



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

**(Version 05.0)**

*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:** Gigawatt Global Programme of Activities

**Version number of the PoA-DD:** Version 05

**Completion date of the PoA-DD:** 08/10/2015

**Coordinating/ managing entity:** Gigawatt Global Coöperatief U.A.

**Host Party(ies) :** Rwanda (host)

**Sectoral scope(s) and selected methodology(ies), and where applicable, selected standardized baseline(s):** Scope 1: Energy industries (renewable- / non-renewable sources)

Methodologies: ACM0002 *Grid-connected electricity generation from renewable sources* (version 16.0) and AMS-I.D *Grid connected renewable electricity generation* (version 18.0).

No Standardized methodology has been selected for this PoA

## PART I. Programme of activities (PoA)

### SECTION A. General description of PoA

#### A.1. Title of the PoA

**Title:** Gigawatt Global Programme of Activities

**Version:** Version 05

**Date:** 08/10/2015

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

The purpose of the Gigawatt Global Programme of Activities (hereafter referred as the PoA) is to support the development and implementation of utility scale solar photovoltaic (PV) projects in Rwanda, thereby displacing grid-connected, fossil fuel based electricity generation, by promoting grid-connected renewable energy based electricity generation. As such, the PoA will contribute in reduction of greenhouse gas (GHG) emissions.

Despite the energy sector reforms that have taken place since the late 1990s in East Africa, renewable energy projects continue to face considerable barriers, including lack of finance, inadequate tariffs and high cost of capital. Those barriers are further explained in section B.1. Most projects have also found it difficult to access the opportunities provided by the Clean Development Mechanism (CDM) because of the high transaction cost and long development times. Gigawatt Global Cooperatief U.A. is, therefore, establishing a CDM Programme of Activities (PoA), which will reduce CDM transaction costs and facilitate the route to market for Certified Emission Reductions (CERs) generated by solar PV projects in Rwanda. This will ensure that financial viability of projects will be enhanced and access to capital facilitated.

The technology included in the Programme of Activities is solar photovoltaic (PV). The programme focuses on Greenfield renewable energy projects. Therefore, CO<sub>2</sub> is the main and only type of GHG included in the PoA due to the substitution of fossil fuel based generated electricity in the baseline scenario. Since the PoA will involve the implementation of solar PV power plants, the project activities will correspond to sectoral scope 1: Energy industries (renewable- / non-renewable sources) and will apply either the approved large-scale consolidated methodology ACM0002 *Grid-connected electricity generation from renewable sources* (version 16.0) or the simplified baseline and monitoring small-scale methodology AMS-I.D *Grid connected renewable electricity generation* (version 18.0).

For the large-scale CPAs under the programme, the baseline scenario is derived from the approved large-scale consolidated methodology ACM0002 version 16.0 which states that the baseline scenario is "Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system*." Likewise, the baseline scenario for small-scale CPAs under the programme is derived from the small-scale simplified baseline and monitoring methodology AMS-I.D version 18.0 which states that "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"

According to the utility company, Rwanda Energy Group Limited (REG), formerly known as Energy Water and Sanitation (EWSA)<sup>1</sup>, by June 2013, the electricity generation was dominated by thermal power plants accounting for about 58.7% of the total generation followed by hydropower at 41.2% and a very small fraction of 0.1% accounting for solar photovoltaic (PV)<sup>2</sup>. At this time, the total installed capacity reached 110 MW<sup>3</sup> and an available capacity ranging between 80MW and 92 MW. The government of Rwanda launched the Economic Development and Poverty Reduction Strategy II (EDPRS II), 2013-2018 with a purpose to boost economic growth. Under this policy document, the government aims to increase the installed capacity to over 563 MW by 2017/18. This target has since been further revised in the Rwanda National Energy Policy and Strategy (2011) to envision an increased generation capacity of over 1GW by 2017.<sup>4</sup> A large share of this capacity is anticipated to come from renewable sources<sup>5</sup>. In this context, the baseline scenario is therefore the same as the scenario existing prior to the start of the implementation of individual component project activities under the PoA.

Further information regarding the existing and planned power plants is given in section B.4 in each generic CPA.

### ***Framework for the implementation of the proposed PoA***

Gigawatt Global Cooperatief U.A. hereinafter referred to as “Gigawatt Global” will act as the Coordinating/Managing Entity (CME) for the PoA. The CME will be responsible for:

- Development of the PoA Design Document (CDM-PoA-DD) and CDM Component Project Activity (CPA) Design Documents (CDM-CPA-DD) for CPAs that are developed under the Programme of Activities;
- Obtaining a Letter of Approval for the implementation of the PoA from the host country;
- Obtaining a Letter of Authorization of the coordination of the PoA from the host country;
- Liaise with the Designated National Authority (DNA) on matters related to the implementation of the PoA and inclusion of CPAs;
- Carry out a quality check on CPAs to be included in the Programme of Activities ensure that the CPA meets all the eligibility criteria as formulated in the PoA-DD;
- Collect and compile monitoring records from all the CPA entities;
- Coordinate monitoring activities and data management during the lifetime of the PoA;
- Contract a DOE for validation and verification purposes;
- Prepare and submit monitoring reports and facilitate the verification of the same;
- Act as the focal point with the CDM Executive Board for matters related to the PoA;
- During the lifetime of the PoA, maintenance of all monitoring reports of all CPAs in accordance with record keeping systems outlined in the CDM-PoA-DD.

CPA entities will be responsible for the implementation of individual CPAs under the PoA and will:

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<sup>1</sup> As part of the energy sector reforms, the utility company Energy Water and Sanitation (EWSA) has been split into two separate and independent companies namely Rwanda Energy Group Limited (REG) and the Water and Sanitation Corporation Limited (WASAC) in charge of grid electricity and water resources respectively. However, since EWSA was the utility company at the time of writing the baseline, some sections of the document will maintain reference to EWSA as the utility company.

<sup>2</sup> Electricity data provided by EWSA for the period 2009 - 2013

<sup>3</sup> RURA annual report 2012/2013

<sup>4</sup> There are various sources indicating different electricity generation targets within this duration. However, in order to be in line with the government laws and policies, we have only referenced official government documents that are publicly available.

<sup>5</sup> Republic of Rwanda, Ministry of Infrastructure National Energy Policy and Strategy pg 70-71

- Ensure that the described CPA is implemented;
- Operate and maintain the CPA for the duration of the project;
- Keep records of parameters as per the monitoring plan and provide hard and electronic records to the CME on a regular basis and provide the CME and DOE with required documents and access to sites as needed;
- Make available staff for validation and verification where applicable.

The CME will enter into contractual agreements with all CPA entities as a precedent to inclusion into the programme. The agreements will summarize roles and responsibilities regarding the implementation of the individual projects as CPAs. The agreements will ensure that the CME will have control of all records and information related to the implementation of individual CPAs and will be in a position to ensure that each CPA is being implemented according to the provisions as outlined in the PoA-DD. The agreement will also put in place measures, which avoid double counting of the proposed CPA.

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

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

***Contribution to sustainable development***

The PoA is expected to contribute to sustainable development in the following ways:

- The programme is expected to support projects that will provide reliable electricity to the national electricity grid. This is in line with Rwanda's Vision 2020, which places infrastructural advancement and energy generation as one of the pillars that are necessary in transforming Rwanda to a middle income earning economy.<sup>6</sup>
- The programme is expected to support projects that will provide local employment opportunities during the construction and operation phase.
- The programme is expected to support projects that will improve the hydrocarbon trade balance through reduction of oil imports used for electricity generation.
- The programme is expected to support projects that will result in the transfer of state-of-the-art technology in utility scale power generation from solar PV sources to the Rwandan population. The transfer of technology and know-how will be directly replicable to other future solar PV energy projects.

**A.3. CME and participants of PoA**

Gigawatt Global Coöperatief U.A. will act as the coordinating/managing entity. There is no other project participant but the CME.

**A.4. Party(ies)**

| Name of Party involved ("host" indicates host Party) | Private and/or public entity(ies) project participants, CME (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|------------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Rwanda (host)                                        | Gigawatt Global Coöperatief U.A.                                            | No                                                                                     |

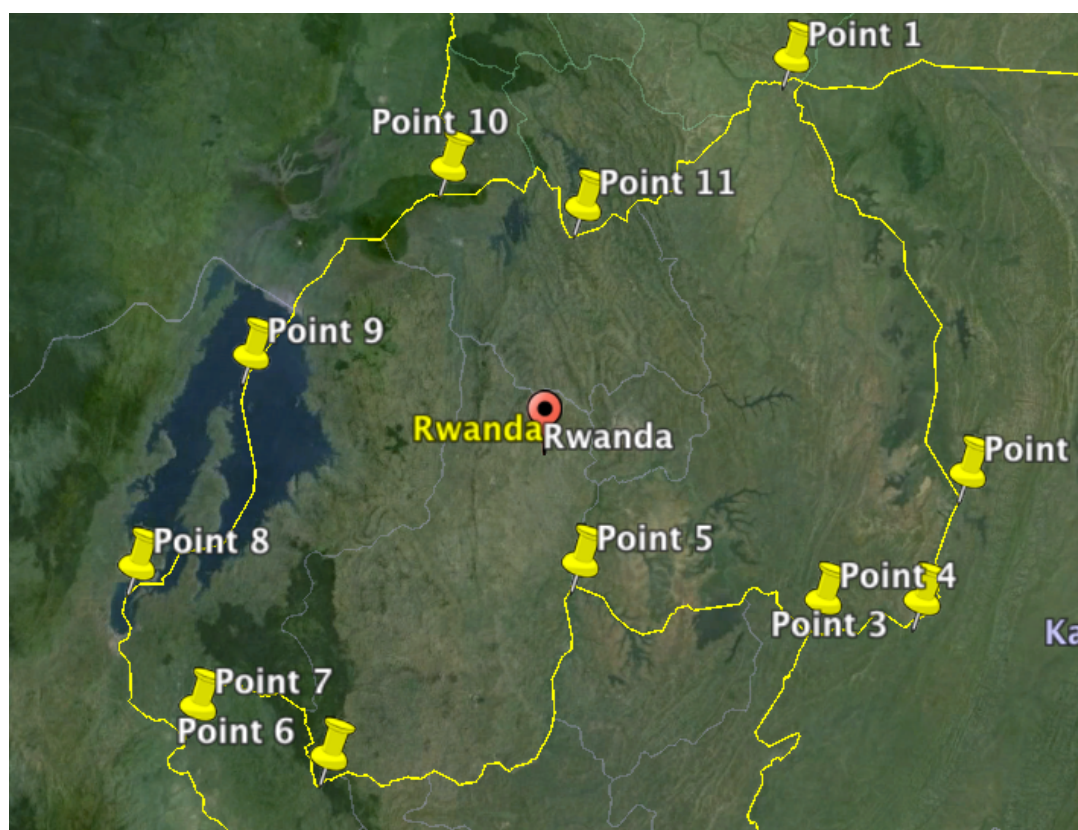
**A.5. Physical/ Geographical boundary of the PoA**

<sup>6</sup> Republic of Rwanda (2000), Rwanda Vision 2020

The geographical area within which component project activities (CPAs) included in the PoA will be implemented is defined by the national boundaries of the Host Country, Rwanda.

Rwanda ratified the Kyoto Protocol on 22<sup>nd</sup> July 2004. The Designated National Authority is Rwanda Environment Management Authority (REMA).

The geographic boundaries and coordinates of Rwanda are shown in Table 1 and **Figure 1** below.



**Figure 1: Geographic boundaries of the Republic of Rwanda**

See below the geographical coordinates of the points marked:

**Table 1: Rwanda geographical coordinates**

| Name     | Latitude   | Longitude  |
|----------|------------|------------|
| Point 1  | -1.075833° | 30.424167° |
| Point 2  | -2.085556° | 30.894722° |
| Point 3  | -2.398333° | 30.794167° |
| Point 4  | -2.409167° | 30.553889° |
| Point 5  | -2.347222° | 29.959444° |
| Point 6  | -2.838611° | 29.375278° |
| Point 7  | -2.735278° | 29.050000° |
| Point 8  | -2.404722° | 29.878889° |
| Point 9  | -1.879167° | 29.126944° |
| Point 10 | -1.394444° | 29.587500° |
| Point 11 | -1.476389° | 29.923611° |

In line with paragraph 150 of the CDM Project Cycle Procedures version 09.0 and paragraph 25 of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0) the programme boundary might be amended as a post-registration change to include additional Host Parties.

## A.6. Technologies/measures

CPAs under the PoA will use renewable energy technologies to generate electricity. The renewable energy technologies and measures to be employed by each CPA will be of solar photovoltaic (PV) type. The following five CPA types will be included in the PoA:

- Greenfield small-scale solar PV power plants/units in Rwanda applying automatic additionality
- Greenfield large-scale solar PV power plants/units in Rwanda applying first-of-its-kind analysis
- Greenfield large-scale solar PV power plants/units in Rwanda applying investment analysis
- Greenfield large-scale solar PV power plants/units in Rwanda applying barrier analysis
- Greenfield large-scale solar PV power plants/units in Rwanda applying automatic additionality

Each CPA will be given a unique name based on the location where the project will be implemented and the installed capacity of the CPA. The following standardized approach will be used:

- [name of location] [installed capacity] Solar PV Project

Upon inclusion in the PoA, each CPA will receive a unique reference number. The geographical coordinates of the CPA will be provided in section A.7 of the CPA-DD.

