is applicable to grid-connected renewable power generation project activities that: (a) install a Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s);(c) involve a retrofit of (an) existing operating plant(s)/units; or (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) involve a replacement of (an) existing plant(s)/unit(s). | The CPA is to install a Greenfield hydropower plant. |
| 2. The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; | The CPA is the installation of a hydro power plant. |
| 3. In the case of capacity additions, retrofits, rehabilitation or replacements (except for wind, solar wave or tidal power capacity addition projects): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity. | Not applicable. |
| 4. In case of hydro power plants one of the following conditions must apply:<br>• The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or<br>• The project activity is implemented in an existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2; or<br>• The project activity results in new single or multiple reservoirs and the power | The CPA is a large scale hydro power project.<br>One of the following conditions must apply:<br>The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or<br>The project activity is implemented in an existing single or multiple reservoirs, where the volume of reservoirs is increased and the power density is greater than 4 W/m2; or<br>The project activity results in new single or multiple reservoirs and the power density is greater than 4 W/m2.<br>The project is not an integrated hydro power plant. |

| | |
|---|---|
| density, calculated using equation (3), is greater than 4 W/m2; or<br>• The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m2, all of the following conditions shall apply:<br>o The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m2;<br>o (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br>o (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be:<br>- Lower than or equal to 15 MW; and<br>- Less than 10 per cent of the total installed capacity of integrated hydro power project. | |
| 5. In the case of integrated hydro power projects, project proponent shall:<br>• Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or<br>• Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity. | The project is not an integrated hydro power plant. |
| 6. The methodology is not applicable to the following:<br>• Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be | The CPA is a hydro power plant not involving switching from fossil fuels to renewable energy sources at the project site, thus this criterion is satisfied. |

| | |
|---|---|
| the continued use of fossil fuels at the site;<br>• Biomass fired power plants; | |

In addition, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system"(Version 4.0).

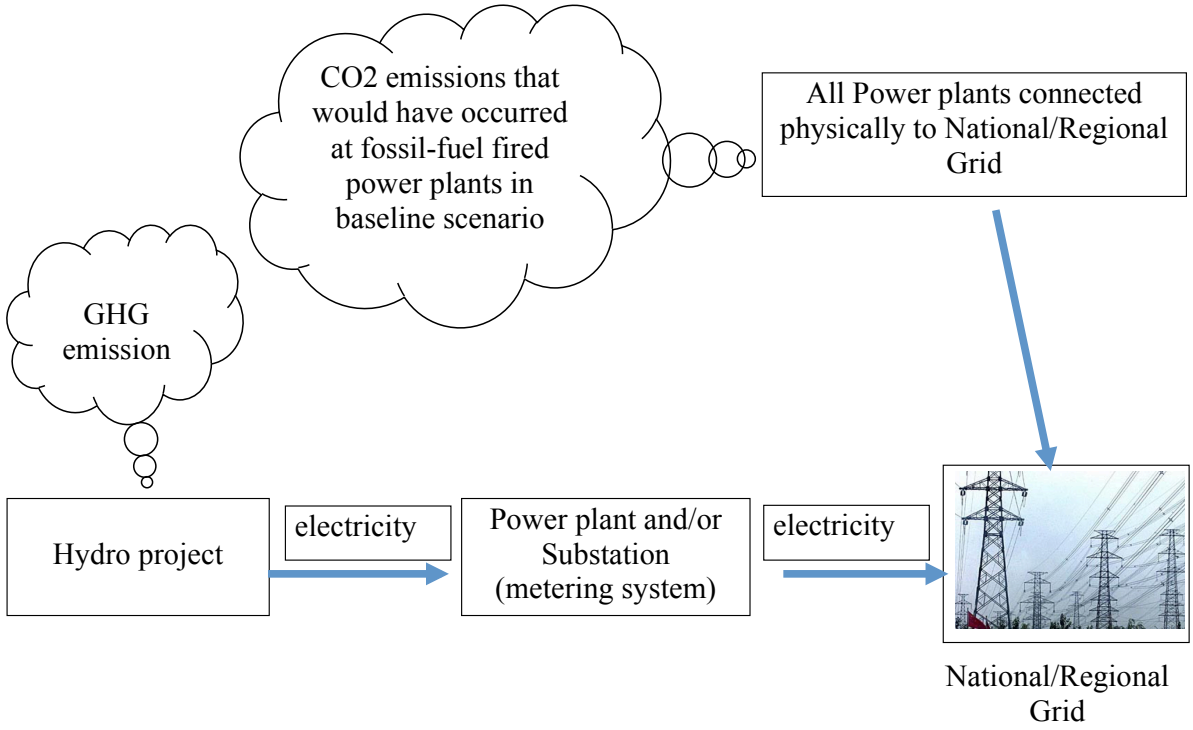
| | |
|---|---|
| This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects) | This tool is applicable because the CPA is a hydropower project activity which supplies the electricity to the National grid system. |
| In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country. | The project electricity system is located within Rwanda, which is not an Annex I country. |

### B.3. Sources and GHGs

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | No | Not applicable. The CPA is a hydro power project. |
| | | CH4 | No | Not applicable. The CPA is a hydro power project. |
| | | N2O | No | Not applicable. The CPA is a hydro power project. |
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CO2 | No | Not applicable. The CPA is a hydro power project. |
| | | CH4 | No | Not applicable. The CPA is a hydro power project. |
| | | N2O | No | Not applicable. The CPA is a hydro power project. |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Minor emission source |
| | | CH4 | Yes | It is included if the power density of the CPA is between 4W/m2 and 10 W/m2. |
| | | N2O | No | Minor emission source |

**Flow chart of the equipment, systems and flows of mass and energy included in the project boundary as well as the monitoring variables for the CPA.**




## B.4. Description of baseline scenario

>> The project activity is the installation of a Greenfield power plant. According to ACM0002, the baseline scenario of the project is:

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

## B.5. Demonstration of eligibility for a generic CPA

>> General Criteria

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of large scale projects will be above 15 MW. All project activities will meet the criteria of the applied methodology(ies). | Yes | The CPA is a hydro power project with installed capacity above 15 MW.<br>The CPA entity provides evidence to prove:<br>Specifications of technology/measure testing/certifications;<br>total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>Detailed Project Report |

| | | |
|---|---|---|
| | | Technology Specification provided by the technology supplier<br>Purchase order copies<br>Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA.The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power project. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity.The procedure to avoid double counting is further explained in Section C of this document. | Yes | Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA" dd/mm/yyyy" is on or after the start date of the PoA"06/05/2013". | Yes | The earliest date of the equipments contracts and construction start is "DD/MM/YYYY", so the start date of the CPA is "DD/MM/YYYY", which is after the start date of the PoA "06/05/2013". |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | Yes | The CPA is a grid-connected project and the electricity will be exported to the grid, as described in the power purchase agreement and/or other available equivalent documents. |
| 8. If Environmental Impact Assessmentis required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | Environmental Impact Assesment has been done on "DD/MM/YYYY". |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on "DD/MM/YYYY" |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance, is separate | Yes | Confirmation letter from CPA entity, in cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance, is separate from, and |

| | | |
|---|---|---|
| from, and is not counted towards the financial obligations of those Parties. | | is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0; AMS-I.D. version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of ACM0002 version 15.0.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | The power density of the CPA is calculated to be " XXXX ", which is greater than 4 W/m2, as described in the Feasibility study report (FSR) or other relevant documents. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Large scale CPA criteria:
The CPA is a large scale project activity, and additionality will be demonstrated as per "Tool for the demonstration and assessment of additionality "version 07.0. the following criteria shall be satisfied:

| | | |
|---|---|---|
| 1. The CPA shall comply with the applicability conditions of ACM0002 version15.0. | | Feasibility study report, or grid connection approval, general project information material such as internal memos or exchanges with a financing institution, or other relevant project documents |
| 2. The CPA is additional in accordance with the "Tool for the demonstration and assessment of additionality" version 7.0.0.<br>When investment analysis is used for the demonstration of additionality option (i) of paragraph 13 (a) of the Standard "Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of Activities"_eb74_repan 05 EB 74 Annex 5 will be applicable.<br>The benchmark analysis as per "Tool for the demonstration and assessment of additionality" version 7.0.0 will be used to conduct the investment analysis.<br>The following parameters are defined by CME for the investment analysis.<br>IRR calculation parameters: | | Calculation of financial indicators in line with the "Guidelines on the assessment of investment analysis" or evidence to demonstrate the barrier analysis and first of its kind analysis etc. |
| Parameter | Unit | Source |
| Electricity generation | MWh | (Pre-) Feasibility Study Report (FSR), Power Purchase Agreement) PPA |

| | | |
|---|---|---|
| Total investment | USD | Quotation, or Engineering and Procurement Contract (EPC) |
| Energy price | USD/MWh | PPA, or nationally published tariffs, or external tariffs estimation |
| Power price | USD/MW | PPA, or nationally published tariffs, or external tariffs estimation |
| Installed capacity | MW | (Pre-) FSR |
| Load factor | % | (Pre-) FSR |
| Transmission costs | USD/MWh, or USD/Year | (Pre-) FSR, or external report |
| O&M (fixed and variable) | USD/Year | Quotation, or estimated standard value on the market |
| Applicable Taxe(s) | USD/Year | Local tax laws |
| Insurance | USD/Year | Quotation, or estimated standard value on the market |
| Technical lifetime of equipment | # of Years | Manufacturer spec, or external source/spec/study |
| Exchange Rate | RWF/USD | Exchange rate as per date of investment |
| Residual value | USD | Calculated as per local accounting regulations, or international best practice |

Additional parameters might be additionally defined and used if applicable in case of specific CPA. All values used must be valid at the time of investment decision-making.

| Benchmark: | | |
|---|---|---|
| Benchmark | Value | Source |
| Commercial lending rate | % | Standard parameters in the market appropriate to the project activity and a project IRR calculation, sourced from:<br>Central bank, private banks, or other private institutions. |
| Weighted average costs of capital (WACC) | % | Standard parameters in the market appropriate to the project activity and a project IRR calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of "Guideline on the Assessment of Investment Analysis", or<br>b) Calculated using the best financial practices:<br>Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Required expected return on equity | % | Standard parameters in the market appropriate to the project activity and equity IRR calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of "Guideline on the Assessment of Investment Analysis", or<br>b) Calculated using the best financial practices: |

| | | |
|---|---|---|
| | | Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Benchmarks supplied by relevant national authorities | % | Standard parameters in the market applicable to the project activity and the type of IRR calculation supplied from:<br>Government bond rates, or other relevant national authority. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1. Explanation of methodological choices

>> Baseline emissions

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

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

Where,

$BE_y$ is the baseline emissions in year y ($tCO_2$/yr);

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

$EF_{grid,CM,y}$ is the combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2$/MWh).

Calculation of $EG_{PJ,y}$

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Where,

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

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

$EG_{facility,y}$ is the quantity of net electricity generation supplied by the project plant/unit to the grid. It shall be determined as a difference between (i) quantity of electricity supplied by the project plant/unit to the grid and quantity of electricity delivered to the project plant/unit from the grid.

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009: http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=
Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation: http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy
It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer completeutility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$). The emission factor is calculated based on the official data which is published by Rwanda DNA: **http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=.**

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".

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

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2/yr$)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e/yr$)

The CPA is a hydro power project, and there is no fossil fuel involved in the project, so $PE_{FF,y}$ and $PE_{GP,y}$ are zero. As per the methodology, the power density of the CPA is "XXXX", which is greater than 10W/m2, hence the $PE_{HP,y}$ is zero. Therefore, the $PE_y$ of the CPA is zero.

Or

If the power density of the CPA is less than 10W/m2 and greater than 4W/m2, then the $PE_{HP,y}$ is calculated as below:

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

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs ($tCO_2e/yr$)

$EF_{Res}$ = Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$)

$TEG_y$ = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

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

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

Where:

$PD$ = Power density of the project activity (W/m$^2$)

$Cap_{PJ}$ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

$Cap_{BL}$ = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

$A_{PJ}$ = Area of the 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

Leakage

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

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2/yr$)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

B.6.2. Data and parameters fixed ex-ante

>>

| **Data / Parameter:** | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | This value is determined and fixed ex-ante for the first crediting period. |

| **Data / Parameter:** | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |

| | |
|---|---|
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | This value is determined and fixed ex-ante for the first crediting period. |

| **Data / Parameter:** | $EF_{grid,CM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7044 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | This value is determined and fixed ex-ante for the first crediting period. |

| **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: | 0 |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| 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 ($m^2$). For new reservoirs, this value is zero |
| Source of data: | Project site |
| Value(s) applied: | 0, and it will be measured at CPA level. |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - |

### B.6.3. Ex-ante calculations of emission reductions

>> Project emissions

For large scalehydropower CPAs, project emissions are accounted for as follows:

$PE_y=PE_{FF,y}+PE_{GD.y}+PE_{HP,y}$
Where:
$PE_y$ is project emissions in year y ($tCO_2$/yr);
$PE_{FF,y}$ is the project emission from fossil fuel consumption in year y ($tCO_2$/yr);
$PE_{GD,y}$ is the project emissions from operation of geothermal power plants due to the release of non-condensable gases in year y ($tCO_2$/yr);
$PE_{HP,y}$ is the project emissions from water reservoirs of hydropower plants in year y ($tCO_2$/yr).
Therefore, for a new hydropower project, the project emission should be: $PE_y = PE_{HP,y}$.
According to ACM0002, the power density of the project is calculated as follows:

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

Where:
$Cap_{PJ}$ is the installed capacity of the hydropower plant after the implementation of the project activity (W);
$Cap_{BL}$ is the installed capacity of the hydropower plant before the implementation of the project activity (W); because the project results a new hydropower station, the $Cap_{BL}$ of the project is zero.
$A_{PJ}$ is the area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full ($m^2$).
$A_{BL}$ is the area of the reservoir measured in the surface of the water, before the implementation of the project activity, the $A_{BL}$ of the project is zero.
If the power density of the single or multiple reservoirs (PD) is greater than 4W/$m^2$ and less than or equal to 10 W/$m^2$
$PE_{HP,y}=EF_{Res}*TEG_y/1000$
Where:
$PE_{HP,y}$ = Project emissions from water reservoirs (tCO2e/yr)
$EF_{Res}$ = Default emission factor for emissions from reservoirs of hydro power plants in year y ($kgCO_2e$/MWh)
$TEG_y$ = total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y(MWh)
If the power density of the project activity (PD) is greater than 10W/$m^2$
$PE_{HP,y}=0$

Baseline emissions
The baseline emissions are to be calculated as follows:

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

Where,
$BE_y$ is the baseline emissions in year y ($tCO_2$/yr);
$EG_{PJ,y}$ is the quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr);
$EF_{grid,CM,y}$ is the combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2$/MWh). According to Rwanda DNA, the value is 0.7044 tCO2e/MWh.

If the CPA is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Leakage
According to ACM0002, no leakage emissions are considered for large scale CPAs.
Emission Reductions
The emission reductions $ER_y$ by the project activity during a given year y calculation is as follows:

$$ER_y = BE_y - PE_y$$

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

### B.7.1. Data and parameters to be monitored by each generic CPA

| **Data / Parameter:** | $EG_{facility,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |
| Measurement methods and procedures: | This parameter will be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid.<br>In case it is calculated then the following parameters will be measured:<br>The quantity of electricity supplied by the project plant/unit to the grid; and<br>(b) The quantity of electricity delivered to the project plant/unit from the grid.<br><br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and at least recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | - |

| **Data / Parameter:** | TEGy |
|---|---|
| Data unit: | MWh/yr |
| Description: | Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y |
| Source of data: | Project activity site |
| Value(s) applied | "XXXXXX" |
| Measurement methods and procedures: | Electricity meters<br><br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Continuous measurement and at least monthly recording |

| | |
|---|---|
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2. |

| **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 site |
| Value(s) applied | "XXXX" |
| Measurement methods and procedures: | Determine the installed capacity based on manufacturer's specifications or commissioning data or recognized standards |
| Monitoring frequency: | Once at the beginning of each crediting period. |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - |

| **Data / Parameter:** | **$A_{PJ}$** |
|---|---|
| Data unit: | m2 |
| Description: | Area of the single or run-of-river 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 | "XXXX" |
| Measurement methods and procedures: | Measure from topographical surveys, maps, satellite pictures, etc. |
| Monitoring frequency: | Once at the beginning of each crediting period |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - |

### B.7.2. Description of the monitoring plan for a generic CPA

>> In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

The installed capacity and surface area of reservoir will be monitored by the CPA implementing entity, and the result of the power density will be reported to the CME within three months after the commissioning of the CPA.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*
Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

**Case 2: Large scale solar project in Rwanda**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

**>>**

The component project activity is the installation of a grid-connected large scale solar power plant with the capacity of "XXX MW". The CPA is located in "XXX (location)" by "XXX (CPA implementing entity)".
The CPA will generate electricity, and the electricity will be fed into the Rwanda electricity grid or be supplied to identified consumer facilities via national/regional grid through a contractual arrangement such as wheeling. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.
The CPA will be implemented under the PoA "Renewable Energy CDM Programme of Rwanda (RECPR) " with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

### B.1. Application of a baseline and monitoring methodology and standardized baseline

>>
ACM0002 version 15.0: Grid-connected electricity generation from renewable sources.