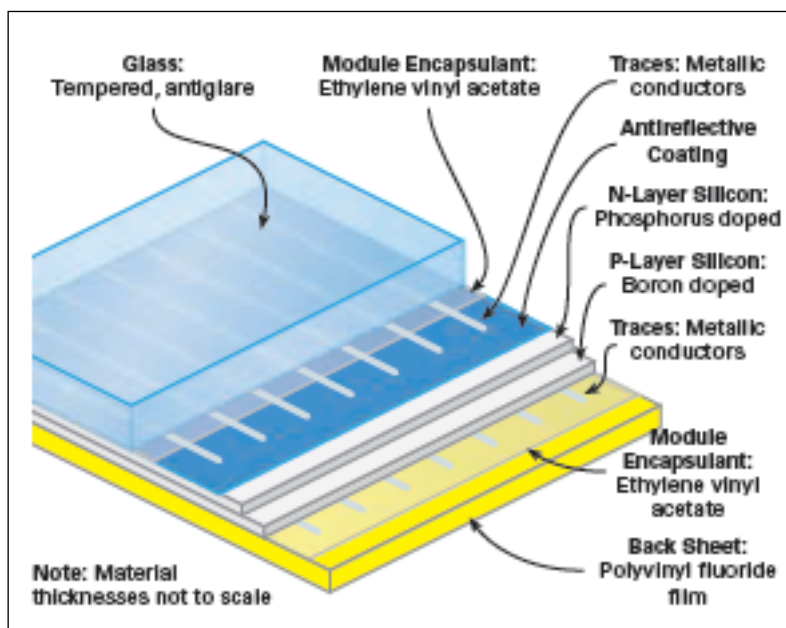
The following description gives more details on solar PV technology.

### **Solar PV technology**

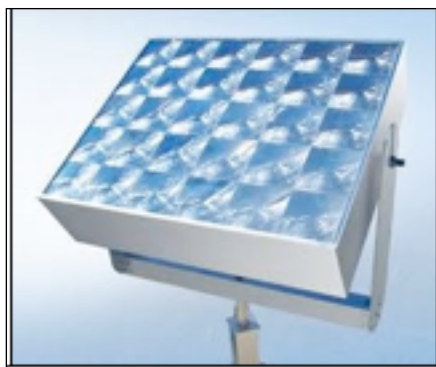
Solar photovoltaic cells, also known as solar cells, are used to convert solar energy into electrical energy. The solar cells are the basic elements of a solar module. When semiconductor materials are exposed to sunlight, electrons are excited from the valence band to the conduction band creating charged particles called holes. By doping the silicon, i.e. adding tiny amounts of other materials like boron or phosphorous to the crystalline structure, p- or n- type semiconductors are formed respectively. By bringing them together, a p-n junction is formed and serves for creating an electric field within the semiconductor, which is able to separate electrons and holes and which creates a direct current (DC).

Solar modules are composed of solar cells in series and parallel in order to obtain a desired final power, current, and voltage. The output current of a solar cell directly relates to the incoming irradiation: The higher the irradiation, the more electron-hole pairs are produced and therefore the current increases and more electricity is produced. There are several slightly different technologies using solar PV cells, solar crystalline modules with 36 to 72 cells being the most widely used.

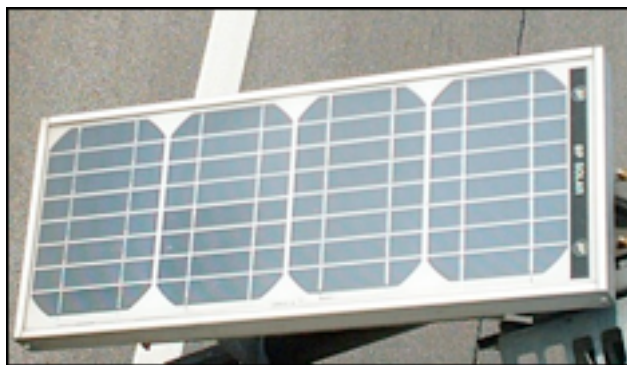
The figures below give an illustration of typical solar technologies that will be implemented under the programme.



**Figure 2: Solar PV analogy**



**Figure 3: Concentrated Solar PV**

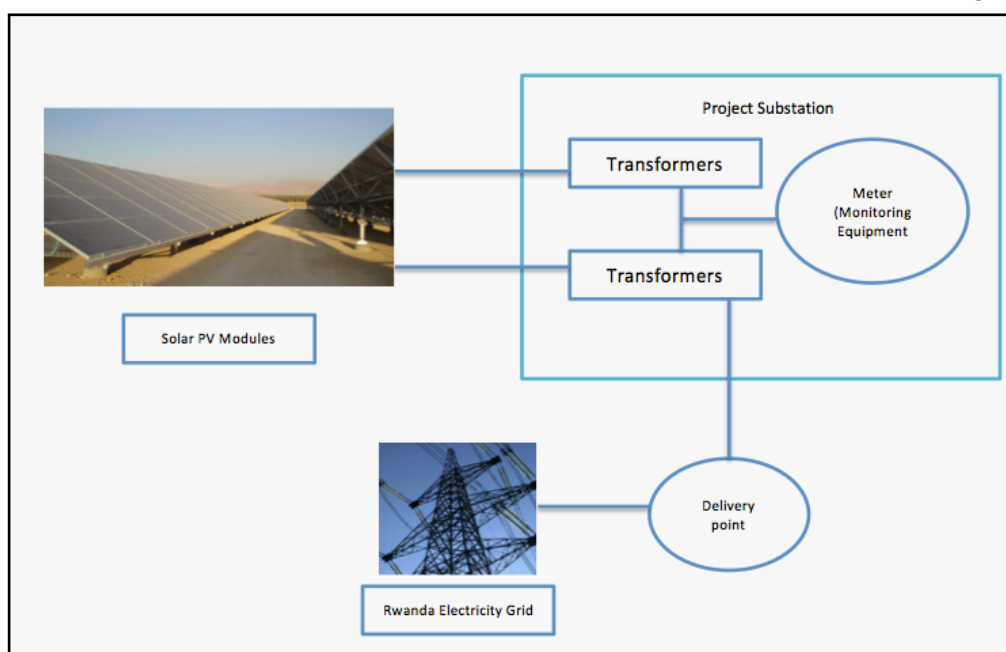


**Figure 4: Solar Photovoltaic (PV)**

Individual power plants may either employ fixed solar PV modules or install the PV modules with 1-axis or 2-axis sun-trackers. The sun-trackers allow the PV modules to track the direction of the sun through the day thereby maximizing the solar energy collected and electricity generated by facing the modules as perpendicular to the sunrays as possible.

In addition to the above-mentioned equipment, the CPAs will require additional equipment for the connection and transmission of the electricity generated to the electricity grid. For instance, an electrical network to collect the electricity will be installed, and where applicable, inverters and transformation boxes. Electricity will be transformed to the required voltage at the Point of Utility with the national electricity grid. In some cases, the CPA may be required to also construct a substation, but in most cases the CPA will be connected to an existing substation. The installation of a metering system is also required for both monitoring records for CDM purposes and for electricity sales.

The following diagram shows a typical equipment layout of a CPA:



**Figure 5: Equipment layout for a typical CPA**

The following technical information will be provided by specific CPAs that will be included in the PoA:

- The nominal installed capacity.<sup>7</sup>
- Number and model of solar modules (solar PV) and inverters.
- Technical specifications of the equipment that will be installed and relevant industry standards.
- Lifetime of the installed equipment.
- Plant load factor, including the relevant losses, internal consumption and net electricity supply to the grid.
- Details about the electricity collection and transmission infrastructure (e.g. number of transformers).
- Details about the metering system.

CPAs will involve transfer of environmentally safe and sound technology through the introduction of state-of-the-art technology in solar PV systems. Transfer of know-how will take place through the training of local engineers and other technical staff by the operations and maintenance contractor with the support of the equipment manufacturer. The equipment manufacturer, as well as assuring performance standards for the projects, will also provide oversight of the maintenance and operation of the equipment during the lifetime of a typical CPA.

Detailed information about the exact technology and measures applied by the individual CPAs will be provided in the relevant section of the specific CPA-DD. The section will also include a description of how environmentally safe and sound technology and know-how is being applied by the specific CPA *inter alia* technology transfer to the host party for application in the CPA.

## **A.7 Public funding of PoA**

There is no public funding involved in this PoA. Individual CPAs under the PoA will document public funding in section A.11 of the CDM-CPA-DD.

<sup>7</sup> In the context of this PoA and the underlying CPAs, the nominal capacity of the installations is defined as the installed capacity based on the nameplate manufacturer specifications (DC).

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

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

By June 2013, the total installed capacity in Rwanda reached 110MW<sup>8</sup>. The country's electricity generation was dominated by thermal power accounting for about 52.08 MW of the total generation followed by hydropower at 42.13 MW. Electricity imports from the regional countries accounted for about 15.5 MW. However, the available capacity fluctuated between 80MW and 92 MW. Of this capacity, grid connected solar accounted for only 0.25MW,<sup>9</sup> which represents less than 0.3% of the total installed capacity. In order to promote the uptake of renewable energy, the government of the Government of Rwanda introduced a Feed-in-Tariff (FiT) policy in 2012 as an investment tool to promote the implementation of renewables in the country.<sup>10</sup> However, the FiT only covers small hydro projects at present and other renewable energy sources still have to undergo the lengthy process of negotiating a suitable tariff with the off-taker.

In general, the energy sector in Africa faces serious challenges with respect to mobilization of financing. The funding barrier is even more challenging for renewable energy projects that face relatively higher upfront investment costs as compared to fossil fuel based projects. For instance The African Development Bank has estimated at US\$ 547 billion the total investment required to implement its scenario of universal access to reliable and increasingly cleaner electric power in all the 53 countries in Africa by 2030. This averages out at over US\$ 27 billion per year, yet total funding to the energy sector in Sub-Saharan African has averaged only about US\$ 2 billion every year.<sup>11</sup> Furthermore, the high cost of investor due diligence and loan appraisals by international financial institutions also forms part of the financial barrier. Local banks often lack the capacity to engage in long term financing of renewable energy technologies and in fact prefer the short term financing options with short maturity periods of 5 years. In this context, it will be demonstrated for each large-scale CPA applying investment analysis under the PoA, that the CPA is not financially viable without the sale of the certified emission reductions. Other large-scale CPA types will use the simplified procedure to demonstrate additionality in line with para 29 of ACM0002 version 16.0 or employ either first-of-its-kind analysis or barrier analysis to prove additionality in line with the *Tool for the demonstration and assessment of additionality (version 07.0.0, EB 70, Annex 8)*.

Small-scale CPAs will demonstrate additionality through the eligibility criteria on section B.2 using the methodological tool: Demonstration of additionality of small-scale project activities (version 10.0, EB 83, Annex 14).

As each CPA will comply with the eligibility criteria on additionality, it can be concluded that in the absence of this PoA and CDM, none of the proposed CPAs would occur.

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

The PoA will comprise of both small-scale and large-scale grid connected electricity generation projects of solar PV technology. As such, small-scale CPAs will apply AMS-I.D while their large-scale counterparts will apply ACM0002 in demonstrating their eligibility for inclusion into the PoA. For the large-scale CPAs under the PoA, the applicable methodology, ACM0002 version 16.0 para. 65 states "*CPAs are regarded to be of the same type if they are similar with regard to the*

<sup>8</sup> RURA annual report 2012-2013 reports 110MW. However electricity data from the utility company (used in the GEF spread sheet) indicates the capacity to be about 127.45 MW.

<sup>9</sup> Electricity data provided by EWSA for the period 2009 -2013

<sup>10</sup> Rwanda Feed-in-tariff policy

<sup>11</sup> African Union (2009) Scaling up Renewable Energy in Africa. 12<sup>th</sup> Ordinary Session of Heads and Governments of the African Union

*demonstration of additionality, emission reduction calculations and monitoring. The CME shall describe in the CDM-PoA-DD for each type of CPAs separately”*

In this regard, this PoA considers five CPA types as listed below:

- Greenfield small-scale solar PV power plants/units in Rwanda applying automatic additionality
- Greenfield large-scale solar PV power plants/units in Rwanda applying first-of-its-kind analysis
- Greenfield large-scale solar PV power plants/units in Rwanda applying investment analysis
- Greenfield large-scale solar PV power plants/units in Rwanda applying barrier analysis
- Greenfield large-scale solar PV power plants/units in Rwanda applying automatic additionality

In accordance with the *CDM Project Standard* (version 09.0 paragraph 207), the CME has to develop eligibility criteria for inclusion of CPAs under the PoA. This is also in accordance with the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* version 03.0.

In addition to the *CDM Project Standard* and the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* (version 03.0), the eligibility criteria for the small-scale solar PV CPAs have been derived from the methodological tool: *Demonstration of additionality of small-scale project activities* (version 10.0) and the provisions defined in AMS-I.D (version 18.0).

Likewise, for large-scale CPAs under the PoA, eligibility will be proven through following the provisions in ACM0002 (version 16.0) in addition to the aforementioned *CDM Project Standard* and the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities*.

**CPA type I: Greenfield small-scale solar PV power plants/units in Rwanda applying automatic additionality.**

**16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA**

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

**16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)**

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line

with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>12</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered or applying to be registered as a single CDM project. This will be evidenced through the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced through a signed confirmation letter from the CME.

#### **16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for small-scale projects according to AMS-I.D (version 18.0).

**Eligibility criteria 3.3:** The installed capacity of the CPA will not exceed 15 MW in line with paragraph 6 of AMS-I.D version 18.0. The installed capacity will be based on the installed/rated

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<sup>12</sup> <http://cdm.unfccc.int/>

capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

**Eligibility criteria 3.4:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.5:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

#### **16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

#### **16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of AMS-I.D, version 18.0 in section D.2 of the CDM-CPA-DD-FORM.

#### **16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the *Guidelines for demonstrating additionality of small-scale project activities*, now revised to methodological tool: Demonstration of additionality of small-scale project activities (version 10.0).

In line with paragraph 11 of the methodological tool: Demonstration of additionality of small-scale project activities (version 10.0), documentation of barrier is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW). Grid-connected solar technologies are part of the positive list in accordance with paragraph 2, (a), (i). Since all small-scale CPAs under the programme will use solar PV technology, all CPAs under this type shall be deemed automatically additional.

The following parameters will be used by the CME to assess automatic additionality:

- The installed capacity.
- Technical specifications of the equipment that will be installed

**Eligibility criteria 6.1:** The installed capacity of each CPA will not exceed 15 MW. The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

**Eligibility criteria 6.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

**16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>13</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>14</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of Official Development Assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

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<sup>13</sup> National Policy on Environment, Rwanda (2003)

<sup>14</sup> EIA Regulations, Rwanda

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

**Eligibility criteria 10:** The CPA has an installed capacity not exceeding 15 MW. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement and or grid-connection study.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

In accordance with the *Guidelines on Assessment of Debundling for SSC Project Activities* (version 03.0), currently revised to methodological tool: Assessment of debundling for small-scale project activities (version 4.0, EB 83, Annex 13), a small-scale project activity shall be deemed to be a debundled component of a large project activity (fragmentation of a large project activity into smaller parts) if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity with the following attributes:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

**Eligibility criteria 11.1:** The CPA is not part of a large-scale CDM project activity. The CPA implementing entity will provide a signed document clearly stating that the CPA is not part of a large-scale project. This will be evidenced by a signed letter from the CPA implementing entity.

**Eligibility criteria 11.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or has been registered as a single CDM project or under application for registration as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 11.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 11.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap<sup>15</sup> with the project area of another CPA or single CDM project of the same type in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

**CPA TYPE II: Greenfield large-scale solar PV power plants/units in Rwanda applying first-of-its-kind analysis**

**16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA**

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<sup>15</sup> In the context of this CPA type, overlapping boundaries would be interpreted to mean that the project boundary of the existing CPA is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

**16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)**

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>16</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

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<sup>16</sup> <http://cdm.unfccc.int/>

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

**16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 (version 16.0)

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies. ACM0002 (version 16.0) para 33 requires that: “The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality*”.

In line with the above *Tool for the demonstration and assessment of additionality* (version 7.0.0), the following eligibility criteria have been formulated to prove additionality:

### **Step 0: Demonstration whether the proposed CPA is the first-of-its-kind**

In accordance with the *Guidelines on additionality of first-of-its-kind project activities* (version 02.0, EB 69, Annex 7), now revised to methodological tool *on additionality of first-of-its-kind project activities* (version 03.0, EB 84, Annex 6), a CPA is considered as its first-of-its-kind if:

- The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;
- The project implements one or more of the measures;
  - Fuel and feedstock switch (example: switch from naphtha to natural gas for energy generation, or switch from limestone to gypsum in cement clinker production);
  - Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy);
  - Methane destruction (example: landfill gas flaring);
  - Methane formation avoidance (example: use of biomass that would have been left to decay in a solid waste disposal site resulting in the formation and emission of methane, for energy generation).
- The project participants selected a crediting period for the project activity that is “a maximum of 10 years with no option of renewal”.
- Output is goods/services produced by the project activity including, among other things, heat, steam, electricity, methane, and biogas unless otherwise specified in the applied methodology.

Different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed clean development mechanism (CDM) project activity and applicable geographical area):

- Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);
- Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon- intensive fuels);
- Size of installation (power capacity)/energy savings:
  - Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6);
  - Small (as defined in paragraph 28 of decision 1/CMP.2);
  - Large.

According to the above definition, solar PV and solar thermal technologies are considered to be the same as both technologies use solar resource to produce output. Therefore, the CPA will consider both technologies in the first-of-its kind analysis process.

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of Rwanda. The applicable geographical area is therefore the host country Rwanda. As per eligibility criteria 3.2 the CPA has also evidenced that it involves the use of solar PV technology, a renewable energy, which is one of the applicable measures as per paragraph 9 of the *methodological tool: Additionality of first-of-its-kind project activities version 03*. For CPAs to be included in the PoA, output is defined as electricity generation being fed into the Rwanda National Grid.

**Eligibility Criteria 6.1:** The CME has confirmed that the CPA is applying a technology which is different from any other project in Rwanda that supplies electricity to the Rwanda National Grid and has started commercial operation before the CME notified the secretariat and the DNA of its intention seek CDM status, or before the inclusion of the CPA in the PoA or before the start date of the CPA (as defined in eligibility criterion 4), whichever is applicable and earlier. This will be evidenced by a comparison with all grid-connected power plants located in Rwanda based on data, which has been made available by Rwanda Utilities Regulatory Authority (RURA), Rwanda Energy Group (REG), formerly Rwanda Energy Water and Sanitation Limited (EWSA), and/or the Ministry of Infrastructure (MININFRA) or any other credible source.

**Eligibility Criteria 6.2:** The project participants selected a crediting period for the CPA that is a maximum of 10 years with no option of renewal. This will be evidenced as per section A.9 of the CPA-DD.

If the proposed CPA is the first-of-its-kind as shown above, its additionality is demonstrated in accordance with paragraph 13 of the *methodological tool: Additionality of first-of-its-kind project activities version 03*.

**16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>17</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>18</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

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<sup>17</sup> National Policy on Environment, Rwanda (2003)

<sup>18</sup> EIA Regulations, Rwanda

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party (ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

**CPA TYPE III: Greenfield large-scale solar PV power plants/units in Rwanda applying investment analysis**

**16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA**

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

**16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)**

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>19</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

#### **16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

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<sup>19</sup> <http://cdm.unfccc.int/>

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 (version 16.0)

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

#### **16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

#### **16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

#### **16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large-scale methodologies. ACM0002, version 16.0 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality*". The latest version of the tool is version 07.0.0. Furthermore, ACM0002 stipulates that: "When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

- Technical and economic parameters that are technology specific (e.g. ranges of load factors, sizes of installation, wind speed);
- Parameters reflecting the investment climate:
  - Subsidies or other financial flows;
  - Tariffs;

- Depreciation;
- Power purchase agreements;
- Other parameters determining market circumstances;
- Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

Since CPAs under this type will prove additionality with investment analysis as explained below, the Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities (version 03.0), paragraph 13 (a) shows that when investment analysis is used for demonstrating additionality, two options can be used. For CPAs under this type Option (i) will be used, whereby investment analysis will be conducted for each CPA. Since the PoA will not use Option (ii), paragraph 63 of the methodology ACM0002 version 16.0 will not be applicable.

In accordance with the standard, in case option (i) is used, the coordinating/managing entity is required to define the input parameters that will be used in the investment analysis in the PoA-DD, together with a description of how the values for these parameters will be obtained for each CPA. The additionality of each CPA shall then be assessed by using the actual values, applicable to the CPA at the time of inclusion, in the investment analysis conducted for the purpose of demonstrating the additionality of the CPA.

The following sources will thereby be valid to determine input values for the below outlined parameters:

- Documentation that has been prepared by an experienced third party
- Documentation that has been approved or issued by Rwandan governmental authorities
- Documentation that has been submitted to or received from financing institutions like banks and equity providers
- Documentation submitted for official purposes such as documents submitted to Rwandan authorities.

**Table 2: CAPEX input parameter - Project Development**

| <b>CAPEX Item</b>                | <b>Description</b>                                                                                                                                              |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Development costs</b> |                                                                                                                                                                 |
| Consulting costs                 | Consulting costs can for instance be costs for pre- and full feasibility studies, EIA studies, financial and legal advisory                                     |
| Permits and licensing            | Costs of permitting and licensing does for instance include EIA license costs, Solar resource licensing costs, Development, Construction and Generation permits |
| Land acquisition                 | Land acquisition costs account for costs of acquiring land required for the construction and operation of the power plant                                       |
| Administration costs             | Administration costs include all costs related to all managerial and administrative costs occurring during the development and construction phase               |
| Community development projects   | Costs related to financial contributions to community projects as agreed with the community surrounding the power plant, e.g. schools, housing, hospitals.      |

**Table 3: CAPEX input parameter - Equipment costs**

| <b>CAPEX Item</b>                                 | <b>Description</b>                                                                                   |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Equipment costs</b>                            |                                                                                                      |
| Initial civil works (drainage, access roads etc.) | Costs for Civil works costs, e.g. roads, drainage if not included in EPC costs                       |
| EPC (Plant) or equivalent EPC costs               | EPC or equivalent EPC costs, e.g. procurement of equipment, installation, testing and commissioning. |
| Interconnection                                   | Costs of grid connection, if not included in EPC costs or EPC                                        |

equivalent costs

Table 4: CAPEX input parameter - Other costs

| CAPEX Item                          | Description                                                                                                                                                               |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Other costs</b>                  |                                                                                                                                                                           |
| Contingency (DEV+EQU+PD)            | Contingency costs applicable to development, equipment and project management costs.                                                                                      |
| Interest during construction        | Interest during construction costs (IDC) are charged by the lending institution for debt interest accrued during the construction period.                                 |
| Commitment fees                     | Commitment fees are typically being charged by the lending institution on non-withdrawn loan amount.                                                                      |
| Front end fees                      | Front-end fees are typically charged by the lending institution as a fee for arranging debt finance                                                                       |
| Debt Service Reserve Account (DSRA) | The establishment of a debt service reserve account is typically required by the lending institution.                                                                     |
| Other financing costs               | Other financing cost include other fees potentially charged by debt or equity financiers                                                                                  |
| Working capital                     | Working capital costs are usually being capitalized to assure liquidity during the initial project phases and can potentially also include cash used to pay up-front VAT. |

Table 5: OPEX input parameter

| OPEX Item                                   | Description                                                                                                                             |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Land leasing fees                           | Costs of land lease include costs for leasing land required for the operation of the power plant in case the land has not been acquired |
| Plant O&M expense                           | Costs associated with the operation and maintenance of the plant.                                                                       |
| Costs related to socio-economic development | Costs related to financial commitments made to the community residing nearby the power plant, during the power plant operational period |

Table 6: Economic / financial input parameter

| Economic/financial data | Description                                                                                                                                                                                                                                                                               |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inflation rates         | Inflation rates are being applied to escalate cost items over time. Different inflation rates will be used according to origin of cost items, e.g. USD costs will use USD inflation rates, Rwandan Franc (RWF) costs will use RWF inflation, EUR cost items will apply EUR inflation etc. |
| Exchange rates          | Exchange rates will be used to translate costs items of different origin to one common currency applied in the financial model.                                                                                                                                                           |
| Corporate tax           | Applicable corporate tax rate will be applied to income before tax                                                                                                                                                                                                                        |
| Equipment Lifetime      | Equipment lifetime will be utilized to calculate project fair value at the end of the 20 year modeling horizon                                                                                                                                                                            |
| Debt/equity gearing     | Applicable debt/equity gearing will be applied to calculate Project IRR or Equity IRR                                                                                                                                                                                                     |
| Interest rates          | Interest rates applicable to debt finance will be considered                                                                                                                                                                                                                              |

|              |                                                              |
|--------------|--------------------------------------------------------------|
| Grace period | Grace period on debt principal's payments will be considered |
| Loan tenor   | Loan tenor applicable to debt finance will be considered     |

Table 7: PPA input parameter

| PPA parameter | Description                                                                                                                                                                      |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tariff        | Applicable tariff (inclusive of capacity and energy charge) as well as applicable portions of escalation will be applied as per information provided by the Government of Rwanda |

The application of the above parameters will be limited to the stipulations in the methodological tool: Investment analysis version 06.0. For that matter, some of them will not be used depending on the indicator choice of the project. For instance if the project has selected the project IRR, the cost of financing expenditures (i.e. loan repayments and interest) shall not be included in the calculation of project IRR in line with paragraph 14 of the methodological tool: Investment analysis version 06.0. Likewise, if the project has selected equity IRR option, only the portion of investment costs which is financed by equity will be considered as the net cash outflow, the portion of the investment costs which is financed by debt should not be considered a cash outflow.

In line with the above guidelines, the following eligibility criteria have been formulated to prove additionality:

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

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

According to para 8 of the *Tool for the demonstration and assessment of additionality* (version 07.0.0), project activities that apply the tool in the context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity.

Alternative 2: 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* (version 04.0.0).

No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Rwanda National Energy Policy and Strategy. These laws and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in Rwanda.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful in accordance

with the Rwanda National Energy Policy and Strategy. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Rwanda National Energy Policy and Strategy and applies to all types of generation technology including renewable power generation technology. Therefore, the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of Greenfield grid-connected solar PV power capacity to the Rwanda grid without carbon credits, this can also be considered to be consistent with mandatory laws and regulations since the Rwanda National Energy Policy and Strategy covers the establishment of new power generation sources from solar PV power technologies in Rwanda.

There are no further applicable national laws or regulations, which require the application as a CDM project activity.

### **Step 2: Investment analysis**

The following steps will be taken to demonstrate that the CPA is financially additional:

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

The *Tool for the demonstration and assessment of additionality* (version 07.0.0) provides three methods for carrying out investment analysis:

- Simple cost analysis (Option I),
- Investment comparison analysis (Option II)
- Benchmark analysis (Option III).

The CPAs included in the PoA are expected to generate financial and economic benefits other than CDM related income (income from the sales of electricity) therefore the simple cost analysis (Option I) can not be applied.

In line with ACM0002 version 16.0, the baseline scenario for the project activities 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”. Therefore, the baseline scenario does not necessarily require investment and is outside the control of the project developers. Option III, benchmark analysis is selected as the appropriate analysis method for the component project activities.

***Eligibility Criteria 6.1:*** The CPA has carried out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet.

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

According to methodological tool: Investment analysis version 6.0 (EB 85 annex 12), CPAs will use one of the following two benchmark indicators:

- Pre-tax nominal Weighted Average Cost of Capital (WACC)
- Post-tax nominal Return on Equity

The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR.

The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations. The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.