The methodology ACM0002 also refers to the latest approved versions of the following tools:

- "Tool to calculate the emission factor for an electricity system"(Version 4.0);
- "Tool for the demonstration and assessment of additionality" (Version 7.0);

### B.2. Applicability of methodology(ies) and standardized baseline(s)

| Applicability criteria | Project activity |
|---|---|
| 1. The methodology is applicable to grid-connected renewable power generation project activities that: (a) install a Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s);(c) involve a retrofit of (an) existing operating plant(s)/units; or (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) involve a replacement of (an) existing plant(s)/unit(s). | The CPA is to install a new grid-connected solar power plant at a site where no solar power plant was operated prior to the implementation of the project activity. |
| 2. The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; | The CPA is the installation of a solar power plant. |
| 3. In the case of capacity additions, retrofits, rehabilitation or replacements (except for wind, solar wave or tidal power capacity addition projects): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant has been undertaken between the start of this minimum historical | Not applicable. The CPA is the installation of a new solar power plant. |

| | |
|---|---|
| reference period and the implementation of the project activity. | |
| 4. In case of hydro power plants one of the following conditions must apply:<br>• The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or<br>• The project activity is implemented in an existing single or multiple reservoirs, where the volume of of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2; or<br>• The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2; or<br>• The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3),is lower than or equal to 4 W/m2, all of the following conditions shall apply:<br>– The power density calculated using the total installed capacity of the integrated project, as per equation (4),is greater than 4 W/m2;<br>– (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br>– (iii) Installed capacity of the power plant(s) with power densitylower than or equal to 4 W/m2 shall be:<br>a. Lower than or equal to 15 MW; and<br>b. Less than 10 per cent of the total installed capacity of integrated hydro power project. | Not applicable. The CPA is the installation of a new solar power plant. |
| 5. In the case of integrated hydro power projects, project proponent shall:<br>• Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or<br>• Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM | Not applicable. The CPA is the installation of a new solar power plant. |

| | |
|---|---|
| project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity. | |
| 6. The methodology is not applicable to the following:<br>• Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;<br>• Biomass fired power plants; | Not applicable. The CPA is the installation of a new solar power plant. |

In addition, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system"(Version 4.0).

| | |
|---|---|
| This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects) | This tool is applicable because the CPA is a solar power project activity which supplies the electricity to the National grid system. |
| In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country. | The project electricity system is located within Rwanda, which is not an Annex I country. |

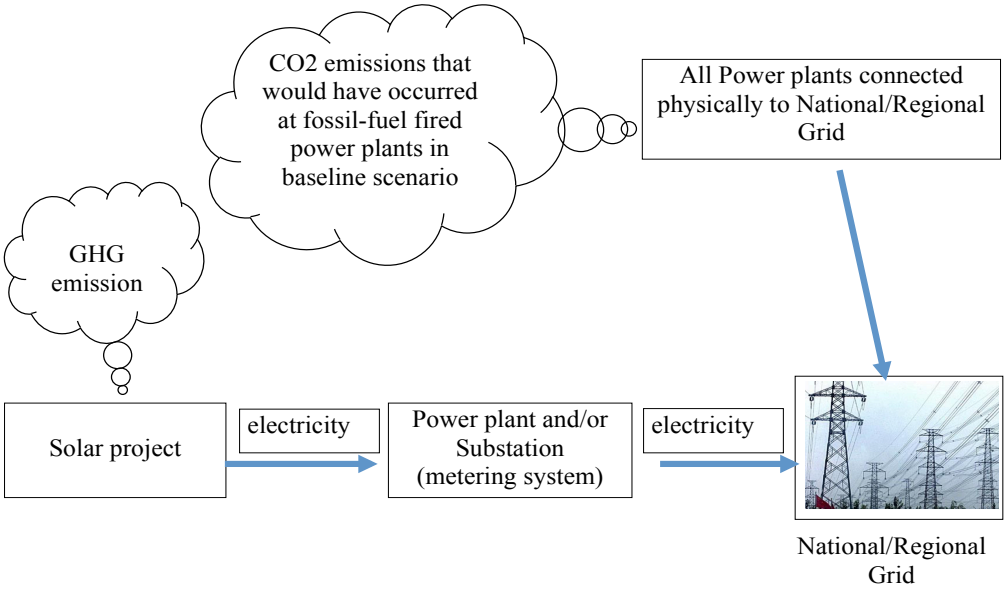
### B.3. Sources and GHGs

As per ACM0002, the spatial extent of the project boundary in the CPA project activity includes the project power plant and all power plants connected physically to the National grid system.
The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | No | Not applicable. The CPA is a solar power project. |
| | | CH4 | No | Not applicable. The CPA is a solar power project. |
| | | N2O | No | Not applicable. The CPA is a solar power project. |
| | CO2 emissions from combustion of fossil fuels for electricity generation in | CO2 | No | Not applicable. The CPA is a solar PV power project. |

| | | | | |
|---|---|---|---|---|
| | solar thermal power plants and geothermal power plants | CH4 | No | Not applicable. The CPA is a solar PV power project. |
| | | N2O | No | Not applicable. The CPA is a solar PVpower project. |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Not applicable. The CPA is a solar power project. |
| | | CH4 | No | Not applicable. The CPA is a solar power project. |
| | | N2O | No | Not applicable. The CPA is a solar power project. |

**Flow chart of the equipment, systems and flows of mass and energy included in the project boundary as well as the monitoring variables for the CPA.**




## B.4. Description of baseline scenario

The project activity is grid connected electricity generation from renewable source, and all the electricity generation will be transmitted to the grid. According to ACM0002, the baseline scenario of the project is:

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

## B.5. Demonstration of eligibility for a generic CPA.

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of | Yes | The CPA is a Solar PV power project with installed capacity above 15 MW.<br>The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• Testing/certifications;<br>Total capacity of each CPA will not |

| | | |
|---|---|---|
| the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | | exceed applied methodology specifications.<br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power plant. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA“dd/mm/yyyy” is on or after the start date of the PoA“06/05/2013”. | Yes | The earliest date of the equipments contracts and construction start is “DD/MM/YYYY”, so the start date of the CPA is “DD/MM/YYYY”, which is after the start date of the PoA “06/05/2013”. |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | Yes | The CPA is a grid-connected project and the electricity will be exported to the grid, as described in the power purchase agreement and/or other available equivalent documents. |
| 8. If Environmental Impact Assessmentis required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | If applicable, environmental Impact Assessment has been done on “DD/MM/YYYY”. |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on “DD/MM/YYYY” |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance.In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an |

| | | |
|---|---|---|
| entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | | affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of ACM0002 version 15.0.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | No applicable. The CPA is a solar PV project. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Large scale CPA criteria:

The CPA is a large scale project activity, and additionality will be demonstrated as per “Tool for the demonstration and assessment of additionality ”version 07.0. the following criteria shall be satisfied:

| | | |
|---|---|---|
| 1. The CPA shall comply with the applicability conditions of ACM0002 version15.0. | | Feasibility study report, or grid connection approval, general project information material such as internal memos or exchanges with a financing institution, or other relevant project documents |
| 2. The CPA is additional in accordance with the “Tool for the demonstration and assessment of additionality” version 7.0.0.<br>When investment analysis is used for the demonstration of additionality option (i) of paragraph 13 (a) of the Standard “Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of Activities”_eb74_repan 05 EB 74 Annex 5 will be applicable.<br>The benchmark analysis as per “Tool for the demonstration and assessment of additionality” version 7.0.0 will be used to conduct the investment analysis.<br>The following parameters are defined by CME for the investment analysis.<br>IRR calculation parameters: | | Calculation of financial indicators in line with the “Guidelines on the assessment of investment analysis” or evidence to demonstrate the barrier analysis and first of its kind analysis etc. |
| Parameter | Unit | Source |

| | | |
|---|---|---|
| Electricity generation | MWh | (Pre-) Feasibility Study Report (FSR), Power Purchase Agreement) PPA |
| Total investment | USD | Quotation, or Engineering and Procurement Contract (EPC) |
| Energy price | USD/MWh | PPA, or nationally published tariffs, or external tariffs estimation |
| Power price | USD/MW | PPA, or nationally published tariffs, or external tariffs estimation |
| Installed capacity | MW | (Pre-) FSR |
| Load factor | % | (Pre-) FSR |
| Transmission costs | USD/MWh, or USD/Year | (Pre-) FSR, or external report |
| O&M (fixed and variable) | USD/Year | Quotation, or estimated standard value on the market |
| Applicable Taxe(s) | USD/Year | Local tax laws |
| Insurance | USD/Year | Quotation, or estimated standard value on the market |
| Technical lifetime of equipment | # of Years | Manufacturer spec, or external source/spec/study |
| Exchange Rate | RWF/USD | Exchange rate as per date of investment |
| Residual value | USD | Calculated as per local accounting regulations, or international best practice |
| Additional parameters might be additionally defined and used if applicable in case of specific CPA. All values used must be valid at the time of investment decision-making. | | |
| Benchmark: | | |
| Benchmark | Value | Source |
| Commercial lending rate | % | Standard parameters in the market appropriate to the project activity and a project IRR calculation, sourced from:<br>Central bank, private banks, or other private institutions. |
| Weighted average costs of capital (WACC) | % | Standard parameters in the market appropriate to the project activity and a project IRR calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of “Guideline on the Assessment of Investment Analysis”, or<br>b) Calculated using the best financial practices:<br>Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Required expected return on equity | % | Standard parameters in the market appropriate to the project activity and equity IRR calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of “Guideline on the Assessment of Investment Analysis”, or<br>b) Calculated using the best financial practices: |

| | | |
|---|---|---|
| | | Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Benchmarks supplied by relevant national authorities | % | Standard parameters in the market applicable to the project activity and the type of IRR calculation supplied from:<br>Government bond rates, or other relevant national authority. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

Baseline emissions

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

$$\mathrm{BE}_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

Where,

$\mathrm{BE}_y$ is the baseline emissions in year y ($tCO_2$/yr);

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

$\mathrm{EF}_{grid,CM,y}$ is the combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2$/MWh).

Calculation of $EG_{PJ,y}$

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Where,

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

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

$EG_{facility,y}$ is the quantity of net electricity generation supplied by the project plant/unit to the grid. It shall be determined as a difference between (i) quantity of electricity supplied by the project plant/unit to the grid and quantity of electricity delivered to the project plant/unit from the grid.

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009: http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=
Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation: http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy
It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer completeutility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$). The emission factor is calculated based on the official data which is published by Rwanda DNA: **http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=.**

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".

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

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2/yr$)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e/yr$)

The CPA is a hydro power project, and there is no fossil fuel involved in the project, so $PE_{FF,y}$ and $PE_{GP,y}$ are zero. As per the methodology, the power density of the CPA is "XXXX", which is greater than 10W/m2, hence the $PE_{HP,y}$ is zero. Therefore, the $PE_y$ of the CPA is zero.

Or

If the power density of the CPA is less than 10W/m2 and greater than 4W/m2, then the $PE_{HP,y}$ is calculated as below:

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

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs ($tCO_2e/yr$)

$EF_{Res}$ = Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$)

$TEG_y$ = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

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

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

Where:

$PD$ = Power density of the project activity (W/m$^2$)

$Cap_{PJ}$ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

$Cap_{BL}$ = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

$A_{PJ}$ = Area of the 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

Leakage

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

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2/yr$)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

### B.6.2. Data and parameters that are to be reported ex-ante

>>

| **Data / Parameter:** | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | This value is determined and fixed ex-ante for the first crediting period. |

| **Data / Parameter:** | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |

| | |
|---|---|
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | This value is determined and fixed ex-ante for the first crediting period. |

| **Data / Parameter:** | $EF_{grid,CM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7044 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | This value is determined and fixed ex-ante for the first crediting period. |

| **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: | 0 |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| 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 ($m^2$). For new reservoirs, this value is zero |
| Source of data: | Project site |
| Value(s) applied: | 0, and it will be measured at CPA level. |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - |

### B.6.3. Ex-ante calculations of emission reductions

>>

Project emissions

For large scalehydropower CPAs, project emissions are accounted for as follows:

$PE_y=PE_{FF,y}+PE_{GD,y}+PE_{HP,y}$
Where:
$PE_y$ is project emissions in year y ($tCO_2$/yr);
$PE_{FF,y}$ is the project emission from fossil fuel consumption in year y ($tCO_2$/yr);
$PE_{GD,y}$ is the project emissions from operation of geothermal power plants due to the release of non-condensable gases in year y ($tCO_2$/yr);
$PE_{HP,y}$ is the project emissions from water reservoirs of hydropower plants in year y ($tCO_2$/yr).
Therefore, for a new hydropower project, the project emission should be: $PE_y = PE_{HP,y}$.
According to ACM0002, the power density of the project is calculated as follows:

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

Where:
$Cap_{PJ}$ is the installed capacity of the hydropower plant after the implementation of the project activity (W);
$Cap_{BL}$ is the installed capacity of the hydropower plant before the implementation of the project activity (W); because the project results a new hydropower station, the $Cap_{BL}$ of the project is zero.
$A_{PJ}$ is the area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full ($m^2$).
$A_{BL}$ is the area of the reservoir measured in the surface of the water, before the implementation of the project activity, the $A_{BL}$ of the project is zero.
If the power density of the single or multiple reservoirs (PD) is greater than 4W/$m^2$ and less than or equal to 10 W/$m^2$
$PE_{HP,y}=EF_{Res}*TEG_y/1000$
Where:
$PE_{HP,y}$ = Project emissions from water reservoirs (tCO2e/yr)
$EF_{Res}$ = Default emission factor for emissions from reservoirs of hydro power plants in year y ($kgCO_2e$/MWh)
$TEG_y$ = total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y(MWh)
If the power density of the project activity (PD) is greater than 10W/$m^2$
$PE_{HP,y}=0$

Baseline emissions
The baseline emissions are to be calculated as follows:

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

Where,
$BE_y$ is the baseline emissions in year y ($tCO_2$/yr);
$EG_{PJ,y}$ is the quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr);
$EF_{grid,CM,y}$ is the combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” ($tCO_2$/MWh). According to Rwanda DNA, the value is 0.7044 tCO2e/MWh.

If the CPA is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Leakage
According to ACM0002, no leakage emissions are considered for large scale CPAs.
Emission Reductions
The emission reductions $ER_y$ by the project activity during a given year y calculation is as follows:

$$ER_y = BE_y - PE_y$$

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

| **Data / Parameter:** | $EG_{facility,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |
| Measurement methods and procedures: | This parameter will be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid.<br>In case it is calculated then the following parameters will be measured:<br>The quantity of electricity supplied by the project plant/unit to the grid; and<br>(b) The quantity of electricity delivered to the project plant/unit from the grid.<br><br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and at least recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | - |

| **Data / Parameter:** | TEGy |
|---|---|
| Data unit: | MWh/yr |
| Description: | Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y |
| Source of data: | Project activity site |
| Value(s) applied | "XXXXXX" |
| Measurement methods and procedures: | Electricity meters<br><br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Continuous measurement and at least monthly recording |
| QA/QC procedures: | - |

| | |
|---|---|
| Purpose of data | Calculate the power density |
| Additional comment: | Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2. |

| **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 site |
| Value(s) applied | "XXXX" |
| Measurement methods and procedures: | Determine the installed capacity based on manufacturer's specifications or commissioning data or recognized standards |
| Monitoring frequency: | Once at the beginning of each crediting period. |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - |

| **Data / Parameter:** | **$A_{PJ}$** |
|---|---|
| Data unit: | m2 |
| Description: | Area of the single or run-of-river 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 | "XXXX" |
| Measurement methods and procedures: | Measure from topographical surveys, maps, satellite pictures, etc. |
| Monitoring frequency: | Once at the beginning of each crediting period |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - |

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible,transparent and adequate data measurement, collection, estimation, and tracking systems. The followingmonitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

The installed capacity and surface area of reservoir will be monitored by the CPA implementing entity, and the result of the power density will be reported to the CME within three months after the commissioning of the CPA.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*
Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period

**Case 3: Large scale geothermal project in Rwanda**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>>The component project activity is the installation of a grid-connected large scale geothermal power plant with the capacity of "XXX MW". The CPA is located in "XXX (location)" by "XXX (CPA implementing entity)".
The CPA will generate electricity, and the electricity will be fed into the Rwanda electricity grid or be supplied to identified consumer facilities via national/regional grid through a contractual arrangement such as wheeling. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.
The CPA will be implemented under the PoA "Renewable Energy CDM Programme of Rwanda (RECPR) " with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

### B.1. Reference of methodology(ies) and standardized baseline(s)

>>ACM0002 version 15.0: Grid-connected electricity generation from renewable sources.

The methodology ACM0002 also refers to the latest approved versions of the following tools:

- "Tool to calculate the emission factor for an electricity system"(Version 4.0);
- "Tool for the demonstration and assessment of additionality" (Version 7.0);
- "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (version 02)

### B.2. Applicability of methodology(ies) and standardized baseline(s)

| Applicability criteria | Project activity |
|---|---|
| 1. The methodology is applicable to grid-connected renewable power generation project activities that: (a) install a Greenfield power plant; (b) involve a capacity addition to (an) existing plant(s);(c) involve a retrofit of (an ) existing operating plant(s)/units; or (d) involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) involve a replacement of (an) existing plant(s)/unit(s). | The CPA is to install a new grid-connected geothermal power plant at a site where no hydro power plant was operated prior to the implementation of the project activity. |
| 2. The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; | The CPA is the installation of a geothermal power plant. |
| 3. In the case of capacity additions, retrofits, rehabilitation or replacements (except for wind, solar wave or tidal power capacity addition projects): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the | Not applicable. The CPA is the installation of a new geothermal power plant. |

| | |
|---|---|
| baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity. | |
| 4. In case of hydro power plants one of the following conditions must apply:<br>• The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or<br>• The project activity is implemented in an existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m2; or<br>• The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m2; or<br>• The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3),is lower than or equal to 4 W/m2, all of the following conditions shall apply:<br>– The power density calculated using the total installed capacity of the integrated project, as per equation (4),is greater than 4 W/m2;<br>– (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;<br>– (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be:<br>a. Lower than or equal to 15 MW; and<br>b. Less than 10 per cent of the total installed capacity of integrated hydro power project. | Not applicable. The CPA is the installation of a new geothermal power plant. |
| 5. In the case of integrated hydro power projects, project proponent shall:<br>• Demonstrate that water flow from upstream power plants/unitsspill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or<br>• Provide an analysis of the water balance covering the water fed to power units, with all possible | Not applicable. The CPA is the installation of a new geothermal power plant. |

| | |
|---|---|
| combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity. | |
| 6. The methodology is not applicable to the following:<br>• Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;<br>• Biomass fired power plants; | Not applicable. The CPA is the installation of a new geothermal power plant. |

In addition, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system"(Version 4.0).

| | |
|---|---|
| 1. This tool may be applied to estimate the OM,BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects) | This tool is applicable because the CPA is a geothermal power project activity which supplies the electricity to the National grid system. |
| 2. In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country. | The project electricity system is located within Rwanda, which is not an Annex I country. |