**Eligibility criteria 6.2:** The CPA has applied (a) the pre-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR, as explained below. This will be evidenced through the investment analysis spread sheet.

For CPAs applying option (a), the following formula will be used to determine the pre-tax nominal WACC:

$$WACC = re \times We + rd \times Wd \times (1 - Tc)$$

Where:

WACC = Weighted Average Cost of Capital

wd = Percentage of debt financing

we = Percentage of equity financing

rd = Average cost of debt financing

re = Average cost of equity financing

Tc = Corporate Tax

The values of Wd and We will be determined and evidenced at the CPA inclusion stage.

The default value for the cost of equity financing is provided as a real term, post-tax value in the methodological tool: Investment analysis (version 6.0). Therefore, the following two steps were undertaken to convert the value to a nominal, pre-tax value:

CPAs will add the inflation rate to convert the real value into a nominal value using the Fisher Equation:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on one of the following options:

- The inflation forecast of the National Bank of Rwanda for the duration of the CPA crediting period.
- The target inflation of the National Bank of Rwanda.
- The average forecasted inflation rate for Rwanda published by the IMF or the World Bank for the next five years after start of the project activity<sup>20</sup>

The post-tax default value will be further converted to a pre-tax value by dividing the post-tax value by  $(1 - \text{tax rate})$ . The tax rate used will be 30% in line with the Rwandan income tax.

For CPAs applying option (b), the use of the post-tax, nominal Return on Equity as a benchmark to compare with the Equity IRR, the following steps will be taken to determine the post-tax, nominal Return on Equity:

The Return on Equity will be based on the default value as provided in the latest version of the methodological tool: Investment analysis (version 6.0) for Group 1 projects in Rwanda. The default value is provided as a real term, post-tax value therefore, the following procedure is followed to convert the value to a nominal, post-tax value:

To convert the real value into a nominal value the Fisher Equation is used:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on:

- The inflation forecast of the National Bank of Rwanda for the duration of the CPA crediting period

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<sup>20</sup> To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of investment decision.

- The target inflation of the National Bank of Rwanda
- The average forecasted inflation rate for Rwanda published by the IMF or the World Bank for the next five years after start of the project activity<sup>21</sup>

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

After determination and calculation of the benchmark, the CPA will determine the Project IRR or Equity IRR, as applicable. In line with the methodological tool: Investment analysis (version 6.0) all values used in the investment analysis will be applicable at the time of the investment decision. For the purpose of the PoA, the time of the investment decision will be either the date on which the plant load factor has become available to the board based on which the board has decided to proceed with the project, or the date on which significant resources have been committed towards the implementation of the project.

The following eligibility criteria have been formulated to assess the calculation and comparison of financial indicators.

**Eligibility criteria 6.3:** Without the CER revenue, the CPA has a less favourable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spreadsheet.

**Eligibility criteria 6.4:** All input values applied in the investment analysis are applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.

**Eligibility criteria 6.5:** The date of the investment decision is either based on the date on which the project has received the solar assessment report and the board has decided to proceed with the project or the date on which the project has committed significant financial resources towards the implementation of the project. This will be evidenced by the solar assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project.

The following additional considerations will be made in terms of the input parameters in the investment analysis:

#### Revenues:

Revenues from electricity sales will be calculated based on the following parameters and consideration:

The electricity generation will be based on the energy yield and net plant load factor as determined by a third party in line with the requirements under the *Guidelines for the reporting and validation of plant load factors (version 01.0)*. The net plant load factor will be based on the P50 forecast and will include losses including but not limited to plant availability, maintenance, equipment degradation, etc.

The tariff used will be based on the PPA, or if not available yet, the one provided to banks and equity financiers, or to the government while applying for implementation approval.

The following eligibility criteria with regard to project revenues will apply to CPAs included in the PoA:

**Eligibility criteria 6.6:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

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<sup>21</sup> To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of investment decision.

**Eligibility criteria 6.7:** The CPA has used a tariff based on the PPA, or if not available yet, the one provided to banks and equity financiers, or to the government while applying for implementation approval.

#### Capital investment (CAPEX)

CAPEX costs included in the calculation of the IRR will include the cost of the solar photovoltaic modules as well as the Balance of Plant (BoP) costs depending on the type of module used. CAPEX costs will be evidenced by quotations from modules suppliers or contracts with modules suppliers. If at the time of the investment decision no quotations or contracts from modules suppliers are available, alternative evidences can be used including quotations or contracts from the same modules supplier for other projects in Rwanda or the region, or email quotations. In the latter case (email), the conservativeness of the quotation will be crosschecked with quotations received after the date of the investment decision.

Additional CAPEX costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to CAPEX will apply to CPAs included in the PoA:

**Eligibility criteria 6.8:** The CAPEX used in the investment analysis included the costs of the solar photovoltaic modules, and if applicable the BoP costs. Those costs are evidenced by quotations from modules suppliers or contracts with modules suppliers. If at the time of the investment decision no quotations or contracts from modules suppliers are available, alternative evidences can be used including quotations or contracts from the same modules supplier for other projects in Rwanda or the region, or email quotations.

#### Operating cost:

Currently, there is no public information available regarding operating costs for large-scale, solar PV projects in Rwanda or East Africa. This is due to the absence of large-scale, solar PV projects in the region. It is expected that some of the operating cost items will be lower than in the rest of the world but these cost gains will be offset by lack of experience and inefficiencies in the system.

Operating costs will at least include:

- Costs related to land leases
- Service and warranty costs
- Operation and maintenance costs
- Administrative costs
- Costs related to socio-economic development

Additional operating costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to operating costs will apply to CPAs included in the PoA:

**Eligibility criteria 6.9:** The operating costs used in the investment analysis will at least include costs related to land leases or land acquisition, service and warranty costs, operation and maintenance costs, administrative costs, and costs related to socio-economic development. The operating costs will be evidenced by land lease, quotations for service and warranty, quotations from the operation and maintenance contractor and if relevant, agreements with the local communities for implementation of development activities. These will be documented in the investment analysis spread sheet.

Taxation:

In accordance with the latest version of the Rwandan Fiscal Laws and Regulations, income tax for resident corporate entities in Rwanda is levied at a rate of 30%.

**Eligibility criteria 6.10:** The CPA has used an income tax rate in line with the Rwanda regulations. This will be evidenced by the latest version of the Rwandan Fiscal Laws and Regulations and documented in the investment analysis spread sheet.

Exchange rates

Exchange rates provided by the National Bank of Rwanda will be used. Alternatively, the exchange rate reported by commercial banks in Rwanda on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

**Eligibility criteria 6.11:** In terms of exchange rates, the exchange rates provided by the National Bank of Rwanda will be used. Alternatively, the exchange rate reported by commercial banks in Rwanda on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

Sub-step 2d: Sensitivity analysis

**Eligibility criteria 6.12:** The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis:

- Investment cost
- Electricity generation
- Operating and maintenance cost
- Tariff

**Eligibility criteria 6.13:** The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.

Step 4: Common practice analysis

In line with the *Tool for the demonstration and assessment of additionality* (version 07.0.0) and the *Guidelines on common practice* (version 02.0), currently revised to methodological tool: common practice (version 03.1), it can be concluded that the CPA is not common practice as F is lower than 0.2 and Nall – Ndiff is lower than 3. The common practice analysis will be based on publicly available data and information from RURA, REG and/or the MININFRA or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

**Eligibility criteria 6.14:** The CPA has confirmed that the results of common practice analysis show F to be lower than 0.2 and Nall – Ndiff is lower than 3.

#### **16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>22</sup> and relevant ministerial order relating to the requirements and procedure for Environmental

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<sup>22</sup> National Policy on Environment, Rwanda (2003)

Impact Assessment (EIA) regulations (2008)<sup>23</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

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<sup>23</sup> EIA Regulations, Rwanda

## **CPA TYPE IV: Greenfield large-scale solar PV power plants/units in Rwanda applying barrier analysis**

### **16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA**

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

### **16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)**

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>24</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced

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<sup>24</sup> <http://cdm.unfccc.int/>

through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

**16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 version 16.0

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies. (version 16.0) requires that: “The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality*”. The latest version of the tool is version 07.0.0.

Furthermore, ACM0002 stipulates that: “When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

- Technical and economic parameters that are technology specific (e.g. ranges of load factors, sizes of installation, wind speed);
- Parameters reflecting the investment climate:
  - Subsidies or other financial flows;
  - Tariffs;
  - Depreciation;
  - Power purchase agreements;
  - Other parameters determining market circumstances;
- Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

In line with the above guidelines, the following eligibility criteria have been formulated to prove additionality:

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

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

According to para 8 of the *Tool for the demonstration and assessment of additionality* (version 07.0.0), project activities that apply the tool in the context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity.

Alternative 2: 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* (version 04.0.0).

No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Rwanda National Energy Policy and Strategy. These laws

and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in Rwanda.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful in accordance with the Rwanda National Energy Policy and Strategy. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Rwanda National Energy Policy and Strategy applies to all types of generation technology including renewable power generation technology. Therefore the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of Greenfield grid-connected solar PV power capacity to the Rwanda grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the Rwanda National Energy Policy and Strategy covers the establishment of new power generation sources from solar PV power technologies in Rwanda.

There are no further applicable national laws or regulations, which require the application as a CDM project activity.

### **Step 3: Barrier analysis**

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. The *Guidelines for objective demonstration and assessment of barriers* (version 1), has been used when applying this step in line with para. 46 of the “*Tool for the demonstration and assessment of additionality*.”

CPAs using barrier analysis will determine whether the proposed project activities faces barriers that:

- a) Prevent the implementation of this type of proposed project activity; and
- b) Do not prevent the implementation of at least one of the alternatives.

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

The *Guidelines for objective demonstration and assessment of barriers* states that “ 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. Projects in Least Developed Countries are not bound by the provisions in this guideline and may use other approaches that are more adapted to the local circumstances.”

CPAs under the programme will therefore be at liberty to claim barriers as best adapted to Rwanda. The individual CPAs may claim other barriers in addition to these highlighted below:

- Barriers related to lack of capital
- Technological barriers
- Barriers due to skilled labor
- Barriers due to increased risks of damage
- Barriers due to prevailing practice

However, in accordance with the *Guidelines for objective demonstration and assessment of barriers*, barriers that can be mitigated by additional financial means can be quantified and represented as costs and will not be identified as a barrier for implementation of project while conducting the barrier analysis. Instead, these will be considered into the framework of the investment analysis. For instance, the necessary trained labor to operate and maintain new clean technologies may not be available right away. However, this would not necessarily prevent implementation of a solar PV project since most O&M contractors in collaboration with the EPC

contractors are able to provide sufficient training and/or even provide themselves staff to operate the plant. This, therefore, adds additional costs (salaries, training costs, service fees) those would be considered in the NPV/IRR analysis.

*Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)*

The CPA implementing entity shall provide transparent and documented evidence, and offer conservative interpretations of this documented evidence, as to how it demonstrates the existence and significance of the identified barriers and whether alternatives are prevented by these barriers. The type of evidence to be provided should include at least one of the following:

- a) Relevant legislation, regulatory information or industry norms;
- b) Relevant (sectoral) studies or surveys (e.g. market surveys, technology studies, etc.) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc.;
- c) Relevant statistical data from national or international statistics;
- d) Documentation of relevant market data (e.g. market prices, tariffs, rules);
- e) Written documentation of independent expert judgments from industry, educational institutions (e.g. universities, technical schools, training centres), industry associations and others.

**Eligibility 6.1:** The CPA has confirmed that the barriers provided are real. This will be evidenced by objective and transparent references from credible sources such as independent third parties, relevant legislation, relevant sectoral studies, and relevant statistical data. From national and international statistics, documentation of relevant market data and expert opinion.

**Eligibility 6.2:** The CME has confirmed that the identified barriers prevent the implementation of the project activity but does not prevent the implementation of at least one of the alternatives.

#### **Step 4: Common practice analysis**

In line with the *Tool for the demonstration and assessment of additionality* (version 07.0.0) and the *Guidelines on common practice* (version 02.0), currently revised to methodological tool: common practice (version 03.1), it can be concluded that the CPA is not common practice as F is lower than 0.2 and  $N_{all} - N_{diff}$  is lower than 3. The common practice analysis will be based on publicly available data and information from RURA, REG and/or the MININFRA or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

**Eligibility criteria 6.3:** The CPA has confirmed that the results of common practice analysis show F to be lower than 0.2 and  $N_{all} - N_{diff}$  is lower than 3

#### **16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>25</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>26</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

<sup>25</sup> National Policy on Environment, Rwanda (2003)

<sup>26</sup> EIA Regulations, Rwanda

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

**CPA TYPE V: Greenfield large-scale solar PV power plants/units in Rwanda applying automatic additionality.**

**16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA**

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

**16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)**

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>27</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

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<sup>27</sup> <http://cdm.unfccc.int/>

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

**16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 (version 16.0).

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies. In accordance with para 29 of ACM0002 version 16.0, the simplified procedure to demonstrate additionality is applicable to the following grid connected electricity generation technologies (positive list):

- Solar photovoltaic technologies;
- Solar thermal electricity generation including *concentrating Solar Power* (CSP);
- Off-shore wind technologies;
- Marine wave technologies;
- Marine tidal technologies.

A specific technology in the positive list is defined as automatically additional if at the time of PDD submission any of the following conditions is met:

- (a) The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country is equal to or less than two per cent; or
- (b) The total installed capacity of the technology in the host country is less than or equal to 50 MW.
- (c) The project proponents that apply simplified procedure to demonstrate additionality shall provide information on actual capital cost of the project activity or the CPA at the time of the first verification.
- (d) The above positive list of technologies is valid for three years from the date of entry into force of version 16.0 of ACM0002 on 28 November 2014

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of Rwanda. The applicable geographical area is therefore the host country Rwanda. As per eligibility criteria 3.2, the CPA has also evidenced that it involves the use of solar PV technology, a renewable energy, which is one of the applicable measures as per paragraph 29 of ACM0002 version 16.0.

Requirement (c) above shall be demonstrated at first verification of the specific CPA. In this regard, no eligibility criterion has been formulated for it at the registration or inclusion stage.

**Eligibility Criteria 6.1:** At the time of CPA-DD submission for inclusion, the percentage share of total installed capacity of the specific technology (solar PV) in the total installed grid connected power generation capacity in the host country is equal to or less than two per cent. This will be evidenced by a comparison with data of the total installed capacity for all grid-connected power plants located in Rwanda, which has been made available by Rwanda Utilities Regulatory Authority (RURA), REG and/or the Ministry of Infrastructure (MININFRA) or any other credible source.

OR

**Eligibility Criteria 6.2:** At the time of CPA-DD submission for inclusion, the total installed capacity of the technology in the host country is less than or equal to 50 MW. This will be evidenced by publicly available data from the Rwandan relevant Ministry, Energy Regulatory Authority or the utility company .

AND

**Eligibility Criteria 6.3:** At the time of CPA-DD submission for inclusion, the positive list of technologies will still be valid. This will be evidenced by the provisions in the latest version of ACM 0002 or the applicable CDM EB decision.

If the proposed CPA meets the eligibility criteria as shown above, it will be deemed to be automatically additional in accordance with paragraph 30 of ACM0002 version 16.0

**16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>28</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>29</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party (ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

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<sup>28</sup> National Policy on Environment, Rwanda (2003)

<sup>29</sup> EIA Regulations, Rwanda

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

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

This PoA will include grid-connected renewable power generation units of solar photovoltaic (PV) type. The project activities will consist of the installation of new power plants at sites where no renewable energy power plant was operated prior to the implementation of the CPA (Greenfield plants).

CPAs will not include the combination of both renewable and non-renewable components (e.g. a solar/diesel unit). Furthermore, CPAs will only comprise of either small-scale or large-scale projects, but not both.

CPAs implemented under this PoA with installed capacities of under 15 MW will apply the approved small-scale baseline and monitoring methodology AMS-I.D *Grid connected renewable electricity generation* (version 18.0). CPAs with installed capacities above 15 MW under the PoA will apply the approved large-scale consolidated methodology ACM0002 *Grid-connected electricity generation from renewable sources* (version 16.0)

This combination of ACM0002 and AMS-I.D methodologies has been already approved by the CDM Executive Board<sup>30</sup>.

Since the CPAs to be included in the PoA will be grid connected renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each CPA. An electronic database will be established that contains general information regarding each CPA as well as data and information, which is monitored on a regular basis and which is used to determine emission reductions achieved by the CPA. The database will be accessible at any time for verification.

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

**Date:** 08/10/2015

**Responsible Person:** Edwin Obiero

**Responsible Entity:** Carbon Africa

**Contact:** [info@carbonafrica.co.ke](mailto:info@carbonafrica.co.ke)

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<sup>30</sup> AM\_CLA\_0241

## SECTION C. Management system

As per the *CDM Project Standard* (version 09.0), paragraph 210 the CME shall establish, implement, and provide a description of the operational and management arrangements for the implementation of the proposed CDM PoA in accordance with requirements outlined in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple technologies for programme of activities* (version 03.0). The following management system will be implemented by the CME for the inclusion of CPAs.

### **Roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;**

The CME of Gigawatt Global Programme of Activities is Gigawatt Global Coöperatief U.A. Gigawatt Global shall provide the necessary managerial, technical, legal, communication and administrative functions to operate and manage the PoA in accordance with the CDM requirements, including the process of inclusion of CPAs. In the case where certain functions or tasks may be outsourced, the ultimate responsibility for final quality control and approval will remain with Gigawatt Global as the CME.

Gigawatt Global will assign one director-level staff member with signing authority to have overall responsibility for the management of the PoA. The director will be supported by one or more Programme Managers and the legal and administrative managers of Gigawatt Global.

### **Competence requirements for personnel**

At minimum, the following competencies will be required of the following levels of staff in order to ensure the optimal management of the PoA.

#### *Director*

- Have a good knowledge of the CDM, with particular experience in Programmes of Activities, CDM requirements and the CDM project cycle
- A good level of technical knowledge in the fields of renewable energy, grid electricity systems, power plant development and operations, economics and financial analysis and regulatory procedures
- Strong abilities in human resource management, critical thinking, problem solving, communication and project management

#### *Programme Managers and Officers*

Knowledge and experience in CDM and the carbon markets and in particular the specific CDM technical and methodological aspects including:

- The technical process, project design, methodology, baseline, project boundary, calculation of GHG, environmental impact and monitoring requirements, measurement techniques, calibration and uncertainty in the measurement of the applicable parameters, impact of failure of monitoring equipment on the measurement of emission reductions of a CPA, as relevant to technical areas within the sectoral scopes relevant to the project activity
- Assessment of additionality, including CDM related investment analysis as appropriate
- Quantification, monitoring and reporting of GHG emissions, including relevant technical and sector issues
- Regulatory requirements relevant to CDM sectoral scopes and project activities including the technical process, project design, methodology, baseline, project boundary, calculations of GHG, environmental impact and monitoring requirements

*Legal Manager and Legal Officer*

- Knowledge of the CDM and the carbon markets and in particular with legal and commercial aspects
- Experience in contract and international law
- Knowledge of host country regulations

*Administrative Manager and Administrative Officer*

- Good understanding of the principles of data and information management
- Awareness of requirements regarding security and confidentiality
- Excellent organizational abilities

**Records of arrangements for training and capacity development for personnel;**

In order to ensure that CME personnel are able to improve their skills and competencies and retain relevant knowledge given the frequent changes to the CDM rules and requirements, staff will undergo a regular skills assessment. This will be conducted through an internal review of skills and competency levels or an assessment of any outsourced third parties. All CME staff will be required to complete an evaluation form and present this to their respective managers. Based on the outcomes of an evaluation meeting, appropriate internal and external training sessions will be organized as necessary for the particular personnel requirements. After receiving training, personnel will be required to circulate a report to the rest of the team as well as to the line manager. In this way, other CME staff will benefit and be kept abreast on relevant information required to ensure the CDM and PoA requirements are met.

Records of CME staff skills and competencies, completed staff evaluation forms and training reports will be stored by the respective managers in electronic form keeping in line with the file naming system.

**Procedures for technical review of inclusion of CPAs;**

As part of the responsibilities of the CME, a technical review of a proposed CPA will be carried out prior to the petition of inclusion to the DOE. The CME will first collect and compile all the supporting evidences stated in the eligibility criteria, and makes sure it does comply accordingly with all the eligibility requirements as per the PoA-DD. The CME will also verify the authenticity of those documents by consulting with national or local authorities when necessary. Finally, the CME will verify that the CPA has not yet been developed as a single CDM project or been included in another PoA by means of checking the CDM website database, and any other documentation that may lead to such an event. An additional quality check will be done whereby another staff member from the CME, not directly involved in the development of the CPA-DD will review the CPA-DD in line with CPA-DD Internal Review Checklist as shown below.

If a CPA complies with all the technical requirements and provides the necessary documentary evidences required by the eligibility criteria as estimated by the CME, its inclusion will be approved in line with the CME responsibilities as it waits for the final assessment from the DOE.

## CDM DD Internal Review Checklist

|           |                              |
|-----------|------------------------------|
| PoA TITLE | <i>Insert PoA title here</i> |
|-----------|------------------------------|

| Review Criteria                                                                                   | Compliance? |    |                |
|---------------------------------------------------------------------------------------------------|-------------|----|----------------|
|                                                                                                   | YES         | NO | Not applicable |
| Have all eligibility criteria for inclusion in the PoA been met?                                  |             |    |                |
| Having procedures to avoid double counting been checked?                                          |             |    |                |
| Have all relevant sections in the 'Generic CPA DD been completed?                                 |             |    |                |
| Have emission reduction calculations been checked by the reviewer?                                |             |    |                |
| If required under Section B of the CPA DD – has an environmental analysis been undertaken?        |             |    |                |
| If required under Section C of the CPA DD – has a stakeholder consultation been undertaken?       |             |    |                |
| If required under the CPA DD – has a GEF calculation been undertaken and checked by the reviewer? |             |    |                |
| Has all supporting documentation been cited by the reviewer?                                      |             |    |                |

CPA DD is:  
 Complete and finalized / Requires further revision  
*(Delete appropriate option)*

**Comments:**

|                           |  |
|---------------------------|--|
| <b>Internal Reviewer:</b> |  |
| <b>Date:</b>              |  |
| <b>Signature:</b>         |  |

### **Procedure to avoid double counting**

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar PV project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- A signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project. The check by the CME will be presented in a signed confirmation letter from the CME.

#### Record keeping system for each CPA under the PoA

The CME will develop and maintain an electronic database, which will contain essential data and information about each CPA, including:

- General information about CPA:
- CPA name
- Name and contact details of the entity implementing the CPA
- Geographical location of the CPA (GPS coordinates)
- Technology employed by the CPA and installed capacity
- Commissioning date
- Start date of the CPA
- Crediting period
- Start and end date of crediting period
- Operational lifetime
- Verification status (number of verification and associated monitoring period)
- Emission reductions monitored and issued in each monitoring period
- Supporting evidence for each eligibility criterion to demonstrate that the CPA meets all the eligibility criteria for inclusion into the PoA.
- Data and information regarding the monitoring of emission reductions achieved by the CPA in line with the monitoring plan as formulated in the PoA-DD

General information regarding the CPA as well as supporting evidence for the inclusion of the CPA will be entered once into the database at the start of the implementation of the CPA. Data and information regarding monitoring of greenhouse gas emissions will be entered on a regular basis as per the requirements of the monitoring plan. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period or the last issuance of CERs, whichever occurs later.

The CME will be responsible for entering, updating and maintaining data and information regarding CPAs into the electronic database and will have read and write access. Gigawatt Global, as the ultimate 'owner' of the system, has full ownership and access to all data and systems.

The CME record keeping and document processes are based on standards for quality management systems (e.g. ISO 9001) documentation requirements, which consist of:

1. Establishing and maintaining a 'Quality Manual';
2. Procedures for control of documents; and
3. Procedures for control of records.

This database and other records applicable will be stored in a market leading cloud based management system that will provide the necessary infrastructure for managing document security, access and version control.

#### **Measures for continuous improvement of the PoA management system**

In the course of the PoA lifetime, it is likely that some of those procedures mentioned will result in insufficient control of the CME management system. In this case, the CME will keep improving its standards always taking a conservative and stricter approach with the aim of meeting the

procedures described in this section. Once the crediting period is over, those new procedures in the management system will be updated.

As per standards for quality management systems (e.g. ISO 9001) the CME will therefore plan and implement monitoring and improvement processes needed to achieve the following:

- Demonstrate conformity and quality to the agreed specification
- Ensure conformity to the management system and
- Continually improve the management system

In order to achieve continual improvement data will be collected in areas of customer satisfaction (where the customer is the CPA implementer), process performance, and product quality (where the product is the CPA-DD development process and management of the inclusion of the CPA) and the implementation of the overall management system.

The results from this collection will be analysed and action taken to improve the effectiveness and efficiency of the system. Training and capacity building of personnel involved in the inclusion of the CPAs will be carried out as outlined as above.

### **PoA subscription**

Each CPA will enter into a PoA Participation Agreement with the CME. The PoA Participation Agreement will include a confirmation that the entity implementing the CPA is aware and agrees that the CPA is being subscribed to the PoA.

## **SECTION D. Duration of PoA**

### **D.1. Start date of PoA**

In line with the *Glossary of CDM terms* (version 08.0), the start date of the PoA is 15/01/2014 which is the date when the coordinating/managing entity officially notified the secretariat and the DNA of their intention to seek the CDM status. The start date of any future CPA is not, or will not be, prior to the date that the CME notified the secretariat and the DNA of their intention to seek the CDM status for the PoA.

### **D.2. Duration of the PoA**

28 years

## **SECTION E. Environmental impacts**

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

Environmental Impact analysis is undertaken at the CPA level since environmental conditions of each CPA will be site specific.

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

To be conducted at the CPA level

### **E.3. Environmental impact assessment**

To be conducted at the CPA level

## **SECTION F. Local stakeholder consultation**

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

Local Stakeholder Consultation is undertaken at the CPA level since the stakeholders to be consulted will be specific to the CPA location.

### **F.2. Summary of comments received**

To be conducted at the CPA level

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

To be conducted at the CPA level

## **SECTION G. Approval and authorization**

A letter of approval and authorization has been issued to the PoA and its CME by the Rwanda Environment Management Authority (REMA), Rwanda's Designated National Authority.

## **PART II. Generic component project activity (CPA)**

### **CPA TYPE I: GREENFIELD SMALL-SCALE SOLAR PV POWER PLANTS/UNITS IN RWANDA APPLYING AUTOMATIC ADDITIONALITY.**

#### **SECTION A. General description of a generic CPA**

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

The generic Component Project Activity (CPA) will involve the implementation and operation of a small-scale solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant). The project activity will generate electricity from renewable sources, which will be fed into Rwanda's national electricity grid, displacing fossil fuel based electricity generation, thus, leading to emission reductions.

The CPA is being pursued as a component of the PoA "Gigawatt Global Programme of Activities" with Gigawatt Global Coöperatief U.A. as the CME.

Demonstration of eligibility into the PoA is provided in section B.5 of the Generic CPA.

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

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

Small-scale CPAs included in the PoA will apply simplified baseline and monitoring methodology AMS-I.D *Grid connected renewable electricity generation* (version 18.0).