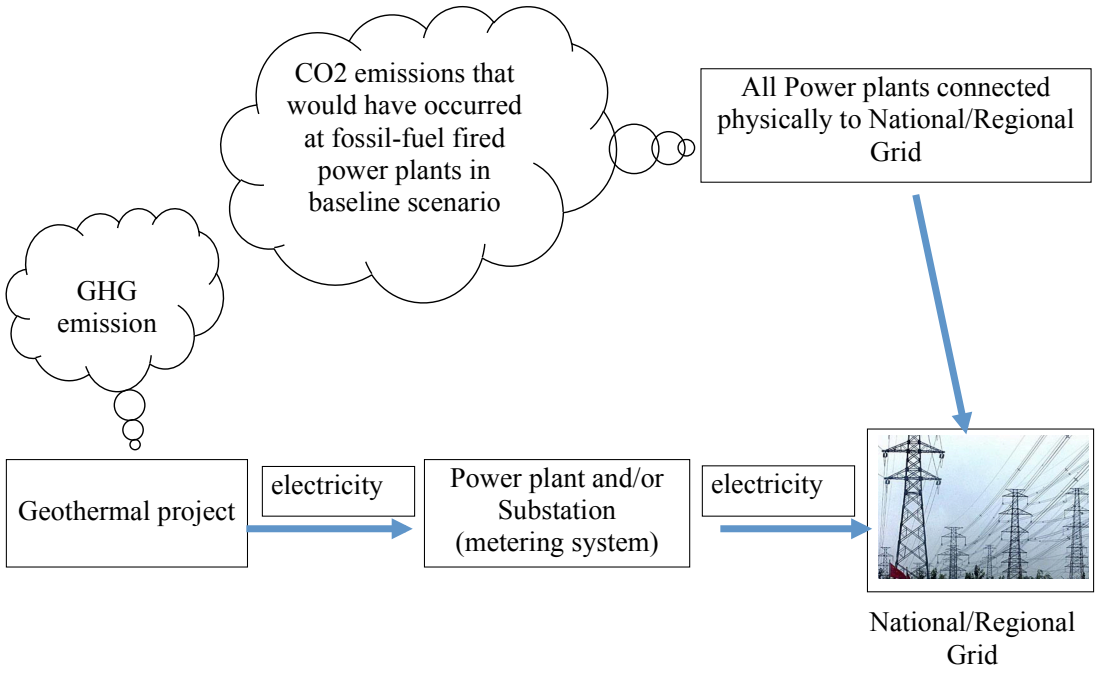
### B.3. Sources and GHGs

As per ACM0002, the spatial extent of the project boundary in the CPA project activity includes the project power plant and all power plants connected physically to the National grid system.
The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non- | CO2 | Yes | Main emission source |
| | | CH4 | Yes | Main emission source |

| | | | | |
|---|---|---|---|---|
| | condensable gases contained in geothermal steam | N2O | No | Minor emission source |
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Not applicable. The CPA is a geothermal power project. |
| | | CH4 | No | Not applicable. The CPA is a geothermal power project. |
| | | N2O | No | Not applicable. The CPA is a geothermal power project. |

**Flow chart of the equipment, systems and flows of mass and energy included in the project boundary as well as the monitoring variables for the CPA.**




## B.4. Description of baseline scenario

The project activity is grid connected electricity generation from renewable source, and all the electricity generation will be transmitted to the grid. According to ACM0002, the baseline scenario of the project is:

Electricity delivered to the grid by the project activity would have otherwise been generated by the existing grid-connected power plant and the addition of new power sources, as reflected in the combined margin ( $EF_{grid,CM,y}$ ) calculations described in the "Tool to calculate the emission factor for an electricity system"

## B.5. Demonstration of eligibility for a generic CPA

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or | Yes | The CPA is a geothermal power project with installed capacity above 15 MW. |

| | | |
|---|---|---|
| geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | | The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• Testing/certifications;<br>Total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power plant. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA“dd/mm/yyyy” is on or after the start date of the PoA“06/05/2013”. | Yes | The earliest date of the equipment’s contracts and construction start is “DD/MM/YYYY”, so the start date of the CPA is “DD/MM/YYYY”, which is after the start date of the PoA “06/05/2013”. |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | Yes | The CPA is a grid-connected project and the electricity will be exported to the grid. |
| 8. If Environmental Impact Assessmentis | Yes | If applicable, environmental |

| | | |
|---|---|---|
| required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | | Impact Assessment has been done on “DD/MM/YYYY”. |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on “DD/MM/YYYY” |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance.In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance.In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of ACM0002 version 15.0.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | No applicable. The CPA is a geothermal project. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Large scale CPA criteria:

The CPA is a large scale project activity, and additionality will be demonstrated as per “Tool for the demonstration and assessment of additionality ”version 7.0. the following criteria shall be satisfied:

| | |
|---|---|
| 1. The CPA shall comply with the applicability conditions of ACM0002 version15.0. | Feasibility study report, or grid connection approval, general project information material such as internal memos or exchanges with a financing institution, or other relevant project documents |

| | | |
|---|---|---|
| 2. The CPA is additional in accordance with the "Tool for the demonstration and assessment of additionality" version 7.0.0.<br>When investment analysis is used for the demonstration of additionality option (i) of paragraph 13 (a) of the Standard "Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of Activities"_eb74_repan 05 EB 74 Annex 5 will be applicable.<br>The benchmark analysis as per "Tool for the demonstration and assessment of additionality" version 7.0.0 will be used to conduct the investment analysis.<br>The following parameters are defined by CME for the investment analysis.<br>IRR calculation parameters: | | Calculation of financial indicators in line with the "Guidelines on the assessment of investment analysis" or evidence to demonstrate the barrier analysis and first of its kind analysis etc. |
| Parameter | Unit | Source |
| Electricity generation | MWh | Pre-Feasibility Study Report Pre-FSR; FSR, Power Purchase Agreement) PPA |
| Total investment | USD | Quotation, or Engineering and Procurement Contract (EPC) |
| Energy price | USD/MWh | PPA, or nationally published tariffs, or external tariffs estimation |
| Power price | USD/MW | PPA, or nationally published tariffs, or external tariffs estimation |
| Installed capacity | MW | Pre-FSR; FSR |
| Load factor | % | Pre-FSR; FSR |
| Transmission costs | USD/MWh, or USD/Year | Pre-FSR; FSR, or external report |
| O&M (fixed and variable) | USD/Year | Quotation, or estimated standard value on the market |
| Applicable Taxe(s) | USD/Year | Local tax laws |
| Insurance | USD/Year | Quotation, or estimated standard value on the market |
| Technical lifetime of equipment | # of Years | Manufacturer spec, or external source/spec/study |
| Exchange Rate | RWF/USD | Exchange rate as per date of investment |
| Residual value | USD | Calculated as per local accounting regulations, or international best practice |
| Additional parameters might be additionally defined and used if applicable in case of specific CPA. All values used must be valid at the time of investment decision-making. | | |
| Benchmark: | | |
| Benchmark | Value | Source |
| Commercial lending rate | % | Standard parameters in the market appropriate to the project activity and a project IRR calculation, sourced from:<br>Central bank, private banks, or other private institutions. |
| Weighted average costs of capital (WACC) | % | Standard parameters in the market appropriate to the project activity and a project IRR |

| | | |
|---|---|---|
| | | calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of "Guideline on the Assessment of Investment Analysis", or<br>b) Calculated using the best financial practices:<br>Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Required expected return on equity | % | Standard parameters in the market appropriate to the project activity and equity IRR calculation.<br><br>Cost of equity determined by:<br><br>a) Values provided in Appendix A of "Guideline on the Assessment of Investment Analysis", or<br>b) Calculated using the best financial practices:<br>Dividend growth model, or<br>Capital Asset Pricing Model (CAPM) |
| Benchmarks supplied by relevant national authorities | % | Standard parameters in the market applicable to the project activity and the type of IRR calculation supplied from:<br>Government bond rates, or other relevant national authority. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

The project activity constitutes a new grid connected renewable energy based power generation plant/unit.

Baseline emissions

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

$$\mathrm{BE}_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$$

Where,

$\mathrm{BE}_y$ is the baseline emissions in year y ($tCO_2$/yr);

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

$\mathrm{EF}_{grid,CM,y}$ is the combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2$/MWh).

Calculation of $EG_{PJ,y}$

Since the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Where,

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

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

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy

It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).
The emission factor is calculated based on the official data which is published by Rwanda DNA: **http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=**

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".
Project emissions
For most renewable power generation project activities, $PE_y$= 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2$/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e$/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e$/yr)

*Fossil fuel combustion ($PE_{FF,y}$)*

For geothermal projects, which also use fossil fuels for electricity generation, $CO_2$ emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). The use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected.

$PE_{FF,y}$ shall be calculated as per the latest version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion".

As per "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" version 02, the $CO_2$ emissions from the combustion of fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,j,y}$ = Are the $CO_2$ emissions from fossil fuel combustion in process j during year y

$FC_{i,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);

$COEF_{i,y}$ = Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit);

i = Are the fuel types combusted in process j during the year y.

The $CO_2$ emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending
on the availability of data on the fossil fuel type i, as follows:

Option A: The $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type I, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = w_{C,i,y} \times 44/12$

If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{i,y} = w_{C,i,y} \times \rho_{i,y} \times 44/12$

Where:

$w_{C,i,y}$ = Is the weighted average mass fraction of carbon in fuel type I in year y (tC/mass unit of the fuel);

$\rho_{i,y}$ = Is the weighted average density of fuel type I in year y (mass unit/volume unit of the fuel).

Option B: The $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

$NCV_{i,y}$ = Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit);

$EF_{CO2,i,y}$ = Is the weighted average $CO_2$ emission factor of fuel type I in year y ($tCO_2$/GJ).

Option A should be the preferred approach, if the necessary data is available.

*Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)*

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam. Non-condensable gases in geothermal reservoirs usually consist mainly of $CO_2$ and $H_2S$. They also contain a small quantity of hydrocarbons, including predominantly $CH_4$. In geothermal power projects, non-condensable gases flow with the steam into the power plant. A small proportion of the $CO_2$ is converted to carbonate/bicarbonate in the cooling water circuit. In addition, parts of the non-condensable gases are reinjected into the geothermal reservoir. However, as a conservative approach, this methodology assumes that all non-condensable gases entering the power plant are discharged to atmosphere via the cooling tower. Fugitive carbon dioxide and methane emissions due to well testing and well bleeding are not considered, as they are negligible.

$PE_{GP,y}$ is calculated as follows:

$$PE_{GP,y} = \left(w_{steam,CO2,y} + w_{steam,CH4,y} * GWP_{CH4}\right) * M_{steam,y}$$

Where:

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$w_{steam,CO2,y}$ = Average mass fraction of carbon dioxide in the produced steam in year *y* ($tCO_2$/t steam)

$w_{steam,CH4,y}$ = Average mass fraction of methane in the produced steam in year *y* ($tCH_4$/t steam)

$GWP_{CH4}$ = Global warming potential of methane valid for the relevant commitment period($tCO_2e/tCH_4$)

$M_{steam,y}$ = Quantity of steam produced in year *y* (t steam/yr)

The CPA is a geothermal power project, then

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

Leakage

No leakage emissions are considered.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2$/yr)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

### B.6.2. Data and parameters that are to be reported ex-ante

| | |
|---|---|
| Data / Parameter: | $EF_{grid,OM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{grid,BM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | --This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{grid,CM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7044 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | - This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $GWP_{CH4}$ |
| Data unit: | $tCO_2e/tCH_4$ |
| Description: | Global warming potential of methane valid for the relevant commitment period |
| Source of data: | IPCC |
| Value(s) applied: | 25 |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | - |
| Additional comment: | - |

### B.6.3. Ex-ante calculations of emission reductions

>>

Project emissions

For large scale geothermal power CPAs, project emissions are accounted for as follows:

$PE_y=PE_{FF,y}+PE_{GD,y}$

Where:

$PE_y$ is project emissions in year y ($tCO_2$/yr);

$PE_{FF,y}$ is the project emission from fossil fuel consumption in year y ($tCO_2$/yr);

$PE_{GD,y}$ is the project emissions from operation of geothermal power plants due to the release of non-condensable gases in year y ($tCO_2$/yr);

Baseline emissions
The baseline emissions are to be calculated as follows:

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

Where,

$BE_y$ is the baseline emissions in year y ($tCO_2$/yr);

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

$EF_{grid,CM,y}$ is the combined margin $CO_2$ emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" ($tCO_2$/MWh).

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy

It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$). The emission factor is calculated based on the official data which is published by Rwanda DNA: **http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=**

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".

Calculation of $EG_{PJ,y}$

Since the CPA is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Where,

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

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

Leakage

According to ACM0002, no leakage emissions are considered for large scale CPAs.

Emission Reductions

The emission reductions $ER_y$ by the project activity during a given year y calculation is as follows:

$ER_y = BE_y - PE_y$ = XXXXXXX

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

### B.7.1. Data and parameters to be monitored by each generic CPA

| Data / Parameter: | $EG_{facility,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |
| Measurement methods and procedures: | This parameter will be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid.In case it is calculated then the following parameters will be measured:<br>The quantity of electricity supplied by the project plant/unit to the grid; and<br>(b) The quantity of electricity delivered to the project plant/unit from the grid<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | - |

| Data / Parameter: | $w_{steam,CO2,y}$ |
|---|---|
| Data unit: | $tCO_2$/t steam |
| Description: | Average mass fraction of carbon dioxide in the produced steam in year *y* |

| | |
|---|---|
| Source of data: | Project activity site |
| Value(s) applied | XXXXX |
| Measurement methods and procedures: | Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The $CO_2$ and $CH_4$ sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide ($H_2S$) and carbon dioxide ($CO_2$) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including $CH_4$. All alkanes concentrations are reported in terms of methane |
| Monitoring frequency: | At least every three months and more frequently, if necessary |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $w_{steam,CH4,y}$ |
| Data unit: | $tCH_4$/t steam |
| Description: | Average mass fraction of methane in the produced steam in year *y* |
| Source of data: | Project activity site |
| Value(s) applied | |
| Measurement methods and procedures: | As per the procedures outlined for $w_{steam,CO2,y}$ |
| Monitoring frequency: | As per the procedures outlined for $w_{steam,CO2,y}$ |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $M_{steam,y}$ |
| Data unit: | t steam/yr |
| Description: | Quantity of steam produced in year *y* |
| Source of data: | Project activity site |
| Value(s) applied | |
| Measurement methods and procedures: | The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports |
| Monitoring frequency: | Daily |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

As per ACM0002, the project emissions from fossil fuel consumption by geothermal project should be monitored in line with "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel

combustion". Below parameters are monitored for calculating the project emissions from fossil fuel consumption by geothermal project.

| | |
|---|---|
| Data / Parameter: | $FC_{i,j,y}$ |
| Data unit: | Mass or volume unit per year (e.g. ton/yr or $m^3$/yr) |
| Description: | Quantity of fuel type i combusted in process j during the year y |
| Source of data: | Onsite measurements |
| Value(s) applied | |
| Measurement methods and procedures: | • Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift);<br>• Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance;<br>• In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions. |
| Monitoring frequency: | Continuously |
| QA/QC procedures: | The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes.<br><br>Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $W_{C,i,y}$ |
| Data unit: | tC/mass unit of the fuel |
| Description: | Weighted average mass fraction of carbon in fuel type i in year y |
| Source of data: | The following data sources may be used if the relevant conditions apply:<br>Data source: Conditions for using the data source<br>Values provided by the fuel supplier in invoices: This is the preferred source<br>Measurements by the project participants: If a) is not available |
| Value(s) applied | |
| Measurement methods and procedures: | Measurements should be undertaken in line with national or international fuel standards |
| Monitoring frequency: | The mass fraction of carbon should be obtained for each fuel delievery, from which weighted average annual values should be calculated. |
| QA/QC procedures: | Verify if the values under a) and b) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in b) should have ISO17025 accreditation or justify that they can comply with similar quality standards. |

| | |
|---|---|
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | Applicable where Option A is used in section B.6.1. |

| | |
|---|---|
| Data / Parameter: | $\rho_{i,y}$ |
| Data unit: | Mass unit/volume unit |
| Description: | Weighted average density of fuel type i in year y |
| Source of data: | The following data sources may be used if the relevant conditions apply:<br><br>Data source: a) Values provided by the fuel supplier in invoices — Conditions for using the data source: This is the preferred source<br>Data source: b) Measurements by the project participants — Conditions for using the data source: If a) is not available<br>Data source: c) Regional or national default values — Conditions for using the data source: If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| Value(s) applied | |
| Measurement methods and procedures: | Measurements should be undertaken in line with national or international fuel standards. |
| Monitoring frequency: | The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated |
| QA/QC procedures: | |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | Applicable where Option A is used in section B.6.1 and where $FC_{i,j,y}$ is measured in a volume unit. Preferably the same data source should be used for $w_{C,i,y}$ and $\rho_{i,y}$. |

| | |
|---|---|
| Data / Parameter: | $NCV_{i,y}$ |
| Data unit: | GJ per mass or volume unit (e.g. GJ/$m^3$, GJ/ton) |
| Description: | Weighted average net calorific value of fuel type i in year y |

| | |
|---|---|
| Source of data: | The following data sources may be used if the relevant conditions apply:<br><br>Data source: a) Values provided by the fuel supplier in invoices — Conditions for using the data source: This is the preferred source if the carbon fraction of the fuel is not provided (Option A)<br>Data source: b) Measurements by the project participants — Conditions for using the data source: If a) is not available<br>Data source: c) Regional or national default values — Conditions for using the data source: If a) is not available. These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>Data source: d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — Conditions for using the data source: If a) is not available |
| Value(s) applied | |
| Measurement methods and procedures: | For a) and b): Measurements should be undertaken in line with national or international fuel standards. |
| Monitoring frequency: | For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account. |
| QA/QC procedures: | Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | Applicable where Option B is used in section B.6.1. |

| | |
|---|---|
| Data / Parameter: | $EF_{CO2,i,y}$ |
| Data unit: | $tCO_2/GJ$ |
| Description: | Weighted average $CO_2$ emission factor of fuel type i in year y. |

<table>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:<br><br><table><tr><td>Data source</td><td>Conditions for using the data source</td></tr><tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr><tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr><tr><td>c) Regional or national default values</td><td>If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).</td></tr><tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr></table></td></tr>
<tr><td>Value(s) applied</td><td></td></tr>
<tr><td>Measurement methods and procedures:</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency:</td><td>For a) and b): The CO2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account</td></tr>
<tr><td>QA/QC procedures:</td><td></td></tr>
<tr><td>Purpose of data</td><td>To calculate the project emissions from fossil fuel consumption by geothermal project.</td></tr>
<tr><td>Additional comment:</td><td>Applicable where option B is used in section B.6.1.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used.</td></tr>
</table>

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the data of the parameters listed in section B.7.1, and the data will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*
Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

**Case 4: Small scale geothermal project for captive use and mini-grid in Rwanda**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>>

The component project activity is the installation of a small scale geothermal power plant with the capacity of "XXX MW". The CPA is located in "XXX (location)" by "XXX (CPA implementing entity)".

The CPA will generate electricity, and the electricity will be supplied to identified consumer facilities. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.

The CPA will be implemented under the PoA "Renewable Energy CDM Programme of Rwanda (RECPR)" with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

### B.1. Reference of methodology(ies) and standardized baseline(s)

>>

AMS-I.F (version 02) "Renewable electricity generation for captive use and mini-grid"

The following methodological tools are also referred to:

- *Tool to calculate the emission factor for an electricity system (version 04)*
- *Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion (version 02)*

### B.2. Application of methodology(ies) and standardized baseline(s)

>>

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.F *Renewable electricity generation for captive use and mini-grid* because the project activity meets the applicability criteria as follows:

| Applicability criteria | CPA scenario |
|---|---|
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:<br>• A national or a regional grid (grid hereafter);<br>• Fossil fuel fired captive power plant;<br>• A carbon intensive mini-grid. | The CPA is a geothermal power project and will supply the electricity to users. The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:<br>• National grid (grid hereafter);<br>• A mini grid where all generators use exclusively fuel oil and/or diesel fuel.<br>For CPA displacing electricity from grid, the excess electricity may be supplied to the grid.<br><br>The CPA will not displace electricity from mini grid where energy sources are not fuel oil and/or diesel fuel and the CPA will not displace electricity from fossil fuel fired captive power plant. |
| 2. For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators | If the mini-grid is included in the CPA, then the mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators connected to the mini-grid is equal |

| | |
|---|---|
| connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid. | to or less than 15 MW) which is not connected to a national or a regional grid. |
| 3. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>• The project activity is implemented in an existing reservoir with no change in the volume of reservoir;<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2. | Not applicable, because the CPA is a Greenfield geothermal power project. |
| 4. For biomass power plants, no other biomass other than renewable biomass are to be used in the project plant. | Biomass power plants are not included in the CPA. |
| 5. This methodology is applicable for project activities that: (a) Install a new power plant at 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). | The CPA is a Greenfield plant. |
| 6. 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 from the existing units. | Not applicable, because the CPA is a Greenfield geothermal power project. |
| 7. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW. | Retrofit or replacement is not included in the CPA. |
| 8. If the unit added 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 unit added co-fires fossil fuel, the capacity of the entire | Not applicable, because the CPA is a Greenfield geothermal power project. |

| | |
|---|---|
| unit shall not exceed the limit of 15 MW. | |
| 9. Combined heat and power (co-generation) systems are not eligible under this category. | Combined heat and power systems are not included in the CPA. |
| 10. If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions. | The CPA is a geothermal power project, and a contract between the supplier and consumers of the electricity will be signed and ensures that there is no double counting of emission reductions. |

In addition, if the CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system (version 04.0)" as follows:

| | |
|---|---|
| 11. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). | The CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, |
| 12. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country. | The project electricity system is located in Rwanda. This country is not an annex I country. |

### B.3. Sources and GHGs

According to AMS.I.F., the spatial extent of the project boundary includes industrial, commercial facilities consuming energy generated by the system. In the case of electricity generated and supplied to distributed users (e.g. residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of renewable generating units. The boundary also extends to the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | Yes | Main emission source |
| | | CH4 | Yes | Main emission source |
| | | N2O | No | Minor emission source |
| | CO2 emissions from combustion of | CO2 | Yes | Main emission source |

| | | | | |
|---|---|---|---|---|
| | fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Not applicable. The CPA is a geothermal power project. |
| | | CH4 | No | Not applicable. The CPA is a geothermal power project. |
| | | N2O | No | Not applicable. The CPA is a geothermal power project. |

## B.4. Description of baseline scenario

>>

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

a) National grid;
b) A mini grid where all generators use exclusively fuel oil and/or diesel fuel.

For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as table below.

Table I.F.1

EMISSION FACTORS FOR DIESEL GENERATOR SYSTEMS (IN KG $CO_2$E/KWH*) FOR THREE DIFFERENT LEVELS OF LOAD FACTORS**

| Cases: | Mini-grid with 24 hour service | Mini-grid with temporary service (4-6 hr/day); Productive applications; Water pumps | Mini-grid with storage |
|---|---|---|---|
| Load factors [%] | 25% | 50% | 100% |
| <15 kW | 2.4 | 1.4 | 1.2 |
| >=15 <35 kW | 1.9 | 1.3 | 1.1 |
| >=35 <135 kW | 1.3 | 1.0 | 1.0 |
| >=135<200 kW | 0.9 | 0.8 | 0.8 |
| > 200 kW*** | 0.8 | 0.8 | 0.8 |

It is determined to choose emission factor 0.8 kg $CO_2$e/kWh as conservative approach for all the CPA falling into this category.

Baseline emissions for other systems are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor. For this project, it is the situation displacing the electricity from grid, emission factor shall be calculated as per the procedures provided in AMS-I.D. According to AMS-I.D., the emission factor can be calculated as 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".

## B.5. Demonstration of eligibility for a generic CPA

>>

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or | Yes | The CPA is a geothermal power project. |

| | | |
|---|---|---|
| geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | | The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• Testing/certifications;<br>• Total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power project. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity.<br><br>Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA “dd/mm/yyyy” is on or after the start date of the PoA”06/05/2013”. | Yes | The earliest date of the equipment’s contracts and construction start is “DD/MM/YYYY”, so the start date of the CPA is “DD/MM/YYYY”, which is after the start date of the PoA “06/05/2013”. |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel | Yes | The CPA is a grid-connected project, or connected to mini grid, or supplies to individual users. |

| | | |
|---|---|---|
| fuel, or individual users | | |
| 8. If Environmental Impact Assessment is required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | If applicable, Environmental Impact Assessment has been done on “DD/MM/YYYY”. |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on “DD/MM/YYYY” |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of AMS.I.F version 2.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | Not applicable, because the CPA is a geothermal power project. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Micro scale CPA criteria:

In case the SSC-CPA is a microscale project activity, and additionality will be demonstrated using the Guidelines for demonstrating additionality of microscale project activities (version 05). then the following criteria shall be fulfilled.

| | | |
|---|---|---|
| 1. Installed capacity of the SSC-CPA is not greater than 5MW. | Yes | The capacity of the CPA is “XXXX”, which is not greater than 5MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the “Guidelines on assessment of de-bundling for SSC project activities” | Yes | *Describe how the CPA is in accordance with the “Guidelines on assessment of de-bundling for SSC project activities” version 03* |

| | | |
|---|---|---|
| version 03, the CPA shall satisfy the conditions as per the guidelines. | | |
| 3. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

Small scale CPA criteria:

In case the SSC-CPA is not a microscale project activity, and additionality will be demonstrated using the "Guidelines on the demonstration of additionality of small scale project activities" (version 09), then the following criteria shall be satisfied.

| | | |
|---|---|---|
| 1. The installed capacity of the CPA is not greater than 15MW threshold throughout the crediting period of the CPA in accordance with the "General Guidelines to SSC CDM methodologies" and relevant methodologies AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The installed capacity of the CPA is "XXXX", which is not greater than 15MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies of Guidelines on the demonstration of additionality of small scale project activities (version 09), the project activity is considered automatically additional. | Yes | Describe how the CPA is in accordance with the positive list. |
| 4. If the project activity involves technologies which are not listed under the positive list of renewable electricity generation, additionality shall be demonstrated using one of the following methods as per the "Guidelines on the demonstration of additionality of small scale project activities", (version 09):<br>• Investment barrier;<br>• Access to finance barrier;<br>• Technology barrier;<br>• Barrier due to prevailing practice;<br>• First-of-its-kind barrier<br>• Other barriers.<br>Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries3 it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the | Yes | Describe how the additionality of the project activity is demonstrated as per the "Guidelines on the demonstration of addtionality of small scale project activities", (version 09) taking in to consideration "Guidelines for objective demonstration and assessment of barriers" Version 01. |

| | | |
|---|---|---|
| projects in other countries". | | |
| 5. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

Baseline emissions:

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

National grid;
A mini grid where all generators use exclusively fuel oil and/or diesel fuel
For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1 in section B.4.It is determined to choose emission factor 0.8 kg $CO_2e$/kWh as conservative approach for all the CPA falling into this category.
Baseline emissions for displacing electricity from national grid are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:
$BE_y$ Baseline emissions in year y ($tCO_2$)
$EG_{BL,y}$Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y*(MWh)
$EF_{CO2,y}$ Emission factor of national grid ($tCO_2$/MWh), it shall be calculated as per the procedures provided in AMS-I.D.

According to AMS-I.D., the emission factor can be calculated as 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".

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy
It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for

grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).

The emission factor is calculated based on the official data which is published by Rwanda DNA: http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".

Project emissions

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

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2/yr$)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e/yr$)

*Fossil fuel combustion ($PE_{FF,y}$)*

For geothermal projects, which also use fossil fuels for electricity generation, $CO_2$ emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). The use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected.

$PE_{FF,y}$ shall be calculated as per the latest version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion".

As per "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" version 02, the $CO_2$ emissions from the combustion of fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,j,y}$= Are the $CO_2$ emissions from fossil fuel combustion in process j during year y

$FC_{i,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);

$COEF_{i,y}$= Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit);

i = Are the fuel types combusted in process j during the year y.

The $CO_2$ emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type i, as follows:

Option A: The $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type I, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = w_{C,i,y} \times 44/12$

If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{i,y} = w_{C,i,y} \times \rho_{i,y} \times 44/12$

Where:

$w_{C,i,y}$= Is the weighted average mass fraction of carbon in fuel type I in year y (tC/mass unit of the fuel);

$\rho_{i,y}$ = Is the weighted average density of fuel type I in year y (mass unit/volume unit of the fuel).

Option B: The $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

$NCV_{i,y}$= Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit);

$EF_{CO2,i,y}$ = Is the weighted average $CO_2$ emission factor of fuel type I in year y ($tCO_2/GJ$).

Option A should be the preferred approach, if the necessary data is available.

*Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)*

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam. Non-condensable gases in geothermal reservoirs usually consist mainly of $CO_2$ and $H_2S$. They also contain a small quantity of hydrocarbons, including predominantly $CH_4$. In geothermal power projects, non-condensable gases flow with the steam into the power plant. A small proportion of the $CO_2$ is converted to carbonate/bicarbonate in the cooling water circuit. In addition, parts of the non-condensable gases are reinjected into the geothermal reservoir. However, as a conservative approach, this methodology assumes that all non-condensable gases entering the power plant are discharged to atmosphere via the cooling tower. Fugitive carbon dioxide and methane emissions due to well testing and well bleeding are not considered, as they are negligible.

$PE_{GP,y}$ is calculated as follows:

$$PE_{GP,y} = \left(w_{steam,CO2,y} + w_{steam,CH4,y} * GWP_{CH4}\right) * M_{steam,y}$$

Where:

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$w_{steam,CO2,y}$ = Average mass fraction of carbon dioxide in the produced steam in year *y* ($tCO_2/t$ steam)

$w_{steam,CH4,y}$ = Average mass fraction of methane in the produced steam in year *y* ($tCH_4/t$ steam)

$GWP_{CH4}$ = Global warming potential of methane valid for the relevant commitment period($tCO_2e/tCH_4$)

$M_{steam,y}$ = Quantity of steam produced in year *y* (t steam/yr)

The CPA is a geothermal power project, then

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

Leakage

No leakage emissions are considered.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2/yr$)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

### B.6.2. Data and parameters that are to be reported ex-ante

>>

| | |
|---|---|
| Data / Parameter: | $EF_{grid,OM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{grid,BM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | --This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{grid,CM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7044 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | - This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{CO2,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | CO2 emission factor for the mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel in year y |
| Source of data: | AMS-I.F |

| | |
|---|---|
| Value(s) applied: | It is determined to choose emission factor 0.8 tCO2e/MWh as conservative approach for all the CPA falling into this category. |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $GWP_{CH4}$ |
| Data unit: | $tCO_2e/tCH_4$ |
| Description: | Global warming potential of methane valid for the relevant commitment period |
| Source of data: | IPCC |
| Value(s) applied: | 25 |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | - |
| Additional comment: | - |

**B.6.3. Ex-ante calculations of emission reductions**

>>

Baseline Emissions:

For CPA displacing electricity from mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times emission factor 0.8 kg $CO_2e/kWh$ as conservative approach for all the CPA falling into this category.

Baseline emissions for displacing electricity from grid are the product of amount electricity displaced with the electricity produced by the renewable generating unit and grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:

$BE_y$ Baseline emissions in year y ($tCO_2$)

$EG_{BL,y}$ Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y*(MWh)

$EF_{CO2,y}$ Emission factor of national grid ($tCO_2$/MWh). According to Rwanda DNA, the value is 0.7044 tCO2e/MWh.

Project emissions

For the geothermal power CPAs, project emissions are accounted for as follows:

$PE_y=PE_{FF,y}+PE_{GD.y}$

Where:

$PE_y$ is project emissions in year y ($tCO_2$/yr);

$PE_{FF,y}$ is the project emission from fossil fuel consumption in year y ($tCO_2$/yr);

$PE_{GD,y}$ is the project emissions from operation of geothermal power plants due to the release of non-condensable gases in year y (tCO2/yr);

Leakage

There is no energy generating equipment transferred from another activity, so no leakage emissions are considered.

Emission reductions
Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e$/yr)

$BE_y$ = Baseline emissions in year *y* ($tCO_2$/yr)

$PE_y$ = Project emissions in year *y* ($tCO_2e$/yr)

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

### B.7.1. Data and parameters to be monitored by each generic CPA

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

National grid;
A mini grid where all generators use exclusively fuel oil and/or diesel fuel
Therefore, the monitoring only needs to focus on quantity of net electricity displaced by the project and the project emissions. Furthermore, for situation (b), the baseline emissions is the annual electricity generated (EG) by the renewable energy unit times an emission factor. In order to simplify the monitoring, PP decided to replace monitoring of EG by monitoring of quantity of net electricity displaced by the project ($EG_{BL,y}$) considering $EG_{BL,y}$ is a net value leading to a more conservative result.

| Data / Parameter: | $EG_{BL,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity displaced in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |
| Measurement methods and procedures: | Measured on the CPA site by the meters.<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. The net electricity displaced is the gross energy generation by the project minus the auxiliary/station electricity consumption. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | - |

| Data / Parameter: | $w_{steam,CO2,y}$ |
|---|---|
| Data unit: | $tCO_2$/t steam |
| Description: | Average mass fraction of carbon dioxide in the produced steam in year *y* |
| Source of data: | Project activity site |

| | |
|---|---|
| Value(s) applied | XXXXX |
| Measurement methods and procedures: | Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The $CO_2$ and $CH_4$ sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide ($H_2S$) and carbon dioxide ($CO_2$) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including $CH_4$. All alkanes concentrations are reported in terms of methane |
| Monitoring frequency: | At least every three months and more frequently, if necessary |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $w_{steam,CH4,y}$ |
| Data unit: | $tCH_4/t$ steam |
| Description: | Average mass fraction of methane in the produced steam in year *y* |
| Source of data: | Project activity site |
| Value(s) applied | XXX |
| Measurement methods and procedures: | As per the procedures outlined for $w_{steam,CO2,y}$ |
| Monitoring frequency: | As per the procedures outlined for $w_{steam,CO2,y}$ |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $M_{steam,y}$ |
| Data unit: | t steam/yr |
| Description: | Quantity of steam produced in year *y* |
| Source of data: | Project activity site |
| Value(s) applied | XXX |
| Measurement methods and procedures: | The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports |
| Monitoring frequency: | Daily |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

As per AMS-I.F, the project emissions from fossil fuel consumption by geothermal project should be monitored in line with “Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion”. Below parameters are monitored for calculating the project emissions from fossil fuel consumption by geothermal project.

| | |
|---|---|
| Data / Parameter: | $FC_{i,j,y}$ |
| Data unit: | Mass or volume unit per year (e.g. ton/yr or $m^3$/yr) |
| Description: | Quantity of fuel type i combusted in process j during the year y |
| Source of data: | Onsite measurements |
| Value(s) applied | |
| Measurement methods and procedures: | • Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift);<br>• Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance;<br>• In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions. |
| Monitoring frequency: | Continuously |
| QA/QC procedures: | The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes.<br><br>Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $W_{C,i,y}$ |
| Data unit: | tC/mass unit of the fuel |
| Description: | Weighted average mass fraction of carbon in fuel type i in year y |
| Source of data: | The following data sources may be used if the relevant conditions apply: |

| Data source | Conditions for using the data source |
|---|---|
| Values provided by the fuel supplier in invoices | This is the preferred source |
| Measurements by the project participants | If a) is not available |

| | |
|---|---|
| Value(s) applied | |
| Measurement methods and procedures: | Measurements should be undertaken in line with national or international fuel standards |
| Monitoring frequency: | The mass fraction of carbon should be obtained for each fuel delievery, from which weighted average annual values should be calculated. |
| QA/QC procedures: | Verify if the values under a) and b) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in b) should have ISO17025 accreditation or justify that they can comply with similar quality standards. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |

| | |
|---|---|
| Additional comment: | Applicable where Option A is used in section B.6.1. |

| | |
|---|---|
| Data / Parameter: | $\rho_{i,y}$ |
| Data unit: | Mass unit/volume unit |
| Description: | Weighted average density of fuel type i in year y |
| Source of data: | The following data sources may be used if the relevant conditions apply:<br><br>Data source: a) Values provided by the fuel supplier in invoices — Conditions for using the data source: This is the preferred source<br>Data source: b) Measurements by the project participants — Conditions for using the data source: If a) is not available<br>Data source: c) Regional or national default values — Conditions for using the data source: If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| Value(s) applied | |
| Measurement methods and procedures: | Measurements should be undertaken in line with national or international fuel standards. |
| Monitoring frequency: | The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated |
| QA/QC procedures: | |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | Applicable where Option A is used in section B.6.1 and where $FC_{i,j,y}$ is measured in a volume unit. Preferably the same data source should be used for $w_{C,i,y}$ and $\rho_{i,y}$. |

| | |
|---|---|
| Data / Parameter: | $NCV_{i,y}$ |
| Data unit: | GJ per mass or volume unit (e.g. GJ/$m^3$, GJ/ton) |
| Description: | Weighted average net calorific value of fuel type i in year y |

| | |
|---|---|
| Source of data: | The following data sources may be used if the relevant conditions apply:<br><br>Data source: a) Values provided by the fuel supplier in invoices — Conditions for using the data source: This is the preferred source if the carbon fraction of the fuel is not provided (Option A)<br>Data source: b) Measurements by the project participants — Conditions for using the data source: If a) is not available<br>Data source: c) Regional or national default values — Conditions for using the data source: If a) is not available. These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).<br>Data source: d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — Conditions for using the data source: If a) is not available |
| Value(s) applied | |
| Measurement methods and procedures: | For a) and b): Measurements should be undertaken in line with national or international fuel standards. |
| Monitoring frequency: | For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account. |
| QA/QC procedures: | Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | Applicable where Option B is used in section B.6.1. |

| | |
|---|---|
| Data / Parameter: | $EF_{CO2,i,y}$ |
| Data unit: | $tCO_2/GJ$ |
| Description: | Weighted average $CO_2$ emission factor of fuel type i in year y. |

<table>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:<br><br><table><tr><td>Data source</td><td>Conditions for using the data source</td></tr><tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr><tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr><tr><td>c) Regional or national default values</td><td>If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).</td></tr><tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr></table></td></tr>
<tr><td>Value(s) applied</td><td></td></tr>
<tr><td>Measurement methods and procedures:</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency:</td><td>For a) and b): The CO2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account</td></tr>
<tr><td>QA/QC procedures:</td><td></td></tr>
<tr><td>Purpose of data</td><td>To calculate the project emissions from fossil fuel consumption by geothermal project.</td></tr>
<tr><td>Additional comment:</td><td>Applicable where option B is used in section B.6.1.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used.</td></tr>
</table>

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the data of the parameters listed in section B.7.1 and the data will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*
Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

**Case 5: Small scale solar project for captive use and mini-grid in Rwanda**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>>

The component project activity is the installation of a small scale solar power plant with the capacity of "XXX MW". The CPA is located in "XXX (location)" by "XXX (CPA implementing entity)".