AMS-I.D version 18.0 also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 04.0)*
- *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)*
- *Tool to determine the remaining lifetime of equipment (version 01)*
- *Project and leakage emissions from biomass (version 02.0)*
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)*

CPAs included under this PoA will not apply the *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)*, since no on-site fossil fuel consumption will take place. The *tool to determine the remaining lifetime of equipment* will not be applied since the project activity is of Greenfield type and the *Project and leakage emissions from biomass* is not applied since the project activity does not involve biomass cultivation. In addition, the tool for the *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period* is only applicable upon renewal of a crediting period.

Therefore, for the first crediting period, only the *Tool to calculate the emission factor for an electricity system* will be applied by the individual CPAs.

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

The CPA qualifies as small-scale Type I component project activity because the maximum output capacity achieved by individual small-scale CPAs will not exceed 15MW in each year of

the crediting period. The CPA will not involve any sampling since it involves the generation of electricity from a renewable source.

The CPA falls under category AMS-I.D. *Grid connected renewable electricity generation* (version 18.0) because the CPA meets the applicability criteria as follows:

| Applicability criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Generic CPA justification                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:</p> <p>(a) Supplying electricity to a national or a regional grid; or</p> <p>(b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.</p>                                                                                                                                                                                                                                                                                                                                             | <p>The generic small-scale CPA under the programme will use grid-connected solar PV power generation that will supply electricity to a national grid, or to an identified consumer facility via national grid through a contractual arrangement such as wheeling.</p> |
| <p>This methodology is applicable to project activities that:</p> <p>(a) Install a Greenfield plant;</p> <p>(b) Involve a capacity addition in (an) existing plant(s);</p> <p>(c) Involve a retrofit of (an) existing plant(s)</p> <p>(d) Involve a rehabilitation of (an) existing plant(s); or</p> <p>(e) Involve a replacement of (an) existing plant(s).</p>                                                                                                                                                                                                                                                                                                                                                           | <p>The generic small-scale CPA will include activities that:</p> <p>(a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant).</p>                                  |
| <p>Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:</p> <p>a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir;</p> <p>b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m<sup>2</sup>;</p> <p>c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m<sup>2</sup>.</p> | <p>Not applicable. This CPA includes solar PV energy projects, not hydro power plants.</p>                                                                                                                                                                            |
| <p>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.</p>                                                                                                                                                                                                                                                                                                                                                                                                | <p>Not applicable. The programme of activities will not use both, renewable and non-renewable components.</p>                                                                                                                                                         |
| <p>Combined heat and power (co-generation) systems are not eligible under this category.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>Not applicable. The programme of activities does not include combined heat and power (co-generation) systems.</p>                                                                                                                                                  |
| <p>In the case of project activities that involve the capacity addition of renewable energy</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>Not applicable. The programme of activities does not include capacity additions.</p>                                                                                                                                                                               |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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.                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| In the case of retrofit, rehabilitation 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.                                                                                                                                                                                                                                                                                                                                                                                                 | Not applicable. The programme of activities does not include retrofit or replacement systems.                                                                            |
| In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored. | Not applicable. The programme of activities does not include any landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions |
| In case biomass is sourced from dedicated plantations, the applicability criteria in the Tool "Project emissions from cultivation of biomass" shall apply.                                                                                                                                                                                                                                                                                                                                                                                                                                | Not applicable. The programme of activities does not include any biomass use.                                                                                            |

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 04.0) as follows:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 since the generic CPA involves the generation of electricity from solar and its supply to the Rwandan grid system.                                                                                                                 |
| Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity. | The emission factor is calculated for either only grid connected power plants or both grid connected and off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" will be met. |
| 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.<br>Rwanda is not an Annex-I country.                                                                                                                                                                  |
| The value applied to the CO <sub>2</sub> emission factor of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Not applicable since no biofuels are used                                                                                                                                                                                                                  |

|                   |                                                      |
|-------------------|------------------------------------------------------|
| biofuels is zero. | for grid-connected electricity generation in Rwanda. |
|-------------------|------------------------------------------------------|

### B.3. Sources and GHGs

According to the approved small-scale methodology AMS-I.D. *Grid connected renewable electricity generation* (version 18), “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 project power plant and all power plants physically connected to the Rwandan National Grid system constitute the project boundary for this project.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the tables below. The figures below provide flow charts of the equipment and systems, emissions sources and gases included in the project boundary as well as the monitoring variables in the project boundary of the different CPAs eligible under this PoA.

| Source           |                                                                                                                                                                | Gas              | Included | Justification/Explanation                                                                                                                                                                    |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Baseline         | CO <sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity                             | CO <sub>2</sub>  | Yes      | Main emission source as per AMS-I.D and the <i>Tool to calculate the emission factor for an electricity system</i>                                                                           |
|                  |                                                                                                                                                                | CH <sub>4</sub>  | No       | Minor emission source as per AMS-I.D and the <i>Tool to calculate the emission factor for an electricity system</i>                                                                          |
|                  |                                                                                                                                                                | N <sub>2</sub> O | No       | Minor emission source as per AMS-I.D and the <i>Tool to calculate the emission factor for an electricity system</i>                                                                          |
| Project activity | CO <sub>2</sub> emissions from combustion of fossil fuels for electricity generation in the case of a combination of non- renewable and Solar PV units/plants. | CO <sub>2</sub>  | No       | No on-site fossil fuel consumption will take place. Therefore no emissions as per AMS-I.D and the Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion |
|                  |                                                                                                                                                                | CH <sub>4</sub>  | No       |                                                                                                                                                                                              |
|                  |                                                                                                                                                                | N <sub>2</sub> O | No       |                                                                                                                                                                                              |
|                  | For geothermal power plants, fugitive emissions of CH <sub>4</sub> and CO <sub>2</sub> from non-condensable gases contained in geothermal steam Source 2       | CO <sub>2</sub>  | No       | Geothermal power plants are not included in this PoA and the CPA is a solar PV                                                                                                               |
|                  |                                                                                                                                                                | CH <sub>4</sub>  | No       |                                                                                                                                                                                              |
|                  |                                                                                                                                                                | N <sub>2</sub> O | No       |                                                                                                                                                                                              |
|                  | CO <sub>2</sub> emissions from biomass sourced from dedicated plantations                                                                                      | CO <sub>2</sub>  | No       | No biomass is involved in this PoA. The CPAs is solar PV based                                                                                                                               |
|                  |                                                                                                                                                                | CH <sub>4</sub>  | No       |                                                                                                                                                                                              |
|                  |                                                                                                                                                                | N <sub>2</sub> O | No       |                                                                                                                                                                                              |
|                  | For hydro power plants, emissions of CH <sub>4</sub> from the reservoir                                                                                        | CO <sub>2</sub>  | No       | No emissions since the CPAs under the programme will use solar PV technology                                                                                                                 |
|                  |                                                                                                                                                                | CH <sub>4</sub>  | No       |                                                                                                                                                                                              |
|                  |                                                                                                                                                                | N <sub>2</sub> O | No       |                                                                                                                                                                                              |

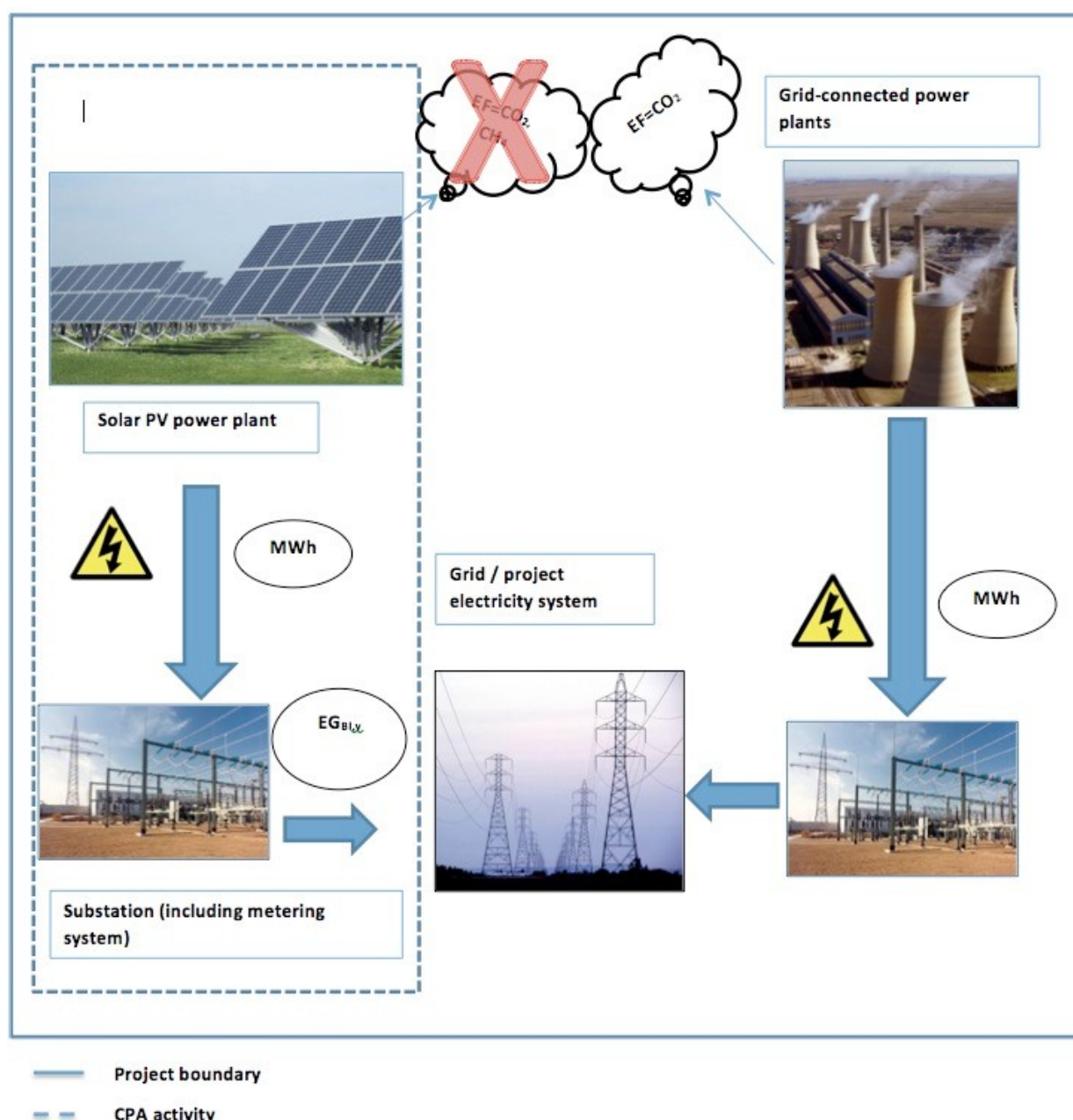


Figure 6: Flow diagram delineating the CPA boundary

#### B.4. Description of baseline scenario

In accordance with the simplified baseline and monitoring methodology AMS-I.D (version 18.0) *Grid connected renewable electricity generation*, the baseline scenario is “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”.

##### Structure of the Rwanda Power sector

The power sector in Rwanda lies under the Ministry of Infrastructure (MININFRA), which has the primary responsibility of policy formulation and strategy setting for the energy sector, and for coordinating developments in the electricity sub-sector.<sup>31</sup> The Government of Rwanda (GoR) launched the Economic Development and Poverty Reduction Strategy II (EDPRS II), 2013-2018,

<sup>31</sup> [http://www.mininfra.gov.rw/Mission and Purpose](http://www.mininfra.gov.rw/Mission%20and%20Purpose); Accessed on 18 December 2014

with an aim to boost economic growth.<sup>32</sup> Increasing the supply, access and stability of electricity have been identified as some of the core pillars for achieving this stated objective and increasing electricity generation from renewables has been particularly emphasized.<sup>33</sup>

The Rwanda Utilities Regulatory Authority (RURA) is the body that is tasked to oversee the energy sector together with other sectors in telecommunications, water, waste and transport. RURA was established on 13/01/2001 through the adoption of Law N°39/2001. This Law was further reviewed and replaced by Law N° 09/2013 of 01/03/2013, which further amended its mission, powers, organization and functions specifically in the energy sector. RURA is mandated to control and regulate electricity generation, transmission and distribution in order to ensure efficiency and sustainability in the sector. As such, it plays a supervisory role by among other things, granting licenses for generation, transmission and distribution of electricity in Rwanda.<sup>34</sup>

Apart from MININFRA and the Rwanda Utilities Regulator (RURA), the utility company, the newly established utility company, the Rwanda Energy Group Limited (REG)<sup>35</sup> is the other key player in the energy sector. The 100% state owned company is the largest electricity generator accounting for over 90% of the total electricity generated and also responsible for transmission, distribution and supply of electricity in Rwanda.<sup>36</sup>

Since the early 2000, Rwanda has gradually moved towards power sector reforms focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths but have typically involved the passing of electricity laws, the establishment of a regulatory body overseeing the power sector, some form of unbundling of the power sector and the introduction of Independent Power Producers (IPPs). Rwanda has also introduced Feed-in-Tariff policies starting with small hydro projects with the rest of renewable energy technologies to be included in future. The Renewable Energy Feed-in-Tariff (REFIT) adopted in 2012, is a direct result of the governments Green Growth Strategy adopted in 2011 to foster the uptake of renewable energy in the national grid.<sup>37</sup>

Previously, EWSA was responsible for providing both electricity and water thereby hindering its ability to make real progress in improving energy supply in Rwanda. As a consequence, the company was separated into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC) with different and independent roles in providing energy and water services respectively. This move is expected to promote efficiency and transparency in the generation and distribution of electricity in Rwanda.

### **Installed Generation Capacity**

Rwanda's installed capacity has increased significantly from a mere 25MW in 1994 to 110MW in 2013.<sup>38</sup> The five-year average<sup>39</sup> of the national electricity generation mix is dominated by thermal sources (58.7%), hydro (41.2%) and the remaining 0.1% for solar PV.