The CPA will generate electricity, and the electricity will be supplied to identified consumer facilities. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.

The CPA will be implemented under the PoA "Renewable Energy CDM Programme of Rwanda (RECPR)" with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

### B.1. Reference of methodology(ies) and standardized baseline(s)

>>

AMS-I.F (version 02) "Renewable electricity generation for captive use and mini-grid"

The following methodological tools are also referred to:

- *Tool to calculate the emission factor for an electricity system (version 04)*

### B.2. Applicability of methodology(ies) and standardized baseline(s)

>>

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.F *Renewable electricity generation for captive use and mini-grid* because the project activity meets the applicability criteria as follows:

| Applicability criteria | CPA scenario |
|---|---|
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:<br>• A national or a regional grid (grid hereafter);<br>• Fossil fuel fired captive power plant;<br>• A carbon intensive mini-grid. | The CPA is a solar power project and will supply the electricity to users. The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:<br>• National grid (grid hereafter);<br>• A mini grid where all generators use exclusively fuel oil and/or diesel fuel;<br><br>For CPA displacing electricity from grid, the excess electricity may be supplied to the grid.<br><br>The CPA will not displace electricity from mini grid where energy sources are not fuel oil and/or diesel fuel and the CPA will not displace electricity from fossil fuel fired captive power plant. |
| 2. For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators connected to the mini-grid is equal to or | If the mini-grid is included in the CPA, then the mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected |

| | |
|---|---|
| less than 15 MW) which is not connected to a national or a regional grid. | to a national or a regional grid. |
| 3. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>• The project activity is implemented in an existing reservoir with no change in the volume of reservoir;<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2. | Not applicable, because the CPA is a Greenfield solar PV power project. |
| 4. For biomass power plants, no other biomasses other than renewable biomass are to be used in the project plant. | Biomass power plants are not included in the CPA. |
| 5. This methodology is applicable for project activities that: (a) Install a new power plant at 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 retrofitof (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s). | The CPA is a Greenfield plant. |
| 6. 6. 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 from the existing units. | Not applicable, because the CPA is a Greenfield solar PV power project. |
| 7. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW. | Retrofit or replacement is not included in the CPA. |
| 8. If the unit added 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 unit added co-fires fossil fuel, the capacity of the entire unit | Not applicable, because the CPA is a Greenfield solar PV power project. |

| | |
|---|---|
| shall not exceed the limit of 15 MW. | |
| 9. Combined heat and power (co-generation) systems are not eligible under this category. | Combined heat and power systems are not included in the CPA. |
| 10. If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions. | The CPA is a solar power project, and a contract between the supplier and consumers of the electricity will be signed and ensures that there is no double counting of emission reductions. |

In addition, if the CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system (version 04.0)" as follows:

| | |
|---|---|
| 1. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). | The CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, |
| 2. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country. | The project electricity system is located in Rwanda. This country is not an annex I country. |

## B.3. Sources and GHGs

According to AMS.I.F., the spatial extent of the project boundary includes industrial, commercial facilities consuming energy generated by the system. In the case of electricity generated and supplied to distributed users (e.g. residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of renewable generating units. The boundary also extends to the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The sources and gases included in the SSC-CPA boundary for individual solar PV CPAs is as shown in the table below:

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | No | Not applicable. The CPA is a solar PV power project. |
| | | CH4 | No | Not applicable. The CPA is a solar PV power project. |
| | | N2O | No | Not applicable. The CPA is a solar PV power project. |

| | | | | |
|---|---|---|---|---|
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CO2 | No | Not applicable. The CPA is a solar PV power project. |
| | | CH4 | No | Not applicable. The CPA is a solar PV power project. |
| | | N2O | No | Not applicable. The CPA is a solar PV power project. |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Not applicable. The CPA is a solar PV power project. |
| | | CH4 | No | Not applicable. The CPA is a solar PV power project. |
| | | N2O | No | Not applicable. The CPA is a solar PV power project. |

## B.4. Description of baseline scenario

>>

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

(a) National grid;
(b) A mini grid where all generators use exclusively fuel oil and/or diesel fuel

1. For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1.

Table I.F.1
EMISSION FACTORS FOR DIESEL GENERATOR SYSTEMS (IN KG $CO_2$E/KWH*) FOR THREE DIFFERENT LEVELS OF LOAD FACTORS**

| Cases: | Mini-grid with 24 hour service | Mini-grid with temporary service (4-6 hr/day); Productive applications; Water pumps | Mini-grid with storage |
|---|---|---|---|
| Load factors [%] | 25% | 50% | 100% |
| <15 kW | 2.4 | 1.4 | 1.2 |
| >=15 <35 kW | 1.9 | 1.3 | 1.1 |
| >=35 <135 kW | 1.3 | 1.0 | 1.0 |
| >=135<200 kW | 0.9 | 0.8 | 0.8 |
| > 200 kW*** | 0.8 | 0.8 | 0.8 |

It is determined to choose emission factor 0.8 kg $CO_2$e/kWh as conservative approach for all the CPA falling into this category.

2. Baseline emissions for other systems are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor. For this project, it is the situation displacing the electricity from grid, emission factor shall be calculated as per the procedures provided in AMS-I.D. According to AMS-I.D., the emission factor can be calculated as 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”.

## B.5. Demonstration of eligibility for a generic CPA

>>

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|

| | | |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | Yes | The CPA is a solar PV power project.<br><br>The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• Testing/certifications;<br>• Total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power project. |
| 3. 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. Signed confirmation from the entity implementing the CPA.The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA “dd/mm/yyyy” is on or after the start date of the PoA “06/05/2013”. | Yes | The earliest date of the equipments contracts and construction start is “DD/MM/YYYY”, so the start date of the CPA is “DD/MM/YYYY”, which is after the start date of the PoA “06/05/2013”. |
| 7. The CPA could either be grid-connected, connected to mini grid | Yes | The CPA is a grid-connected project, or connected to mini grid, |

| | | |
|---|---|---|
| where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | | or supplies to individual users. |
| 8. If Environmental Impact Assessment is required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | If applicable, Environmental Impact Assesment has been done on “DD/MM/YYYY”. |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on “DD/MM/YYYY” |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of AMS.I.F version 2.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | Not applicable, because the CPA is a solar PV power project. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Micro scale CPA criteria:
In case the SSC-CPA is a microscale project activity, and additionality will be demonstrated using the Guidelines for demonstrating additionality of microscale project activities (version 05). then the following criteria shall be fulfilled.

| | | |
|---|---|---|
| 15. Installed capacity of the SSC-CPA is not greater than 5MW. | Yes | The capacity of the CPA is “XXXX”, which is not greater than 5MW. |
| 16. In order to determine the occurrence of de-bundling in accordance with the | Yes | Describe how the CPA is in accordance with the “Guidelines |

| | | |
|---|---|---|
| "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | | on assessment of de-bundling for SSC project activities" version 03 |
| 17. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

Small scale CPA criteria:
In case the SSC-CPA is not a microscale project activity, and additionality will be demonstrated using the "Guidelines on the demonstration of additionality of small-scale project activities" (version 09), then the following criteria shall be satisfied.

| | | |
|---|---|---|
| 1. The installed capacity of the CPA is not greater than 15MW threshold throughout the crediting period of the CPA in accordance with the "General Guidelines to SSC CDM methodologies" and relevant methodologies AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The installed capacity of the CPA is "XXXX", which is not greater than 15MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies of Guidelines on the demonstration of additionality of small scale project activities (version 09), the project activity is considered automatically additional. | Yes | Yes, the CPA is listed under the positive list. Hence the CPA is considered automatically additional. |
| 4. If the project activity involves technologies which are not listed under the positive list of renewable electricity generation, additionality shall be demonstrated using one of the following methods as per the "Guidelines on the demonstration of additionality of small scale project activities", (version 09):<br>• Investment barrier;<br>• Access to finance barrier;<br>• Technology barrier;<br>• Barrier due to prevailing practice;<br>• First-of-its-kind barrier<br>• Other barriers.<br>Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries3 it is sufficient to transparently describe the relevant barriers, as less stringency is needed with | Yes | Describe how the additionality of the project activity is demonstrated as per the "Guidelines on the demonstration of addtionality of small scale project activities", (version 09) taking in to consideration "Guidelines for objective demonstration and assessment of barriers" Version 01. |

| | | |
|---|---|---|
| regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries". | | |
| 5. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

Baseline emissions:
The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

National grid;
A mini grid where all generators use exclusively fuel oil and/or diesel fuel
For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1 in section B.4.It is determined to choose emission factor 0.8 kg $CO_2$e/kWh as conservative approach for all the CPA falling into this category.
Baseline emissions for displacing electricity from national grid are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:
Where:
$BE_y$ Baseline emissions in year y ($tCO_2$)
$EG_{BL,y}$Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y*(MWh)
$EF_{CO2,y}$ Emission factor of national grid ($tCO_2$/MWh), it shall be calculated as per the procedures provided in AMS-I.D.

According to AMS-I.D., the emission factor can be calculated as 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".

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy

It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).

The emission factor is calculated based on the official data which is published by Rwanda DNA: http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".

Project emissions

For solar PV CPAs, $PE_y$= 0.

Leakage

No leakage emissions are considered.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2/yr$)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

### B.6.2. Data and parameters that are to be reported ex-ante

>>

| Data / Parameter: | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |

| | |
|---|---|
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | --This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{grid,CM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7063 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | - This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{CO2,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | CO2 emission factor for the mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel in year y |
| Source of data: | AMS-I.F |
| Value(s) applied: | It is determined to choose emission factor 0.8 tCO2e/MWh as conservative approach for all the CPA falling into this category. |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

### B.6.3. Ex-ante calculations of emission reductions

>>

Baseline Emissions:

For CPA displacing electricity from mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times emission factor 0.8 kg $CO_2$e/kWh as conservative approach for all the CPA falling into this category.

Baseline emissions for displacing electricity from grid are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:

Where:

$BE_y$ Baseline emissions in year y ($tCO_2$)

$EG_{BL,y}$Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y*(MWh)

$EF_{CO2,y}$ Emission factor of national grid ($tCO_2$/MWh). According to Rwanda DNA, the value is 0.7063 tCO2e/MWh.

Project emissions
For solar PV CPAs, $PE_y$= 0.
Leakage
No leakage emissions are considered.

Emission reductions
Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2$e/yr)

$BE_y$ = Baseline emissions in year *y* ($tCO_2$/yr)

$PE_y$ = Project emissions in year *y* ($tCO_2$e/yr)

Therefore,

$$ER_y = EG_{BL,y} * EF_{CO_2,y} = EG_{facility,y} * EF_{CO_2,y} = XXXXXX$$

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

### B.7.1. Data and parameters to be monitored by each generic CPA

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

(a) National grid;
(b) A mini grid where all generators use exclusively fuel oil and/or diesel fuel

Therefore, the monitoring only needs to focus on quantity of net electricity displaced by the project. Furthermore, for situation (b), the baseline emissions is the annual electricity generated (EG) by the renewable energy unit times an emission factor. In order to simplify the monitoring, PP decided to replace monitoring of EG by monitoring of quantity of net electricity displaced by the project ($EG_{BL,y}$) considering $EG_{BL,y}$ is a net value leading to a more conservative result.

| Data / Parameter: | $EG_{BL,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |
| Measurement methods and procedures: | Measured on the CPA site by the meters<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. The net electricity displaced is the gross energy generation by the project minus the auxiliary/station electricity consumption. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | - |

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*

Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the dataand information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.

During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3"Health and safety regulation is followed or exceeded resulting in the protection of human health" which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

**Case 6: Small scale hydro project for captive use and mini-grid in Rwanda (Greenfield)**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>>

The component project activity is the installation of a small scale hydro power plant with the capacity of "XXX MW". The CPA is located in "XXX (location)" by "XXX (CPA implementing entity)".

The CPA will generate electricity, and the electricity will be supplied to identified consumer facilities. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.

The CPA will be implemented under the PoA "Renewable Energy CDM Programme of Rwanda (RECPR)" with the CME as DG Works Ltd.

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

### B.1. Reference of the approved baseline and monitoring methodology(ies) selected

>>

AMS-I.F (version 02) "Renewable electricity generation for captive use and mini-grid"

The following methodological tools are also referred to:

- *"Tool to calculate the emission factor for an electricity system" (version 04)*
- *"Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" (version 02)*

### B.2. Application of methodology(ies)

>>

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.F *Renewable electricity generation for captive use and mini-grid* because the project activity meets the applicability criteria as follows:

| Applicability criteria | CPA scenario |
|---|---|
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:<br>a) A national or a regional grid (grid hereafter); | The CPA is a hydro power project and will supply the electricity to users. The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:<br>(a) National (grid hereafter);<br>(b) A mini grid where all generators use exclusively fuel oil and/or diesel fuel<br><br>For CPA displacing electricity from grid, the excess electricity may be supplied to the grid. |

| | |
|---|---|
| b) Fossil fuel fired captive power plant;<br>c) A carbon intensive mini-grid. | The CPA will not displace electricity from mini grid where energy sources are not fuel oil and/or diesel fuel and the CPA will not displace electricity from fossil fuel fired captive power plant. |
| 2. For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid. | If the mini-grid is included in the CPA, then the mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid. |
| 3. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>• The project activity is implemented in an existing reservoir with no change in the volume of reservoir;<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2. | In the case that the CPA involves reservoirs, the power density of the CPA is “XXXXX”, which is greater than 4W/m2. |
| 4. For biomass power plants, no other biomass other than renewable biomass are to be used in the project plant. | Biomass power plants are not included in the CPA. |
| 5. This methodology is applicable for project activities that: (a) Install a new power plant at 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). | The CPA is a Greenfield plant. |
| 6. 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 from the existing units. | Not applicable. |
| 7. In the case of retrofit or replacement, to qualify as a small-scale project, the | Retrofit or replacement is not included in the CPA. |

| | |
|---|---|
| total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW. | |
| 8. If the unit added 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 unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW. | Not applicable. |
| 9. Combined heat and power (co-generation) systems are not eligible under this category. | Combined heat and power systems are not included in the CPA. |
| 10. If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions. | The CPA is a hydro power project, and a contract between the supplier and consumers of the electricity will be signed and ensures that there is no double counting of emission reductions. |

In addition, if the CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system (version 04.0)" as follows:

| | |
|---|---|
| 1. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). | The CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, |
| 2. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country. | The project electricity system is located in Rwanda. This country is not an annex I country. |

### B.3. Sources and GHGs

According to AMS.I.F., the spatial extent of the project boundary includes industrial, commercial facilities consuming energy generated by the system. In the case of electricity generated and supplied to distributed users (e.g. residential users) via mini/isolated grid(s) the project boundary may be confined to physical, geographical site of renewable generating units. The boundary also extends to the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

The sources and gases included in the SSC-CPA boundary for individual hydro CPAs is as shownin the table below:

| Source | Gas | Included? | Justification/Explanation |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | No | Not applicable. The CPA is a hydro power project. |
| | | CH4 | No | Not applicable. The CPA is a hydro power project. |
| | | N2O | No | Not applicable. The CPA is a hydro power project. |
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CO2 | No | Not applicable. The CPA is a hydro power project. |
| | | CH4 | No | Not applicable. The CPA is a hydro power project. |
| | | N2O | No | Not applicable. The CPA is a hydro power project. |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Minor emission source |
| | | CH4 | Yes | It is included if the power density of the CPA is between 4W/m2 and 10 W/m2. |
| | | N2O | No | Minor emission source |

**B.4. Description of baseline scenario**
**>>**

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:
(a) National grid;
(b) A mini grid where all generators use exclusively fuel oil and/or diesel fuel

1. For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1.

Table I.F.1
EMISSION FACTORS FOR DIESEL GENERATOR SYSTEMS (IN KG $CO_2$E/KWH*) FOR THREE DIFFERENT LEVELS OF LOAD FACTORS**

| Cases: | Mini-grid with 24 hour service | Mini-grid with temporary service (4-6 hr/day); Productive applications; Water pumps | Mini-grid with storage |
|---|---|---|---|
| Load factors [%] | 25% | 50% | 100% |
| <15 kW | 2.4 | 1.4 | 1.2 |
| >=15 <35 kW | 1.9 | 1.3 | 1.1 |
| >=35 <135 kW | 1.3 | 1.0 | 1.0 |
| >=135<200 kW | 0.9 | 0.8 | 0.8 |
| > 200 kW*** | 0.8 | 0.8 | 0.8 |

It is determined to choose emission factor 0.8 kg $CO_2$e/kWh as conservative approach for all the CPA falling into this category.

2. Baseline emissions for other systems are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor. For this project, it is the situation displacing the electricity from grid, emission factor shall be calculated as per the procedures provided in AMS-I.D. According to AMS-I.D., the emission factor can be calculated as

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".