By June 2013, the total installed capacity in Rwanda reached 110MW<sup>40</sup>. The country's electricity generation was dominated by thermal power accounting for about 52.08 MW of the total generation

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<sup>32</sup> Economic Development and Poverty Reduction Strategy II (EDPRS II)

<sup>33</sup> Republic of Rwanda (2000), Rwanda Vision 2020

<sup>34</sup> [www.rura.rw/about-rura/](http://www.rura.rw/about-rura/); Accessed on 18 December 2014

<sup>35</sup> Formerly the utility company was Energy Water and Sanitation Company (EWSA)

<sup>36</sup> [www.reg.rw/home/](http://www.reg.rw/home/); Accessed on 18 December 2014

<sup>37</sup> [www.rura.rw/](http://www.rura.rw/); Accessed on 18 December 2014

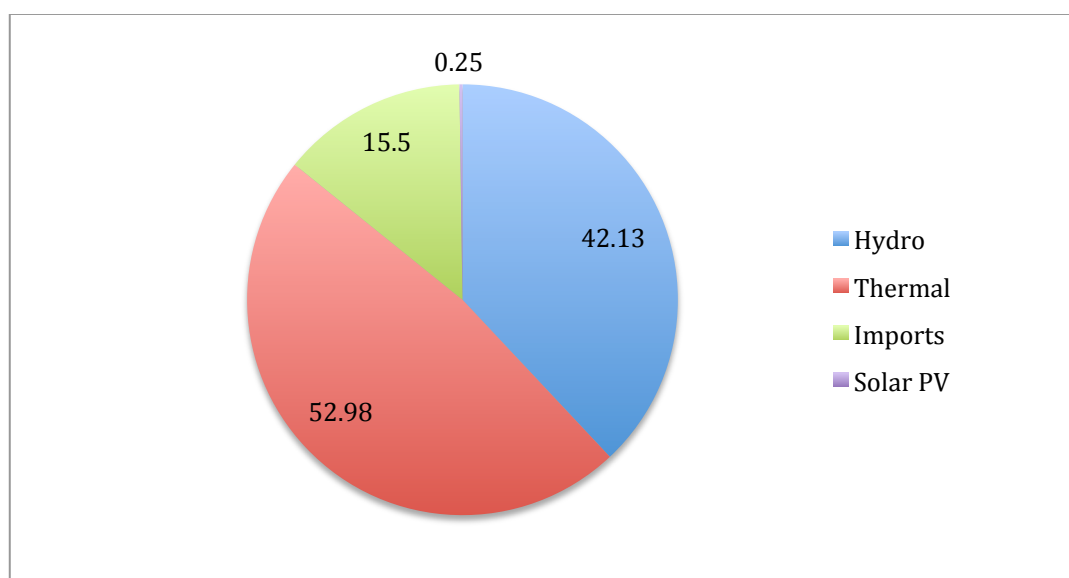
<sup>38</sup> <http://www.ewsarw.com/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>39</sup> Electricity data provided by EWSA for the period 2009 -2013

followed by hydropower at 42.13 MW. Electricity imports from the regional countries accounted for about 15.5 MW. However, the available capacity fluctuated between 80MW and 92 MW. Of this capacity, grid connected solar accounted for only 0.25MW,<sup>41</sup> which represents 0.1% of the total installed capacity.

According to the former utility company, EWSA, generation from thermal sources accounting for more than half the national generation mix, directly translated to high cost of fuel consumption estimated at USD 40 million annually and an average electricity cost of USD 0.26/kWh.<sup>42</sup> This average electricity costs in Rwanda is almost double the overall global average of USD 0.14/kWh.<sup>43</sup> The Rwandan government has consequently been forced to provide electricity subsidies in order to keep the tariff comparable with the regional average.

This information on Rwanda energy generation mix is summarised graphically as follows:



**Figure 7: Installed grid electricity capacity by type in Rwanda**

### **Future Generation**

Rwanda's electricity consumption constitutes only 4% of the overall primary energy consumption with biomass forming the largest proportion at 85% and petroleum accounting for 11%.<sup>44</sup> On one hand, these percentages present the electricity subsector as the least developed in the energy sector while on the other hand, the figures illustrate a high dependency on wood fuel in Rwanda.

The GoR recognizes that the availability of reliable power supply is a pre-requisite for economic growth, social prosperity, as well as human development. The government, therefore, aims at increasing and diversifying electricity generation in the country through a rollout programme that will rapidly increase supply. Already some positive results have been posted following the

<sup>40</sup> RURA annual report 2012-2013 reports 110MW. However electricity data from the utility company (used in the GEF spread sheet) indicates the capacity to be about 127.45 MW. The former has been used since its publicly available information while data from EWSA is not.

<sup>41</sup> Electricity data provided by EWSA for the period 2009 -2013

<sup>42</sup> <http://www.ewsa.rw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>43</sup> Rapid Assessment of a National Energy and Low Carbon path for Rwanda (May 2009)

<sup>44</sup> RURA Annual Report 2012/2013, Page 77

implementation of the initial phase of the government initiative and increasing electricity access by a remarkable 160% between the year 2008 and 2011.<sup>45</sup> Nonetheless, only 16% (350,000) of Rwanda's households are connected to the grid as shown in the table below. In this regard, the government has revised its target to expand electricity access to households to approximately 70% by 2017.<sup>46</sup> The expansion plan is aimed at increasing the electricity generation capacity by an additional 1000MW in 2017<sup>47</sup> and 1300MW by 2020.<sup>48</sup> The 1,000MW additional installed capacity in 2017 will comprise of 340 MW of hydropower, 310MW of geothermal power, 300MW of natural gas (methane-based) power, 200MW of peat-based power and 20MW of diesel thermal plants and 5 MW from solar PV.<sup>49</sup>

The table below shows the growth in electricity service from the year 2000 to 2012:

**Table 8: Growth in electricity service (2000 - 2012)**

| Year                  | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Peak Load (MW)        |      |      |      |      |      |      |      | 47   | 51   | 56   | 64   | 78   | 92   |
| Sales (GWh)           | 204  | 209  | 225  | 235  | 204  | 194  | 230  | 249  | 277  | 308  | 353  | 417  |      |
| Losses                |      |      | 35   |      |      |      | 22   | 18   | 18   | 20   | 19   | 19   |      |
| No. of customers '000 | 49   | 49   | 58   | 67   | 68   | 70   | 77   | 86   | 109  | 140  | 175  | 280  | 350  |
| Access %              |      |      |      |      |      |      |      |      | 4    | 8    | 13   | 14   | 16   |

Source: EWSA

**Table 9: Target Capacity Additions in Rwanda by 2017**

| Generation type | Target installed capacity (MW) |
|-----------------|--------------------------------|
| Peat            | 200                            |
| Geothermal      | 310                            |
| Hydro Power     | 340                            |
| Methane         | 300                            |
| Diesel          | 20                             |
| Solar           | 5 <sup>50</sup>                |
| Total           | 1,175                          |

<sup>45</sup> Rwanda Energy Sector Review and Action Plan (2013), Page 31

<sup>46</sup> Rwanda Energy Sector Review and Action Plan, Page 8

<sup>47</sup> Energy Policy and Strategy, page 54

<sup>48</sup> Energy Policy and Strategy, page 52

<sup>49</sup> The summation of these capacities yield about 1,175MW against the indicated 1000MW. Other sources indicate a capacity target of 20MW for solar PV in Rwanda. We have however chosen to stick with the capacity target as documented in the policy document.

<sup>50</sup> The Electricity policy and strategy indicates 5 MW although other sources indicate 20MW. The later has been picked since its more realistic. Besides, the Rwanda development Board lists two solar PV projects of 10MW each to be under development.

| Year | Based on EDPRS and Vision 2020 |                         |              | Based on Targets Set in 2010 by the New Government |                         |              |
|------|--------------------------------|-------------------------|--------------|----------------------------------------------------|-------------------------|--------------|
|      | Access (%)                     | Installed Capacity (MW) | Energy (GWH) | Access (%)                                         | Installed Capacity (MW) | Energy (GWH) |
| 2008 | 6.0                            | 45                      | 225.0        | 6.0                                                | 45                      | 225          |
| 2010 | 11.0                           | 85                      | 353          | 11.0                                               | 85                      | 353          |
| 2015 | 22                             | 200                     | 965.5        | 35.0                                               | 800                     | 1200         |
| 2017 | 28.0                           | 300                     | 1,200.0      | 50.0                                               | 1000                    | 1400         |
| 2020 | 32                             | 400                     | 1,478.0      | 90                                                 | 1200                    | 1950         |
| 2025 | 40.0                           |                         | 2,148.4      | 94.0                                               | 1500                    | 3300         |

**Figure 8: Vision 2020 vs. New Electricity generation targets** Source: Electricity Master Plan (2011), Seven-Year Electricity (2011)

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

### 16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

### 16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>51</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered or applying to be registered as a single CDM project. This will be evidenced through the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced through a signed confirmation letter from the CME.

#### **16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports e.g. Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for small-scale projects according to AMS-I.D (version 18.0).

**Eligibility criteria 3.3:** The installed capacity of the CPA will not exceed 15 MW in line with paragraph 6 of AMS-I.D version 18.0. The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

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<sup>51</sup> <http://cdm.unfccc.int/>

**Eligibility criteria 3.4:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.5:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of AMS-I.D, version 18.0 in section D.2 of the CDM-CPA-DD-FORM.

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the *Guidelines for demonstrating additionality of small-scale project activities*, now revised to methodological tool: Demonstration of additionality of small-scale project activities (version 10.0).

In line with paragraph 11 of the methodological tool: Demonstration of additionality of small-scale project activities (version 10.0), documentation of barrier is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW). Grid-connected solar technologies are part of the positive list in accordance with paragraph 2, (a), (i). Since all small-scale CPAs under the programme will use solar PV technology, all CPAs under this type shall be deemed automatically additional.

The following parameters will be used by the CME to assess automatic additionality:

- The installed capacity.
- Technical specifications of the equipment that will be installed

**Eligibility criteria 6.1:** The installed capacity of each CPA will not exceed 15 MW. The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

**Eligibility criteria 6.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

**16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>52</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>53</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of Official Development Assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

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<sup>52</sup> National Policy on Environment, Rwanda (2003)

<sup>53</sup> EIA Regulations, Rwanda

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

**Eligibility criteria 10:** The CPA has an installed capacity not exceeding 15 MW. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement and or grid-connection study.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

In accordance with the *Guidelines on Assessment of Debundling for SSC Project Activities* (version 03.0), currently revised to methodological tool: Assessment of debundling for small-scale project activities (version 4.0, EB 83, Annex 13), a small-scale project activity shall be deemed to be a debundled component of a large project activity (fragmentation of a large project activity into smaller parts) if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity with the following attributes:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

**Eligibility criteria 11.1:** The CPA is not part of a large-scale CDM project activity. The CPA implementing entity will provide a signed document clearly stating that the CPA is not part of a large-scale project. This will be evidenced by a signed letter from the CPA implementing entity.

**Eligibility criteria 11.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or has been registered or applying to be registered as a single CDM project or under application for registration as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 11.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 11.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap<sup>54</sup> with the project area of another CPA or single CDM project of the same type in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

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

### **B.6.1. Explanation of methodological choices**

The generic CPA will focus on grid-connected renewable electricity generation from solar power. The generic CPA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (Greenfield plant).

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<sup>54</sup> In the context of this CPA type, overlapping boundaries would be interpreted to mean that the project boundary of the existing CPA is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

CPAs will not include the combination of both renewable and non-renewable components (e.g. a solar PV/diesel unit).

The emission factor of the grid is calculated in a transparent and conservative manner using the combined margin (CM) consisting of the operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

### **Baseline emissions**

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

The baseline emissions ( $BE_y$ ) are calculated using **equation (1)** of AMS-I.D version 18.0:

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

Where:

- $BE_y$  = Baseline Emissions in year y (t CO<sub>2</sub>)
- $EG_{PJ,y}$  = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)
- $EF_{grid,y}$  = Combined margin CO<sub>2</sub> emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (t CO<sub>2</sub>/MWh)

As per AMS-I.D (version 18.0):

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

Where:

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

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

The emission factor will be calculated in a transparent and conservative manner using option (a), the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0). Therefore:

$$EF_{grid,y} = EF_{grid, CM,y}$$

The grid emission factor will be calculated for the Rwandan electricity system and will be applied to each CPA of the PoA. Equations and source of data to calculate the grid emission factor for Rwanda are provided below.

### ***Step 1. Identify the relevant electric power system***

For calculating the grid emission factor, the project activity has identified the Rwandan National Grid as the relevant project electricity system.

The identification of the Rwanda National Grid as the relevant project electricity system is based on the following arguments:

- The Rwandan DNA has not published a delineation of the project electricity system and connected electricity system.
- There are no spot markets in the Rwandan grid system.
- Although the Rwandan grid is connected to a number of its neighbouring countries' grids including Uganda, Burundi and DRC Congo, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary. Those countries will however be considered as connected electricity systems and the electricity imported into the Rwandan grid (project electricity system) will be included as imports.
- Finally, Rwanda does not have a layered dispatch system and the country has only one grid system that serves the entire country. Therefore, and in line with version 04.0 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

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

The project activity has selected either Option I where only grid power plants are included in the calculation or Option II where both grid power plants are included in the calculation.

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

The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

- a) Simple OM
- b) Simple adjusted OM
- c) Dispatch data analysis OM
- d) Average OM

It is stated under the *Tool to calculate the emission factor for an electricity system* that simple OM can only be used if low-cost/must-run resources constitute less than 50 per cent of total grid generation. In line with a five-year electricity generation data during the period of 2009 and 2013, low-cost/must-run resources in Rwanda, which are mainly hydro, constitute about 41% of total grid generation. Therefore, since this condition has been met, the simple OM method is used.