### B.5. Demonstration of eligibility for a generic CPA

>>

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | Yes | The CPA is a hydro power project.<br><br>The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• Testing/certifications;<br>• Total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power project. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |

| | | |
|---|---|---|
| 6. The start date of the proposed CPA“dd/mm/yyyy” is on or after the start date of the PoA“06/05/2013”. | Yes | The earliest date of the equipments contracts and construction start is “DD/MM/YYYY”, so the start date of the CPA is “DD/MM/YYYY”, which is after the start date of the PoA “06/05/2013”. |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | Yes | The CPA is a grid-connected project, or connected to mini grid, or supplies to individual users. |
| 8. If Environmental Impact Assessmentis required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | If applicable, Environmental Impact Assessment has been done on “DD/MM/YYYY”. |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on “DD/MM/YYYY” |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of AMS.I.F version 2.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | In the case that the CPA involves reservoirs, the power density of the CPA is calculated to be “XXXX”, which is greater than 4 W/m2. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Micro scale CPA criteria:
In case the SSC-CPA is a microscale project activity, and additionality will be demonstrated using the Guidelines for demonstrating additionality of microscale project activities (version 05). then the following criteria shall be fulfilled.

| | | |
|---|---|---|
| 1. Installed capacity of the SSC-CPA is not greater than 5MW. | Yes | The capacity of the CPA is "XXXX", which is not greater than 5MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

Small scale CPA criteria:
In case the SSC-CPA is not a microscale project activity, and additionality will be demonstrated using the "Guidelines on the demonstration of additionality of small scale project activities" (version 09), then the following criteria shall be satisfied.

| | | |
|---|---|---|
| 4. The installed capacity of the CPA is not greater than 15MW threshold throughout the crediting period of the CPA in accordance with the "General Guidelines to SSC CDM methodologies" and relevant methodologies AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The installed capacity of the CPA is "XXXX", which is not greater than 15MW. |
| 5. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 6. If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies of Guidelines on the demonstration of additionality of small scale project activities (version 09), the project activity is considered automatically additional. | Yes/na | Describe whether the CPA is included in the positive list. |
| 7. If the project activity involves technologies which are not listed under the positive list of renewable electricity generation, additionality shall be demonstrated using one of the following methods as per the "Guidelines on the demonstration of additionality of small scale project activities", (version 09):<br>• Investment barrier;<br>• Access to finance barrier; | Yes/na | Describe how the additionality of the project activity is demonstrated as per the "Guidelines on the demonstration of addtionality of small scale project activities", (version 09) taking in to consideration "Guidelines for objective demonstration and assessment of barriers" Version 01. |

| | | |
|---|---|---|
| • Technology barrier;<br>• Barrier due to prevailing practice;<br>• First-of-its-kind barrier<br>• Other barriers.<br>Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries3 it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries". | | |
| 8. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

Baseline emissions:

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

(a) National grid;

(b) A mini grid where all generators use exclusively fuel oil and/or diesel fuel

For a mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times an emission factor for a modern diesel generating unit of the relevant capacity operating at optimal load as given in Table I.F.1 in section B.4. It is determined to choose emission factor 0.8 kg $CO_2$e/kWh as conservative approach for all the CPA falling into this category.

Baseline emissions for displacing electricity from national grid are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:

$BE_y$ Baseline emissions in year y ($tCO_2$)

$EG_{BL,y}$ Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y*(MWh)

$EF_{CO2,y}$ Emission factor of national grid ($tCO_2$/MWh), it shall be calculated as per the procedures provided in AMS-I.D.

According to AMS-I.D., the emission factor can be calculated as 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".

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:

http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy
It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.
According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).
The emission factor is calculated based on the official data which is published by Rwanda DNA: http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=
The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".
Project emissions
For most renewable power generation project activities, $PE_y$= 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2/yr$)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e/yr$)

The CPA is a hydro power project, and there is no fossil fuel involved in the project, so $PE_{FF,y}$ and $PE_{GP,y}$ are zero. As per the methodology, in the case that the CPA involves reservoirs, the power density of the CPA is "XXXX", which is greater than 10W/m2, hence the $PE_{HP,y}$ is zero. Therefore, the $PE_y$ of the CPA is zero.

Or

If the power density of the CPA is less than 10W/m2 and greater than 4W/m2, then the $PE_{HP,y}$ is calculated as below:

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

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs ($tCO_2e/yr$)

$EF_{Res}$ = Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$)

$TEG_y$ = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

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

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

Where:

$PD$ = Power density of the project activity (W/m$^2$)

$Cap_{PJ}$ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

$Cap_{BL}$ = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

$A_{PJ}$ = Area of the 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

Leakage
There is no energy generating equipment transferred from another activity, so no leakage is considered..

Emission reductions
Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e$/yr)

$BE_y$ = Baseline emissions in year *y* ($tCO_2$/yr)

$PE_y$ = Project emissions in year *y* ($tCO_2e$/yr)

**B.6.2. Data and parameters that are to be reported ex-ante**

>>

| Data / Parameter: | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |

| | |
|---|---|
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | --This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{grid,CM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7044 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | - This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{CO2,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | CO2 emission factor for the mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel in year y |
| Source of data: | AMS-I.F |
| Value(s) applied: | It is determined to choose emission factor 0.8 tCO2e/MWh as conservative approach for all the CPA falling into this category. |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| 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: | 0 |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs |

| | |
|---|---|
| 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 ($m^2$). For new reservoirs, this value is zero |
| Source of data: | Project site |
| Value(s) applied: | 0, and it will be measured at CPA level. |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - Only applicable when the CPA involves reservoirs |

### B.6.3. Ex-ante calculations of emission reductions

>>

Baseline Emissions:

For CPA displacing electricity from mini-grid system where all generators use exclusively fuel oil and/or diesel fuel, the baseline emissions is the annual electricity generated by the renewable energy unit times emission factor 0.8 kg $CO_2e$/kWh as conservative approach for all the CPA falling into this category.

Baseline emissions for displacing electricity from grid are the product of amount electricity displaced with the electricity produced by the renewable generating unit and an emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,y}$$

Where:

$BE_y$ Baseline emissions in year y ($tCO_2$)

$EG_{BL,y}$ Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year *y*(MWh)

$EF_{CO2,y}$ Emission factor of national grid ($tCO_2$/MWh). According to Rwanda DNA, the value is 0.7044 tCO2e/MWh.

Project emissions

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

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e$/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2$/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e$/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e$/yr)

The CPA is a hydro power project, and there is no fossil fuel involved in the project, so $PE_{FF,y}$ and $PE_{GP,y}$ are zero. As per the methodology, the power density of the CPA is "XXXX", which is greater than 10W/m2, hence the $PE_{HP,y}$ is zero. Therefore, the $PE_y$ of the CPA is zero.

Or

If the power density of the CPA is less than 10W/m2 and greater than 4W/m2, then the $PE_{HP,y}$ is calculated as below:

$$\mathrm{PE}_{\mathrm{HP,y}} = \frac{EF_{\mathrm{Res}} * TEG_y}{1000}$$

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs ($tCO_2e/yr$)

$EF_{Res}$ = Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$)

$TEG_y$ = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

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

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

Where:

$PD$ = Power density of the project activity ($W/m^2$)

$Cap_{PJ}$ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

$Cap_{BL}$ = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

$A_{PJ}$ = Area of the 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

Leakage

No leakage emissions are considered.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2/yr$)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

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

### B.7.1. Data and parameters to be monitored by each generic CPA

The CPA only applies to displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from two sources listed below:

(a) National grid;
(b) A mini grid where all generators use exclusively fuel oil and/or diesel fuel

Therefore, the monitoring of electricity quantity only needs to focus on quantity of net electricity displaced by the project. Furthermore, for situation (b), the baseline emissions is the annual electricity generated (EG) by the renewable energy unit times an emission factor. In order to simplify the monitoring, PP decided to replace monitoring of EG by monitoring of quantity of net electricity displaced by the project ($EG_{BL,y}$) considering $EG_{BL,y}$ is a net value leading to a more conservative result.

| Data / Parameter: | $EG_{BL,y,}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |

| | |
|---|---|
| Measurement methods and procedures: | Measured on the CPA site by the meters<br><br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. The net electricity displaced is the gross energy generation by the project minus the auxiliary/station electricity consumption. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | TEGy |
| Data unit: | MWh/yr |
| Description: | Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y |
| Source of data: | Project activity site |
| Value(s) applied | "XXXXXX" |
| Measurement methods and procedures: | Electricity meters<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Continuous measurement and at least monthly recording |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs, and applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2. |

| | |
|---|---|
| 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 site |
| Value(s) applied | "XXXX" |
| Measurement methods and procedures: | Determine the installed capacity according to the nameplates or equipments contracts of turbines and generators. |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs |

| | |
|---|---|
| Data / Parameter: | $A_{PJ}$ |
| Data unit: | m2 |
| Description: | Area of the single or run-of-river 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 | "XXXX" |

| | |
|---|---|
| Measurement methods and procedures: | Measure from topographical surveys, maps, satellite pictures, measurement by the third party, etc. |
| Monitoring frequency: | yearly |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs |

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

If the power density is applicable, the installed capacity and surface area of reservoir will be monitored by the CPA implementing entity, and the result of the power density will be reported to the CME within three months after the commissioning of the CPA.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*

Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template

 Preparation for verification
 Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

**Case 7: Small scale grid connected geothermal project in Rwanda**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>>
The component project activity is the installation of a small scale geothermal power plant with the capacity of “XXX MW”. The CPA is located in “XXX (location)” by “XXX (CPA implementing entity)”.
The CPA will generate electricity, and the electricity will be fed into the Rwanda electricity grid. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.
The CPA will be implemented under the PoA “Renewable Energy CDM Programme of Rwanda (RECPR)” with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

### B.1. Reference of methodology(ies) and standardized baseline(s)

>>
AMS-I.D (version 17) “Grid connected renewable electricity generation”

The following methodological tools are also referred to:

- *“Tool to calculate the emission factor for an electricity system” (version 04)*
- *“Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion” (version 02)*

### B.2. Applicability of methodology(ies) and standardized baseline(s)

>>
The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17)because the project activity meets the applicability criteria as follows:

| Applicability criteria | CPA scenario |
|---|---|

| | |
|---|---|
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:<br>a) Supplying electricity to a national or a regional grid; or<br>b) (Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. | The CPA is a geothermal power project, and the electricity generated by the CPA will be supplied to National grid, or identified users via national/regional grid through a contractual arrangement such as wheeling. |
| 2. This methodology is applicable to project activities that: (a) Install a new power plant at 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). | The CPA is a Greenfield plant. |
| 3. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>• The project activity is implemented in an existing reservoir with no change in the volume of reservoir;<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2. | Not applicable, because the CPA is a geothermal power project. |
| 4. 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. | The geothermal component of the CPA is not greater than 15MW. The CPA doesn't co-fire fossil fuel. |
| 5. Combined heat and power (co-generation) systems are not eligible under this category. | The CPA does not involve combined heat and power. |
| 6. In the case of project activities that involve the 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 | Not applicable, because the CPA is a Greenfield project. |

| | |
|---|---|
| MW and should be physically distinct from the existing units. | |
| 7. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW. | The CPA does not involve the retrofit or replacement. |

In addition, if the CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system (version 04.0)" as follows:

| | |
|---|---|
| 1. This tool may be applied to estimate the OM,BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). | The CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, |
| 2. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country. | The project electricity system is located in Rwanda. This country is not an annex I country. |

## B.3. Sources and GHGs

According to AMS.I.D, 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."
The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the following table.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | Yes | Main emission source |
| | | CH4 | Yes | Main emission source |
| | | N2O | No | Minor emission source |
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Not applicable. The CPA is a geothermal power project. |
| | | CH4 | No | Not applicable. The CPA is a geothermal power project. |
| | | N2O | No | Not applicable. The CPA is a geothermal power project. |

## B.4. Description of baseline scenario

>>

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.

**B.5. Demonstration of eligibility for a generic CPA**

>>

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | Yes | The CPA is a geothermal power project. The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• Testing/certifications;<br>• Total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power project. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA “dd/mm/yyyy”is on or after the start | Yes | The earliest date of the equipments contracts and |

| | | |
|---|---|---|
| date of the PoA"06/05/2013". | | construction start is "DD/MM/YYYY", so the start date of the CPA is "DD/MM/YYYY", which is after the start date of the PoA "06/05/2013". |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | Yes | The CPA is a grid-connected project, or connected to mini grid, or supplies to individual users. |
| 8. If Environmental Impact Assessment is required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | If applicable, Environmental Impact Assesment has been done on "DD/MM/YYYY". |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on "DD/MM/YYYY" |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance.In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of AMS.I.D version 17.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | Not applicable, because the CPA is a geothermal power project. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Micro scale CPA criteria:

In case the SSC-CPA is a microscale project activity, and additionality will be demonstrated using the Guidelines for demonstrating additionality of microscale project activities (version 05). then the following criteria shall be fulfilled.

| | | |
|---|---|---|
| 1. Installed capacity of the SSC-CPA is not greater than 5MW. | Yes | The capacity of the CPA is "XXXX", which is not greater than 5MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

Small scale CPA criteria:
In case the SSC-CPA is not a micro scale project activity, and additionality will be demonstrated using the "Guidelines on the demonstration of additionality of small scale project activities" (version 09), then the following criteria shall be satisfied.

| | | |
|---|---|---|
| 1. The installed capacity of the CPA is not greater than 15MW threshold throughout the crediting period of the CPA in accordance with the "General Guidelines to SSC CDM methodologies" and relevant methodologies AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The installed capacity of the CPA is "XXXX", which is not greater than 15MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies of Guidelines on the demonstration of additionality of small scale project activities (version 09), the project activity is considered automatically additional. | Yes | Describe how the CPA is in accordance with the positive list. |
| 4. If the project activity involves technologies which are not listed under the positive list of renewable electricity generation, additionality shall be demonstrated using one of the following methods as per the "Guidelines on the demonstration of additionality of small scale project activities", (version 09):<br>• Investment barrier;<br>• Access to finance barrier;<br>• Technology barrier;<br>• Barrier due to prevailing practice; | Yes | Describe how the additionality of the project activity is demonstrated as per the "Guidelines on the demonstration of addtionality of small scale project activities", (version 09) taking in to consideration "Guidelines for objective demonstration and assessment of barriers" Version 01. |

| | | |
|---|---|---|
| • First-of-its-kind barrier<br>• Other barriers.<br>Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries3 it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries". | | |
| 5. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

Baseline emissions

The baseline emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

| | |
|---|---|
| $BE_y$ | Baseline Emissions in year *y* (t $CO_2$) |
| $EG_{BL,y}$ | Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh) |
| $EF_{CO2,grid,y}$ | $CO_2$ emission factor of the grid in year *y* (t $CO_2$/MWh) |

The emission factor can be calculated in a transparent and conservative manner as follows:
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
The weighted average emissions (in t $CO_2$/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.
Calculations shall be based on data from an official source (where available) and made publicly available.

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:

http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy
It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).
The emission factor is calculated based on the official data which is published by Rwanda DNA: **http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=**

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".
Project emissions
For most renewable power generation project activities, $PE_y$= 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2/yr$)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e/yr$)

*Fossil fuel combustion ($PE_{FF,y}$)*
For geothermal projects, which also use fossil fuels for electricity generation, $CO_2$ emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). The use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) can be neglected.
$PE_{FF,y}$ shall be calculated as per the latest version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion".

As per "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" version 02, the $CO_2$ emissions from the combustion of fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the $CO_2$ emission coefficient of those fuels, as follows:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Where:
$PE_{FC,j,y}$= Are the $CO_2$ emissions from fossil fuel combustion in process j during year y
$FC_{i,j,y}$ = Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr);
$COEF_{i,y}$= Is the $CO_2$ emission coefficient of fuel type i in year y ($tCO_2$/mass or volume unit);
i = Are the fuel types combusted in process j during the year y.

The $CO_2$ emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type i, as follows:

Option A: The $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type I, using the following approach:

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = w_{C,i,y} \times 44/12$
If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{i,y} = w_{C,i,y} \times \rho_{i,y} \times 44/12$

Where:

$w_{C,i,y}$= Is the weighted average mass fraction of carbon in fuel type I in year y (tC/mass unit of the fuel);
$\rho_{i,y}$ = Is the weighted average density of fuel type I in year y (mass unit/volume unit of the fuel).

Option B: The $COEF_{i,y}$ is calculated based on net calorific value and $CO_2$ emission factor of the fuel type i, as follows:

$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$

Where:
$NCV_{i,y}$= Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit);
$EF_{CO2,i,y}$ = Is the weighted average $CO_2$ emission factor of fuel type I in year y ($tCO_2/GJ$).

Option A should be the preferred approach, if the necessary data is available.

*Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)*
For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam. Non-condensable gases in geothermal reservoirs usually consist mainly of $CO_2$ and $H_2S$. They also contain a small quantity of hydrocarbons, including predominantly $CH_4$. In geothermal power projects, non-condensable gases flow with the steam into the power plant. A small proportion of the $CO_2$ is converted to carbonate/bicarbonate in the cooling water circuit. In addition, parts of the non-condensable gases are reinjected into the geothermal reservoir. However, as a conservative approach, this methodology assumes that all non-condensable gases entering the power plant are discharged to atmosphere via the cooling tower. Fugitive carbon dioxide and methane emissions due to well testing and well bleeding are not considered, as they are negligible.
$PE_{GP,y}$ is calculated as follows:

$$PE_{GP,y} = \left(w_{steam,CO2,y} + w_{steam,CH4,y} * GWP_{CH4}\right) * M_{steam,y}$$

Where:

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)
$w_{steam,CO2,y}$ = Average mass fraction of carbon dioxide in the produced steam in year *y* ($tCO_2$/t steam)
$w_{steam,CH4,y}$ = Average mass fraction of methane in the produced steam in year *y* ($tCH_4$/t steam)
$GWP_{CH4}$ = Global warming potential of methane valid for the relevant commitment period($tCO_2e/tCH_4$)
$M_{steam,y}$ = Quantity of steam produced in year *y* (t steam/yr)

The CPA is a geothermal power project, then

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

Leakage
No leakage emissions are considered.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2/yr$)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

### B.6.2. Data and parameters that are to be reported ex-ante

>>

| Data / Parameter: | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | --This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $EF_{grid,CM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7044 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculate baseline emissions |
| Additional comment: | - This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $GWP_{CH4}$ |
|---|---|
| Data unit: | $tCO_2e/tCH_4$ |

| | |
|---|---|
| Description: | Global warming potential of methane valid for the relevant commitment period |
| Source of data: | IPCC |
| Value(s) applied: | 25 |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | - |
| Additional comment: | - |

### B.6.3. Ex-ante calculations of emission reductions

>>

Project emissions

For the geothermal power CPAs, project emissions are accounted for as follows:

$PE_y = PE_{FF,y} + PE_{GD.y}$

Where:

$PE_y$ is project emissions in year y ($tCO_2$/yr);

$PE_{FF,y}$ is the project emission from fossil fuel consumption in year y ($tCO_2$/yr);

$PE_{GD,y}$ is the project emissions from operation of geothermal power plants due to the release of non-condensable gases in year y (tCO2/yr);

Baseline emissions

The baseline emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

| | |
|---|---|
| $BE_y$ | Baseline Emissions in year *y* (t $CO_2$) |
| $EG_{BL,y}$ | Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh) |
| $EF_{CO2,grid,y}$ | $CO_2$ emission factor of the grid in year *y* (t $CO_2$/MWh) |

Since the CPA is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Where,

$EG_{BL,y}$ is the quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh);

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

The quantity of net electricity supplied to the National grid is XXXXX MWh. According to Rwanda DNA, the CO2 emission factor of the National grid is 0.7044 tCO2e/MWh.

Leakage

No leakage emissions are considered.

Emission Reductions

The emission reductions $ER_y$ by the project activity during a given year y calculation is as follows:

$$ER_y = BE_y - PE_y$$

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

### B.7.1. Data and parameters to be monitored by each generic CPA

| Data / Parameter: | $EG_{facility,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |
| Measurement methods and procedures: | Measured on the CPA site by the meters<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | - |

| Data / Parameter: | $w_{steam,CO2,y}$ |
|---|---|
| Data unit: | $tCO_2/t$ steam |
| Description: | Average mass fraction of carbon dioxide in the produced steam in year *y* |
| Source of data: | Project activity site |
| Value(s) applied | XXXXX |
| Measurement methods and procedures: | Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The $CO_2$ and $CH_4$ sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide ($H_2S$) and carbon dioxide ($CO_2$) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including $CH_4$. All alkanes concentrations are reported in terms of methane |
| Monitoring frequency: | At least every three months and more frequently, if necessary |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

| Data / Parameter: | $w_{steam,CH4,y}$ |
|---|---|
| Data unit: | $tCH_4/t$ steam |

| | |
|---|---|
| Description: | Average mass fraction of methane in the produced steam in year *y* |
| Source of data: | Project activity site |
| Value(s) applied | XXX |
| Measurement methods and procedures: | As per the procedures outlined for $w_{steam,CO2,y}$ |
| Monitoring frequency: | As per the procedures outlined for $w_{steam,CO2,y}$ |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $M_{steam,y}$ |
| Data unit: | t steam/yr |
| Description: | Quantity of steam produced in year *y* |
| Source of data: | Project activity site |
| Value(s) applied | XXX |
| Measurement methods and procedures: | The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports |
| Monitoring frequency: | Daily |
| QA/QC procedures: | - |
| Purpose of data | Calculate the project emissions |
| Additional comment: | |

As per AMS-I.D, the project emissions from fossil fuel consumption by geothermal project should be monitored in line with "Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion". Below parameters are monitored for calculating the project emissions from fossil fuel consumption by geothermal project.

| | |
|---|---|
| Data / Parameter: | $FC_{i,j,y}$ |
| Data unit: | Mass or volume unit per year (e.g. ton/yr or $m^3$/yr) |
| Description: | Quantity of fuel type i combusted in process j during the year y |
| Source of data: | Onsite measurements |
| Value(s) applied | |
| Measurement methods and procedures: | • Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift);<br>• Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance;<br>• In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions. |
| Monitoring frequency: | Continuously |

| | |
|---|---|
| QA/QC procedures: | The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes.<br><br>Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | $W_{C,i,y}$ |
| Data unit: | tC/mass unit of the fuel |
| Description: | Weighted average mass fraction of carbon in fuel type i in year y |
| Source of data: | The following data sources may be used if the relevant conditions apply:<br>Data source / Conditions for using the data source<br>Values provided by the fuel supplier in invoices / This is the preferred source<br>Measurements by the project participants / If a) is not available |
| Value(s) applied | |
| Measurement methods and procedures: | Measurements should be undertaken in line with national or international fuel standards |
| Monitoring frequency: | The mass fraction of carbon should be obtained for each fuel delivery, from which weighted average annual values should be calculated. |
| QA/QC procedures: | Verify if the values under a) and b) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in b) should have ISO17025 accreditation or justify that they can comply with similar quality standards. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | Applicable where Option A is used in section B.6.1. |

| | |
|---|---|
| Data / Parameter: | $\rho_{i,y}$ |
| Data unit: | Mass unit/volume unit |
| Description: | Weighted average density of fuel type i in year y |

<table>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:<br><br><table><tr><td>Data source</td><td>Conditions for using the data source</td></tr><tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr><tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr><tr><td>c) Regional or national default values</td><td>If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).</td></tr></table></td></tr>
<tr><td>Value(s) applied</td><td></td></tr>
<tr><td>Measurement methods and procedures:</td><td>Measurements should be undertaken in line with national or international fuel standards.</td></tr>
<tr><td>Monitoring frequency:</td><td>The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated</td></tr>
<tr><td>QA/QC procedures:</td><td></td></tr>
<tr><td>Purpose of data</td><td>To calculate the project emissions from fossil fuel consumption by geothermal project.</td></tr>
<tr><td>Additional comment:</td><td>Applicable where Option A is used in section B.6.1 and where $FC_{i,j,y}$ is measured in a volume unit. Preferably the same data source should be used for $w_{C,i,y}$and $\rho_{i,y}$.</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Data unit:</td><td>GJ per mass or volume unit (e.g. GJ/$m^3$, GJ/ton)</td></tr>
<tr><td>Description:</td><td>Weighted average net calorific value of fuel type i in year y</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:<br><br><table><tr><td>Data source</td><td>Conditions for using the data source</td></tr><tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source if the carbon fraction of the fuel is not provided (Option A)</td></tr><tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr><tr><td>c) Regional or national default values</td><td>If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances).</td></tr><tr><td>d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr></table></td></tr>
<tr><td>Value(s) applied</td><td></td></tr>
</table>

| | |
|---|---|
| Measurement methods and procedures: | For a) and b): Measurements should be undertaken in line with national or international fuel standards. |
| Monitoring frequency: | For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account. |
| QA/QC procedures: | Verify if the values under a), b) and c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards. |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |
| Additional comment: | Applicable where Option B is used in section B.6.1. |

| | |
|---|---|
| Data / Parameter: | $EF_{CO2,i,y}$ |
| Data unit: | $tCO_2/GJ$ |
| Description: | Weighted average $CO_2$ emission factor of fuel type i in year y. |
| Source of data: | The following data sources may be used if the relevant conditions apply: |

| Data source | Conditions for using the data source |
|---|---|
| a) Values provided by the fuel supplier in invoices | This is the preferred source |
| b) Measurements by the project participants | If a) is not available |
| c) Regional or national default values | If a) is not available<br><br>These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances). |
| d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories | If a) is not available |

| | |
|---|---|
| Value(s) applied | |
| Measurement methods and procedures: | For a) and b): Measurements should be undertaken in line with national or international fuel standards |
| Monitoring frequency: | For a) and b): The CO2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.<br>For c): Review appropriateness of the values annually<br>For d): Any future revision of the IPCC Guidelines should be taken into account |
| QA/QC procedures: | |
| Purpose of data | To calculate the project emissions from fossil fuel consumption by geothermal project. |

| | |
|---|---|
| Additional comment: | Applicable where option B is used in section B.6.1.<br>For a): If the fuel supplier does provide the NCV value and the $CO_2$ emission factor on the invoice and these two values are based on measurements for this specific fuel, this $CO_2$ factor should be used. If another source for the $CO_2$ emission factor is used or no $CO_2$ emission factor is provided, Options b), c) or d) should be used. |

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the data of the parameters listed in section B.7.1 and the data will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*

Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPAimplementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing

entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

**Case 8: Small scale grid connected solar project in Rwanda**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>>
The component project activity is the installation of a small scale solar power plant with the capacity of “ XXX MW”. The CPA is located in “XXX (location) ” by “ XXX (CPA implementing entity) ”.
The CPA will generate electricity, and the electricity will be fed into the Rwanda electricity grid. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions.
The CPA will be implemented under the PoA “Renewable Energy CDM Programme of Rwanda (RECPR)” with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

### B.1. Reference of methodology(ies) and standardized baseline(s)

>>

AMS-I.D (version 17) “Grid connected renewable electricity generation”

The following methodological tools are also referred to:

- *“Tool to calculate the emission factor for an electricity system” (version 04)*

### B.2. Applicability of methodology(ies) and standardized baseline(s)

>>
The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows:

| Applicability criteria | CPA scenario |
|---|---|
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:<br>a) Supplying electricity to a national or a | The CPA is a solar power project, and the electricity generated by the CPA will be supplied to National grid, or identified users via national/regional grid through a contractual arrangement such as wheeling. |

| | |
|---|---|
| regional grid; or<br>b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. | |
| 2. This methodology is applicable to project activities that: (a) Install a new power plant at 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). | The CPA is a Greenfield plant. |
| 3. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>• The project activity is implemented in an existing reservoir with no change in the volume of reservoir;<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2. | Not applicable, because the CPA is a solar PV power project. |
| 4. 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. | Not applicable, because the CPA has no non-renewable components and doesn't co-fire fossil fuel. |
| 5. Combined heat and power (co-generation) systems are not eligible under this category. | The CPA does not involve combined heat and power. |
| 6. In the case of project activities that involve the 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 from the existing units. | Not applicable, because the CPA is a Greenfield project. |
| 7. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the | The CPA does not involve the retrofit or replacement. |

| | |
|---|---|
| limit of 15 MW. | |

In addition, if the CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, the CPA meets the applicability criteria of the "Tool to calculate the emission factor for an electricity system (version 04.0)" as follows:

| | |
|---|---|
| 1. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). | The CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, |
| 2. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country. | The project electricity system is located in Rwanda. This country is not an annex I country. |

### B.3. Sources and GHGs

According to AMS.I.D, 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."

The sources and gases included in the SSC-CPA boundary for individual solar PV CPAs is as shown in the table below:

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | No | Not applicable. The CPA is a solar PV power project. |
| | | CH4 | No | Not applicable. The CPA is a solar PV power project. |
| | | N2O | No | Not applicable. The CPA is a solar PV power project. |
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CO2 | No | Not applicable. The CPA is a solar PV power project. |
| | | CH4 | No | Not applicable. The CPA is a solar PV power project. |
| | | N2O | No | Not applicable. The CPA is a solar PV power project. |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Not applicable. The CPA is a solar PV power project. |
| | | CH4 | No | Not applicable. The CPA is a solar PV power project. |
| | | N2O | No | Not applicable. The CPA is a solar PV power project. |

### B.4. Description of baseline scenario

>>

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.

### B.5. Demonstration of eligibility for a generic CPA

>>

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | Yes | The CPA is a solar PV power project.<br><br>The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• testing/certifications;<br>• total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power project. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |

| | | |
|---|---|---|
| 6. The start date of the proposed CPA “dd/mm/yyyy” is on or after the start date of the PoA“06/05/2013”. | Yes | The earliest date of the equipment’s contracts and construction start is “DD/MM/YYYY”, so the start date of the CPA is “DD/MM/YYYY”, which is after the start date of the PoA “06/05/2013”. |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | Yes | The CPA is a grid-connected project, or connected to mini grid, or supplies to individual users. |
| 8. If Environmental Impact Assessment is required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | If applicable, Environmental Impact Assessment has been done on “DD/MM/YYYY”. |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on “DD/MM/YYYY” |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of AMS.I.D version 17.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | Not applicable, because the CPA is a solar PV power project. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Micro scale CPA criteria:

In case the SSC-CPA is a microscale project activity, and additionality will be demonstrated using the Guidelines for demonstrating additionality of microscale project activities (version 05). then the following criteria shall be fulfilled.

| | | |
|---|---|---|
| 1. Installed capacity of the SSC-CPA is not greater than 5MW. | Yes | The capacity of the CPA is "XXXX", which is not greater than 5MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

Small scale CPA criteria:
In case the SSC-CPA is not a microscale project activity, and additionality will be demonstrated using the "Guidelines on the demonstration of additionality of small scale project activities" (version 09), then the following criteria shall be satisfied.

| | | |
|---|---|---|
| 1. The installed capacity of the CPA is not greater than 15MW threshold throughout the crediting period of the CPA in accordance with the "General Guidelines to SSC CDM methodologies" and relevant methodologies AMS-I.D. version 17.0; AMS-I.F.version2.0; | Yes | The installed capacity of the CPA is "XXXX", which is not greater than 15MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies of Guidelines on the demonstration of additionality of small scale project activities (version 09), the project activity is considered automatically additional. | Yes/na | Yes, the CPA is listed under the positive list. Hence the CPA is considered automatically additional. |
| 4. If the project activity involves technologies which are not listed under the positive list of renewable electricity generation, additionality shall be demonstrated using one of the following methods as per the "Guidelines on the demonstration of additionality of small scale project activities", (version 09):<br>• Investment barrier;<br>• Access to finance barrier;<br>• Technology barrier;<br>• Barrier due to prevailing practice; | Yes/na | Describe how the additionality of the project activity is demonstrated as per the "Guidelines on the demonstration of addtionality of small scale project activities", (version 09) taking in to consideration "Guidelines for objective demonstration and assessment of barriers" Version 01. |

| | | |
|---|---|---|
| • First-of-its-kind barrier<br>• Other barriers.<br>Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries3 it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries". | | |
| 5. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

Baseline emissions

The baseline emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

| | |
|---|---|
| $BE_y$ | Baseline Emissions in year *y* (t $CO_2$) |
| $EG_{BL,y}$ | Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh) |
| $EF_{CO2,grid,y}$ | $CO_2$ emission factor of the grid in year *y* (t $CO_2$/MWh) |

The emission factor can be calculated in a transparent and conservative manner as follows:
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
The weighted average emissions (in t CO2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.
Calculations shall be based on data from an official source (where available) and made publicly available.

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is

found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy
It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).
The emission factor is calculated based on the official data which is published by Rwanda DNA: **http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=**

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".
Project emissions
For solar PV CPAs, $PE_y$= 0.

Leakage
No leakage emissions are considered.

Emission reductions
Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2/yr$)

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

### B.6.2. Data and parameters that are to be reported ex-ante

>>

| Data / Parameter: | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |

| | |
|---|---|
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | --This value is determined and fixed ex-ante for the first crediting period. |

| | |
|---|---|
| Data / Parameter: | $EF_{grid,CM,y}$ |
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7063 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | - This value is determined and fixed ex-ante for the first crediting period. |

### B.6.3. Ex-ante calculations of emission reductions

>>

Project emissions

For solar PV power CPAs, project emissions are zero.

Baseline emissions

The baseline emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

$BE_y$ Baseline Emissions in year *y* (t $CO_2$)

$EG_{BL,y}$ Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,grid,y}$ $CO_2$ emission factor of the grid in year *y* (t $CO_2$/MWh)

Since the CPA is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Where,

$EG_{BL,y}$ is the quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh);

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

The quantity of net electricity supplied to the National grid is XXXXX MWh. According to Rwanda DNA, the CO2 emission factor of the National grid is 0.7063 tCO2e/MWh.

Leakage

There is no energy generating equipment transferred from another activity, so no leakage emissions are considered.

Emission Reductions

The emission reductions $ER_y$ by the project activity during a given year y calculation is as follows:

$$ER_y = BE_y - PE_y$$

If the power density is greater than 10W/m2, then

$$ER_y = 0.7063 * EG_{facility,y}$$

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

### B.7.1. Data and parameters to be monitored by each generic CPA

| Data / Parameter: | $EG_{facility,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |
| Measurement methods and procedures: | Measured on the CPA site by the meters<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | - |

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

*Coordinating/managing entity*

Upon receipt of data and information from the CPA implementing entity, the CME will carry out a

quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.
During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

**Case 9: Small scale grid connected hydro project in Rwanda (Greenfield)**

## SECTION A. General description of a generic CPA

### A.1. Purpose and general description of generic CPAs

>>
The component project activity is the installation of a small scale hydro power plant with the capacity of “XXX MW”. The CPA is located in “XXX (location)” by “XXX (CPA implementing entity)”.
The CPA will generate electricity, and the electricity will be fed into the Rwanda electricity grid. By displacing fossil fuel based electricity, the project activity will lead to GHG emission reductions. The CPA will be implemented under the PoA “Renewable Energy CDM Programme of Rwanda (RECPR)” with the CME as DG Works Ltd.

## SECTION B. Application of a baseline and monitoring methodology and standardized baseline

### B.1. Reference of methodology(ies) and standardized baseline(s)

>>

AMS-I.D (version 17) "Grid connected renewable electricity generation"

The following methodological tools are also referred to:
*"Tool to calculate the emission factor for an electricity system" (version 04)*
*"Tool to calculate project or leakage $CO_2$ emissions from fossil fuel combustion" (version 02)*

### B.2. Applicability of methodology(ies) and standardized baseline(s)

>>

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows:

| Applicability criteria | CPA scenario |
|---|---|
| 1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:<br>a) Supplying electricity to a national or a regional grid; or<br>b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. | The CPA is a hydro power project, and the electricity generated by the CPA will be supplied to National grid, or identified users via national/regional grid through a contractual arrangement such as wheeling. |
| 2. This methodology is applicable to project activities that: (a) Install a new power plant at 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). | The CPA is a Greenfield plant. |
| 3. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>• The project activity is implemented in an existing reservoir with no change in the volume of reservoir;<br>• The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;<br>• The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater | In the case that the CPA involves reservoirs, the power density of the CPA is "XXXXX", which is greater than 4 W/m2. |

| | |
|---|---|
| than 4 W/m2. | |
| 4. 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. | Not applicable. The CPA has no non-renewable components and doesn't co-fire fossil fuel. |
| 5. Combined heat and power (co-generation) systems are not eligible under this category. | The CPA does not involve combined heat and power. |
| 6. In the case of project activities that involve the 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 from the existing units. | Not applicable. |
| 7. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW. | The CPA does not involve the retrofit or replacement. |

In addition, if the CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, the CPA meets the applicability criteria of the Tool to calculate the emission factor for an electricity system (version 04.0) as follows:

| | |
|---|---|
| 1. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects). | The CPA supplies electricity to the National grid or the CPA results in saving of electricity that would have been provided by the grid, |
| 2. The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country. | The project electricity system is located in Rwanda. This country is not an annex I country. |

**B.3. Sources and GHGs**

According to AMS.I.D, 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."

The sources and gases included in the SSC-CPA boundary for individual hydro CPAs is as shown in the table below:

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | CO2 | Yes | Main emission source |
| | | CH4 | No | Minor emission source |
| | | N2O | No | Minor emission source |
| Project activity | For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam | CO2 | No | Not applicable. The CPA is a hydro power project. |
| | | CH4 | No | Not applicable. The CPA is a hydro power project. |
| | | N2O | No | Not applicable. The CPA is a hydro power project. |
| | CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants | CO2 | No | Not applicable. The CPA is a hydro power project. |
| | | CH4 | No | Not applicable. The CPA is a hydro power project. |
| | | N2O | No | Not applicable. The CPA is a hydro power project. |
| | For hydro power plants, emissions of CH4 from the reservoir | CO2 | No | Minor emission source |
| | | CH4 | Yes | It is included if the power density of the CPA is between 4W/m2 and 10 W/m2. |
| | | N2O | No | Minor emission source |

### B.4. Description of baseline scenario

>>

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.

### B.5. Demonstration of eligibility for a generic CPA

>>

General criteria:

| Criteria | Eligible or not | Justification |
|---|---|---|
| 1. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal. The proposed CPA comprises of only one type of renewable energy technology: either hydro or solar PV or geothermal as per section A.6. The capacity of small scale projects will be equal to or lower than 15 MW, and the capacity of above large scale projects will be above 15 MW. All of the projects are fixed operation ones. All project activities will meet the criteria of the applied methodology(ies). | Yes | The CPA is a hydro power project.<br><br>The CPA entity provides evidence to prove:<br>• Specifications of technology/measure<br>• Testing/certifications;<br>• Total capacity of each CPA will not exceed applied methodology specifications.<br><br>Evidence provided includes but not limited to the following:<br>• Detailed Project Report<br>• Technology Specification provided by the technology supplier<br>• Purchase order copies<br>• Power purchase agreement |

| | | |
|---|---|---|
| 2. The proposed CPA is located at a site where there was no renewable energy power plant operating prior to the implementation of the proposed CPA. The CPA included is only Greenfield project. | Yes | The CPA is a Greenfield power project. |
| 3. The proposed CPA is located in Rwanda. | Yes | The CPA is located in Rwanda as per GPS coordinates of CPA activity. |
| 4. The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. | Yes. | The CPA owner has entered into a contractual agreement with DG Works Ltd at the CPA level. |
| 5. Conditions for avoiding double counting: The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. The procedure to avoid double counting is further explained in Section C of this document. | Yes | The CPA has not yet been included in another PoA, is not under validation or has not yet been registered as a single CDM project activity. Signed confirmation from the entity implementing the CPA. The CME also crosschecked with DNA before inclusion. The CPA has unique identification and serial number. The CME also checked carbon markets CERs/VERs registries. |
| 6. The start date of the proposed CPA“dd/mm/yyyy” is on or after the start date of the PoA“06/05/2013”. | Yes | The earliest date of the equipment’s contracts and construction start is “DD/MM/YYYY”, so the start date of the CPA is “DD/MM/YYYY”, which is after the start date of the PoA “06/05/2013”. |
| 7. The CPA could either be grid-connected, connected to mini grid where in the baseline all generators use exclusively fuel oil and/or diesel fuel, or individual users | Yes | The CPA is a grid-connected project, or connected to mini grid, or supplies to individual users. |
| 8. If Environmental Impact Assessment is required according to the laws and regulations of Rwanda, the CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations. | Yes | If applicable, Environmental Impact Assessment has been done on “DD/MM/YYYY”. |
| 9. The CPA has carried out a local stakeholder consultation. | Yes | The local stakeholder consultation was completed on “DD/MM/YYYY” |
| 10. The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development assistance", is separate from, and is not counted towards the | Yes | The CPA has not received funding from Annex I party that results in a diversion of official development assistance. In cases where public funding from Parties included in Annex 1 is involved in CPA, CPA entities shall provide an affirmation obtained from Parties included in Annex 1 that such funding does not result in a diversion of official development |

| | | |
|---|---|---|
| financial obligations of those Parties. | | assistance", is separate from, and is not counted towards the financial obligations of those Parties. |
| 11. The CPA shall meet the applicability requirements of all the relevant CDM methodologies: ACM0002 version 15.0.0;AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The CPA meets the applicability requirements of AMS.I.D version 17.0. The details see the section B.2 |
| 12. In case of hydro power plants, the power density of the CPA project activity shall be greater than 4 W/m2. | Yes | In the case that the CPA involves reservoirs, the power density of the CPA is calculated to be “XXXX”, which is greater than 4 W/m2. |
| 13. Implement a record keeping system and a procedure to avoid double accounting as described in section C of PoA-DD. | Yes | A record keeping system and a procedure to avoid double accounting has been implemented as per section C of the PoA-DD. |
| 14. The monitoring plan of the CPA is stated and discussed at CPA level. The monitoring plan of the CPA should include sustainable development criteria listed in the letter of approval by DNA of RWANDA. | Yes | All the sustainable development criteria in the LoA have been included in the monitoring plan. |

Micro scale CPA criteria:
In case the SSC-CPA is a microscale project activity, and additionality will be demonstrated using the Guidelines for demonstrating additionality of microscale project activities (version 05). then the following criteria shall be fulfilled.

| | | |
|---|---|---|
| 1. Installed capacity of the SSC-CPA is not greater than 5MW. | Yes | The capacity of the CPA is “XXXX”, which is not greater than 5MW. |
| 2. In order to determine the occurrence of de-bundling in accordance with the “Guidelines on assessment of de-bundling for SSC project activities” version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the “Guidelines on assessment of de-bundling for SSC project activities” version 03 |
| 3. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

Small scale CPA criteria:
In case the SSC-CPA is not a microscale project activity, and additionality will be demonstrated using the “Guidelines on the demonstration of additionality of small scale project activities” (version 09), then the following criteria shall be satisfied.

| | | |
|---|---|---|
| 1. The installed capacity of the CPA is not greater than 15MW threshold throughout the crediting period of the CPA in accordance with the “General Guidelines to SSC CDM methodologies” and relevant methodologies AMS-I.D.version 17.0; AMS-I.F.version2.0; | Yes | The installed capacity of the CPA is “XXXX”, which is not greater than 15MW. |

| | | |
|---|---|---|
| 2. In order to determine the occurrence of de-bundling in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03, the CPA shall satisfy the conditions as per the guidelines. | Yes | Describe how the CPA is in accordance with the "Guidelines on assessment of de-bundling for SSC project activities" version 03 |
| 3. If the project activity involves technologies which are listed under the positive list of renewable electricity generation technologies of Guidelines on the demonstration of additionality of small scale project activities (version 09), the project activity is considered automatically additional. | Yes or na. | Describe whether the CPA is included in the positive list. |
| 4. If the project activity involves technologies which are not listed under the positive list of renewable electricity generation, additionality shall be demonstrated using one of the following methods as per the "Guidelines on the demonstration of additionality of small scale project activities", (version 09):<br>• Investment barrier;<br>• Access to finance barrier;<br>• Technology barrier;<br>• Barrier due to prevailing practice;<br>• First-of-its-kind barrier<br>• Other barriers.<br>Rwanda is a Least Developed Country, guideline 7 of the "Guidelines for objective demonstration and assessment of barriers" Version 01 (EB50 Annex 13) is applicable: "For projects in Least Developed Countries3 it is sufficient to transparently describe the relevant barriers, as less stringency is needed with regards to data availability in the actual demonstration of barrier, as compared to the projects in other countries". | Yes or na | Describe how the additionality of the project activity is demonstrated as per the "Guidelines on the demonstration of addtionality of small scale project activities", (version 09) taking in to consideration "Guidelines for objective demonstration and assessment of barriers" Version 01. |
| 5. The energy generating equipment employed by the CPA is not transferred from another activity. | Yes | No energy generating equipment by the CPA is transferred from another activity. |

## B.6. Estimation of emission reductions of a generic CPA

### B.6.1, Explanation of methodological choices

>>

Baseline emissions

The baseline emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

$BE_y$ Baseline Emissions in year *y* (t $CO_2$)

$EG_{BL,y}$ Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,grid,y}$ $CO_2$ emission factor of the grid in year *y* (t $CO_2$/MWh)

The emission factor can be calculated in a transparent and conservative manner as follows:
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
The weighted average emissions (in t CO2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.
Calculations shall be based on data from an official source (where available) and made publicly available.

According to"Tool to calculate the emission factor for an electricity system", the most recent data available at the time of submission of the project to the DOE for validation should be used for calculating the grid emission factor. The PoA DD was published for global stakeholder consultation (GSC) on 05/09/2013. The most recent available grid emission factor was published on 27/07/2010 by Rwanda DNA with data vintage from year 2005-2009:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=

Rwanda DNA invited tender for calculation of the 2010 grid emission factor on 3 November 2011 while there is no update until now without any explanation:
http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=37&Itemid=

Energy, Water and Sanitation Authority (EWSA) is the sole national utility distributing power and water in Rwanda, the data used for grid emission factor calculation are provided by EWSA. It is found from EWSA website that the power plant installed capacity data were updated on 23/06/2013 and the year of operation of power plant was also only updated until 2009:
http://www.ewsa.rw/index.php/En/products-services/energy/generation-energy
It is concluded from above descriptions that the grid emission factor made publicly available by Rwanda DNA on 27/07/2010 was most recent available at the time of GSC of the PoA DD. There are no newer complete utility or government records or official publications available in Rwanda, the necessary data, such as power generation, installed capacity, fuel consumption etc., used for grid emission factor calculation are not publicly available for PP to calculate an updated grid emission factor.

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor ($EF_{grid,CM,y}$) must be calculated for the purpose of calculating baseline emissions. The baseline emission factor is equal to the combined margin: an equally weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$).
The emission factor is calculated based on the official data which is published by Rwanda DNA: **http://www.rema.gov.rw/dna/index.php?option=com_docman&task=doc_details&gid=24&Itemid=**

The ex ante option is chosen for the PoA, the grid emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required according to "Tool to calculate the emission factor for an electricity system".
Project emissions
For most renewable power generation project activities, $PE_y$= 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using the following equation:

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

Where:

$PE_y$ = Project emissions in year *y* ($tCO_2e/yr$)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* ($tCO_2/yr$)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* ($tCO_2e/yr$)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* ($tCO_2e/yr$)

The CPA is a hydro power project, and there is no fossil fuel involved in the project, so $PE_{FF,y}$ and $PE_{GP,y}$ are zero. As per the methodology, in the case that the CPA involves reservoirs, the power density of the CPA is "XXXX", which is greater than 10W/m2, hence the $PE_{HP,y}$ is zero. Therefore, the $PE_y$ of the CPA is zero.

Or

If the power density of the CPA is less than 10W/m2 and greater than 4W/m2, then the $PE_{HP,y}$ is calculated as below:

$$\mathrm{PE}_{\mathrm{HP,y}} = \frac{EF_{\mathrm{Res}} * TEG_y}{1000}$$

Where:

$\mathrm{PE}_{\mathrm{HP,y}}$ = Project emissions from water reservoirs ($tCO_2e/yr$)

$EF_{\mathrm{Res}}$ = Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$)

$TEG_y$ = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

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

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

Where:

$PD$ = Power density of the project activity ($W/m^2$)

$Cap_{PJ}$ = Installed capacity of the hydro power plant after the implementation of the project activity (W)

$Cap_{BL}$ = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

$A_{PJ}$ = Area of the 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

Leakage

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

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$ = Emission reductions in year *y* ($tCO_2e/yr$)

$BE_y$ = Baseline emissions in year *y* ($tCO_2$/yr)

$PE_y$ = Project emissions in year *y* ($tCO_2e$/yr)

### B.6.2. Data and parameters that are to be reported ex-ante

>>

| Data / Parameter: | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Operating Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7082 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | -This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7007 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | --This value is determined and fixed ex-ante for the first crediting period. |

| Data / Parameter: | $EF_{grid,CM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Combined Margin emission factor for National grid |
| Source of data: | Referred to the 2009 National grid emission factor |
| Value(s) applied: | 0.7044 |
| Choice of data or Measurement methods and procedures: | Published by Rwanda DNA |
| Purpose of data | To calculatebaseline emissions |
| Additional comment: | - This value is determined and fixed ex-ante for the first crediting period. |

| 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: | 0 |

| | |
|---|---|
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs |

| | |
|---|---|
| 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 ($m^2$). For new reservoirs, this value is zero |
| Source of data: | Project site |
| Value(s) applied: | 0, and it will be measured at CPA level. |
| Choice of data or Measurement methods and procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | - Only applicable when the CPA involves reservoirs |

### B.6.3. Ex-ante calculations of emission reductions

>>

Project emissions

For hydro power CPAs, project emissions are accounted for as follows:

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

Where:

$PE_y$ is project emissions in year y ($tCO_2$/yr);

$PE_{FF,y}$ is the project emission from fossil fuel consumption in year y ($tCO_2$/yr);

$PE_{GD,y}$ is the project emissions from operation of geothermal power plants due to the release of non-condensable gases in year y ($tCO_2$/yr);

$PE_{HP,y}$ is the project emissions from water reservoirs of hydropower plants in year y ($tCO_2$/yr).

Therefore, for a new hydropower project, the project emission should be: $PE_y = PE_{HP,y}$.

According to ACM0002, the power density of the project is calculated as follows:

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

Where:

$Cap_{PJ}$ is the installed capacity of the hydropower plant after the implementation of the project activity (W);

$Cap_{BL}$ is the installed capacity of the hydropower plant before the implementation of the project activity (W); because the project results a new hydropower station, the $Cap_{BL}$ of the project is zero.

$A_{PJ}$ is the area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full ($m^2$).

$A_{BL}$ is the area of the reservoir measured in the surface of the water, before the implementation of the project activity, the $A_{BL}$ of the project is zero.

If the power density of the single or multiple reservoirs (PD) is greater than $4W/m^2$ and less than or equal to $10\ W/m^2$

$PE_{HP,y}=EF_{Res}*TEG_y/1000$

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs (tCO2e/yr)
$EF_{Res}$ = Defaultemission factor for emissions from reservoirs of hydro power plants in year y ($kgCO_2e/MWh$)
$TEG_y$ = total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y(MWh)
If the power density of the project activity (PD) is greater than $10W/m^2$
$PE_{HP,y}=0$

Baseline emissions

The baseline emissions are the product of electrical energy baseline expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$$

Where:

| | |
|---|---|
| $BE_y$ | Baseline Emissions in year *y* (t $CO_2$) |
| $EG_{BL,y}$ | Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh) |
| $EF_{CO2,grid,y}$ | $CO_2$ emission factor of the grid in year *y* (t $CO_2$/MWh) |

If the CPA is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield power plant), therefore:

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

Where,

$EG_{BL,y}$ is the quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh);

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

The quantity of net electricity supplied to the National grid is XXXXX MWh. According to Rwanda DNA, the CO2 emission factor of the National grid is 0.7044 tCO2e/MWh.

Leakage
No leakage emissions are considered.
Emission Reductions
The emission reductions $ER_y$ by the project activity during a given year y calculation is as follows:

$$ER_y = BE_y - PE_y$$

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

#### B.7.1. Data and parameters to be monitored by each generic CPA

| Data / Parameter: | $EG_{facility,y,}$ |
|---|---|
| Data unit: | MWh |
| Description: | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y |
| Source of data: | Electricity meter (s) |
| Value(s) applied | Specific to CPA |

| | |
|---|---|
| Measurement methods and procedures: | Measured on the CPA site by the meters<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Measured continuously and recorded monthly |
| QA/QC procedures: | The meters will be periodically checked according to the relevant national electric industry standard and regulations; Power supplied to the grid will be double checked according to electricity sales invoice. |
| Purpose of data | Calculate the baseline emission |
| Additional comment: | |

| | |
|---|---|
| Data / Parameter: | TEGy |
| Data unit: | MWh/yr |
| Description: | Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y |
| Source of data: | Project activity site |
| Value(s) applied | "XXXXXX" |
| Measurement methods and procedures: | Electricity meters<br>Electricity meters complying with relevant industry standards in the country. |
| Monitoring frequency: | Continuous measurement and at least monthly recording |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs, and applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2. |

| | |
|---|---|
| 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 site |
| Value(s) applied | "XXXX" |
| Measurement methods and procedures: | Determine the installed capacity according to the nameplates or equipments contracts of turbines and generators. |
| Monitoring frequency: | Yearly |
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs |

| | |
|---|---|
| Data / Parameter: | $A_{PJ}$ |
| Data unit: | m2 |
| Description: | Area of the single or run-of-river 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 | "XXXX" |
| Measurement methods and procedures: | Measure from topographical surveys, maps, satellite pictures, measurement by the third party, etc. |
| Monitoring frequency: | yearly |

| | |
|---|---|
| QA/QC procedures: | - |
| Purpose of data | Calculate the power density |
| Additional comment: | Only applicable when the CPA involves reservoirs |

### B.7.2. Description of the monitoring plan for a generic CPA

>>

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. The following monitoring procedures and responsibilities will apply:

*CPA implementing entity*

The CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

Metering will be conducted with calibrated measurement equipment according to the national standards and reference points or other standards as agreed with the grid operator.

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes.

If the power density is applicable, the installed capacity and surface area of reservoir will be monitored by the CPA implementing entity, and the result of the power density will be reported to the CME within three months after the commissioning of the CPA.

The CPA will keep electronic copies of all CDM related data at its headquarters, at least until two yearsafter the end of the last crediting period.

*Coordinating/managing entity*

Upon receipt of data and information from the CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.
All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

In addition to collecting, processing and archiving data and information from the CPA implementing

entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.

During the construction period of the CPA, the CME should check the relevant documents, contracts or project pictures to make sure that sustainable development criteria 1 “Any banned substances that deplete the ozone layer are not used”, criteria 2 “Classified forests shall be protected against any form of degradation or destruction from licensed or unlicensed utilization” and criteria 4 “technology transfer and capacity development regarding the technology will occur” which are listed in the letter of approval of the PoA by Rwanda DNA are fulfilled.
During the operation period of the CPA, the CME should yearly check the workers contracts or relevant documents to make sure that sustainable development criteria 3”Health and safety regulation is followed or exceeded resulting in the protection of human health” which is listed in the letter of approval of the PoA by Rwanda DNA is fulfilled.
Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

# Appendix 1. Contact information of coordinating/managing entity and responsible person(s)/ entity(ies)

| CME and/or responsible person/ entity | ☒ CME<br>☐ Responsible person/ entity for application of the selected methodology(ies) and, where applicable, the selected standardized baseline(s) to the PoA |
|---|---|
| **Organization** | DG Works Ltd |
| **Street/P.O. Box** | P.O.Box 5020 |
| **Building** | |
| **City** | Kigali |
| **State/Region** | |
| **Postcode** | |
| **Country** | Rwanda |
| **Telephone** | +250 786340041 |
| **Fax** | |
| **E-mail** | g.kochaniewicz@gmx.de |
| **Website** | |
| **Contact person** | Grzegorz Kochaniewicz |
| **Title** | Dr. |
| **Salutation** | Mr |
| **Last name** | Kochaniewicz |
| **Middle name** | Jozef |

# Appendix 2. Affirmation regarding public funding

Not applicable.

# Appendix 3. Applicability of methodology(ies) and standardized baseline(s)

Not applicable.

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

Not applicable.

# Appendix 5. Further background information on the monitoring plan

Not applicable.

# Appendix 6. Summary of post registration changes

Not applicable.

- - - - -

**Document information**

| *Version* | *Date* | *Description* |
|---|---|---|
| 04.1 | 5 August 2014 | Editorial revision to correct the document information table. |
| 04.0 | 25 June 2014 | Revisions to:<br>• 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));<br>• Include provisions related to standardized baselines;<br>• 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;<br>• Add general instructions on post-registration changes in paragraph 2 and 3 of general instructions and **Error! Reference source not found.**;<br>• Change the reference number from *F-CDM-PoA-DD* to *CDM-PoA-DD-FORM*;<br>• Editorial improvement. |
| 03.0 | 3 December 2012 | EB 70<br>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<br>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<br>Initial adoption. |

| *Version* | *Date* | *Description* |
|---|---|---|

Decision Class: Regulatory
Document Type: Form
Business Function: Registration
Keywords: programme of activities, project design document