The CPAs will use the *ex-ante* option and the OM will be calculated once at the validation stage using a three years generation-weighted average.

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

The simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub> emissions per unit net electricity generation (tCO<sub>2</sub>/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

**Option A:** Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit; or,

**Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A has been chosen to calculate the operating margin emission factor of power plants serving the grid.

The Simple OM emission factor is calculated using equation 1 as follows:

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

Where:

- $EF_{grid,OMsimple,y}$  = Simple operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  = All grid power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

#### Determining $EF_{EL,m,y}$

For the calculation of the emission factor for each power plant  $m$ , option A1 has been selected as fuel consumption is normally provided. Therefore, equation 2 will be used as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type  $i$  in year  $y$  (GJ/mass or volume unit)
- $EF_{CO2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $i$  = All fuel types combusted in power unit  $m$  in year  $y$
- $y$  = The relevant year as per the data vintage chosen in Step 3

However, in some instances where there is missing data on the fuel consumption amounts, option A.2 will be selected and therefore equation 3 used as follows:

Where several fuel types are used in the power unit, use the fuel type with the lowest CO<sub>2</sub> emission factor for  $EF_{CO2,m,i,y}$  is to be used.

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

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (t CO<sub>2</sub>/MWh)
- $EF_{CO2,m,i,y}$  = Average CO<sub>2</sub> emission factor of fuel type  $i$  used in power unit  $m$  in year  $y$  (t CO<sub>2</sub>/GJ)
- $\eta_{m,y}$  = Average net energy conversion efficiency of power unit  $m$  in year  $y$  (ratio)
- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

#### Determination of $FC_{i,m,y}$

Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit) was based on published records from the utility company and IPP power plants.

(Insert fuel consumption data for latest 3 years)

|       |      | Fuel Consumption data (Litres/year) |        |        |
|-------|------|-------------------------------------|--------|--------|
| Name  | Type | Year 1                              | Year 2 | Year 3 |
|       |      |                                     |        |        |
|       |      |                                     |        |        |
| Total |      |                                     |        |        |

#### Determination of $EG_{m,y}$

For grid power plants,  $EG_{m,y}$  is based on published records and data obtained directly from the utility company and IPP power plants. The grid emission factor calculations are based on the publicly available data in Rwanda, i.e. Data from the utility company and IPP power plants which represents the total electricity generated in the Rwandan grid.

(Insert electricity data for thermal power plants for latest 3 years)

|       |      | Generation data (MWh) |        |        |
|-------|------|-----------------------|--------|--------|
| Name  | Type | Year 1                | Year 2 | Year 3 |
|       |      |                       |        |        |
|       |      |                       |        |        |
| Total |      |                       |        |        |

For off-grid power plants,  $EG_{m,y}$  is based on paragraph 32 of the *Tool to calculate the emission factor for an electricity system*. The tool states that a default value of 10 per cent of the total electricity generation by grid power plants in the electricity system can be used to determine  $EG_{m,y}$  for the purpose of the operating margin determination.

|      |      | Generation data (MWh) |        |        |
|------|------|-----------------------|--------|--------|
| Name | Type | Year 1                | Year 2 | Year 3 |
|      |      |                       |        |        |
|      |      |                       |        |        |

|          |  |  |  |  |
|----------|--|--|--|--|
| Total    |  |  |  |  |
| Off-grid |  |  |  |  |

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

For the calculation of the build margin (BM) emission factor, **Option 1** data vintage will be chosen. Hence, for the first crediting period, the build margin emission factor shall be calculated, *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CPA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require the emission factor to be monitored during the first crediting period.

The build margin emission factor is thus calculated using **equation 13** of the “*Tool to calculate the emission factor for an electricity system*”, as shown below:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year *y* (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit *m* in year *y* (tCO<sub>2</sub>/MWh)
- m* = Power units included in the build margin
- y* = Most recent historical year for which power generation data is available

The CO<sub>2</sub> emission factor of each power unit *m* ( $EF_{EL,m,y}$ ) will be determined as per the guidance in section 6.4.1 for the simple OM, using equation (2) under option A1 or option A2, depending on availability of data, and using for *y* the most recent historical year for which grid power generation data is available, and using for *m* the power *units* included in the build margin.

If the power units included in the build margin *m* correspond to the sample group SETsample-CDM->10yrs, then, as a conservative approach, only Option A2 from guidance in Step 4 section 6.4.1 can be used and the default values provided in appendix 1 shall be used to determine the parameter  $\eta_{m,y}$  for the power units that started to supply electricity to the grid more than 10 years ago.

For Option A1,  $EF_{EL,m,y}$  is calculated in accordance with equation 2 as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit *m* in year *y* (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type *i* in year *y* (GJ/mass or volume unit)

- $EF_{CO_2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)  
 $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)  
 $m$  = The power units included in the build margin  
 $i$  = All fuel types combusted in power unit  $m$  in year  $y$   
 $y$  = The relevant year as per the data vintage chosen in Step 3

For option A2,  $EF_{EL,m,y}$  is calculated in accordance with equation 3 as follows:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (t CO<sub>2</sub>/MWh)  
 $EF_{CO_2,m,i,y}$  = Average CO<sub>2</sub> emission factor of fuel type  $i$  used in power unit  $m$  in year  $y$  (t CO<sub>2</sub>/GJ)  
 $\eta_{m,y}$  = Average net energy conversion efficiency of power unit  $m$  in year  $y$  (ratio)  
 $m$  = The power units included in the build margin  
 $y$  = The relevant year as per the data vintage chosen in Step 3

The sample group of power units  $m$  used to calculate the build margin will be determined in accordance with the “*Tool to calculate the grid emission factor for an electricity system*”.

Below is a table with all power plants in the project electricity system (Source: Rwanda Energy Group (REG) / Energy, Water and Sanitation - EWSA). The power plants are ranked according to commissioning date.

|   | Name of power plant | Commissioning date | Electricity generation 2009-2011 (MWh) | % |
|---|---------------------|--------------------|----------------------------------------|---|
| 1 |                     |                    |                                        |   |
| 2 |                     |                    |                                        |   |
| 3 |                     |                    |                                        |   |
| 4 |                     |                    |                                        |   |

### Step 6: Calculate the Combined Margin

Option (a) i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated as follows:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)  
 $EF_{grid,OM,y}$  = Operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)  
 $W_{OM}$  = Weighting of operating margin emissions factor (%)

$W_{BM}$  = Weighting of build margin emissions factor (%)

For solar power generation projects the following default values are used for  $W_{OM}$  and  $W_{BM}$ :

$$W_{OM} = 0.75$$

$$W_{BM} = 0.25$$

### **Project emissions**

In accordance with paragraph 39 of AMS-I.D (version 18.0), most renewable energy projects except for hydro and geothermal technology types,  $PE_y = 0$ . Since the CPA is of solar PV type,  $PE_y = 0$ .

### **Leakage emissions**

No leakage emissions are considered since the CPA is not a biomass project activity.

### **Emission reductions**

In line with AMS-I.D (version 18.0) the emission reductions are calculated using (equation 9) as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

$ER_y$  = Emission reductions in year  $y$  (t CO<sub>2</sub>/y)

$BE_y$  = Baseline Emissions in year  $y$  (t CO<sub>2</sub>/y)

$PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>/y)

$LE_y$  = Leakage emissions in year  $y$  (t CO<sub>2</sub>/y)

## **B.6.2. Data and parameters fixed ex-ante**

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>NCV_{i,y}</math></b>                                                                                                                                                                           |
| Data unit:                                            | GJ/kg                                                                                                                                                                                                   |
| Description:                                          | Net calorific value (energy content) of fossil fuel type $i$ in year $y$                                                                                                                                |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                          |                                                                     |
|--------------------------|---------------------------------------------------------------------|
| <b>Data / Parameter:</b> | <b><math>EF_{CO_2,i,y} / EF_{CO_2,m,i,y}</math></b>                 |
| Data unit:               | tCO <sub>2</sub> /GJ                                                |
| Description:             | CO <sub>2</sub> emission factor of fossil fuel type $i$ in year $y$ |

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>EG_{m,y}</math></b>                                                                                                                                                                                                                                                                                                                                  |
| Data unit:                                            | MWh                                                                                                                                                                                                                                                                                                                                                           |
| Description:                                          | Net electricity generated by power plant/unit <i>m</i> in year <i>y</i>                                                                                                                                                                                                                                                                                       |
| Source of data:                                       | Rwanda Energy Group (REG)/Energy Water and Sanitation (EWSA)                                                                                                                                                                                                                                                                                                  |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                                                                                                                                                                        |
| Choice of data or Measurement methods and procedures: | Data on electricity generation has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants.                                                                                                                                                                                                                                  |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                             |
| Additional comment:                                   | Applicable only to grid emission factor calculations<br><br>Rwanda Energy Group (REG) is the newly established utility company taking over responsibilities from EWSA. The company was established following the separation of EWSA into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC). |

|                                                       |                                                                                                                                                  |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>FC_{i,m,y}</math></b>                                                                                                                   |
| Data unit:                                            | Kg/year                                                                                                                                          |
| Description:                                          | Amount of fossil fuel type <i>i</i> consumed by power plant / unit <i>m</i> in year <i>y</i>                                                     |
| Source of data:                                       | Rwanda Energy Group (REG) / Energy Water and Sanitation (EWSA)                                                                                   |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                           |
| Choice of data or Measurement methods and procedures: | Data on fuel consumption from thermal power plants has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants. |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                             |

|                                                       |                                                                                                              |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>\eta_{m,y}</math></b>                                                                               |
| Data unit:                                            | Percentage                                                                                                   |
| Description:                                          | Average net energy conversion efficiency of power unit <i>m</i> in year <i>y</i> (ratio)                     |
| Source of data:                                       | Defaults from the tool for average net energy of combined cycle engines.                                     |
| Value(s) applied:                                     | To be determined in the specific CPA-DD                                                                      |
| Choice of data or Measurement methods and procedures: | Data will be obtained based on publicly available information or the REG/EWSA, the utility company in Rwanda |
| Purpose of data                                       | Calculation of baseline emissions                                                                            |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                         |

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

The baseline emissions for CPAs involving solar PV power are to be calculated as follows:

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

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

Calculation of  $EG_{facility,y}$

| Parameter            | Value          | Unit   | Source          |
|----------------------|----------------|--------|-----------------|
| $EG_{PJ,facility,y}$ | [insert value] | MWh/yr | [insert source] |

Calculation of  $EF_{CO_2,grid,y}$

The combined margin emission factor for the grid is calculated using the following equations:

$$EF_{grid,y} = EF_{grid,CM,y}$$

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

Values to determine  $EF_{grid,CM,y}$  for solar PV power CPAs:

| Parameter           | Value    | Unit                  | Source           |
|---------------------|----------|-----------------------|------------------|
| $EF_{grid,BM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{BM}$            | 0.25     |                       | Default value    |
| $EF_{grid,OM-DD,y}$ | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{OM}$            | 0.75     |                       | Default value    |
| $EF_{grid,CM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |

Therefore:

$$EF_{grid,y} = [\text{Insert}] \text{ tCO}_2/\text{MWh}$$

$$BE_y = [\text{Insert}] * [\text{Insert}] = [\text{Insert}] \text{ tCO}_2/\text{year}$$

**Project emissions**

$$PE_y = 0$$

**Leakage emissions**

No leakage emissions are considered since the CPA is not a biomass project activity.

**Emission reductions**

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including Solar PV: [insert value of  $BE_y$ ] - 0 - 0 = [insert value of  $ER_y$ ]

**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**

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>            | <b><math>EG_{PJ, facility, y}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Data unit:                          | MWh/year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 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                    | To be reported in the specific CPA-DD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Measurement methods and procedures: | <p>The metering equipment installed at the CPA site should be in line with the provisions of the Power Purchase Agreement and the Rwandan Electricity Grid Code.</p> <p>This parameter should 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 delivered to the project plant/unit from the grid.</p> <p>In case it is calculated then the following parameters shall be measured:</p> <p>(a) The quantity of electricity supplied by the project plant/unit to the grid; and</p> <p>(b) The quantity of electricity delivered to the project plant/unit from the grid</p> |
| Monitoring frequency:               | <p>Continuous monitoring, hourly measurement and at least monthly recording</p> <p>The basic measurement period shall be carried out in line with the PPA and the relevant industry levels.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| QA/QC procedures:                   | <p>Cross-check results with records of sold electricity.</p> <p>Calibration of meters will be done according to the appropriate standard SANS 474:2008, NRS 057:2011, IEC 62056 adopted by RURA and equipment specifications, whichever is more precise. The basic QA/QC procedures will be carried out in line with the PPA.</p>                                                                                                                                                                                                                                                                                                                                                                                                       |
| Purpose of data                     | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Additional comment:                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

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

Overall authority and responsibility for monitoring will rest with the CME, who will also be responsible for managing the emission reduction monitoring and verification process.

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

CPA implementing entity

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on- site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

| Parameter              | Description                                                                            | Type of CPA |
|------------------------|----------------------------------------------------------------------------------------|-------------|
| $EG_{PJ, facility, y}$ | Quantity of net electricity supplied by the project plant/unit to the grid in year $y$ | All         |

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year  $y$  ( $EG_{facility, y}$ ). The CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the electricity off-taker. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity 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 or the last issuance of CERs, whichever is later.

Metering will be conducted with calibrated measurement equipment in accordance to relevant industry standards. The Rwandan Utilities Regulatory Authority (RURA) has adopted the metering standards (SANS 474:2008, NRS 057:2011, IEC 62056) as outlined in the *Metering Code*, part of the Rwandan Grid Code. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations, which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers and associated test facilities.

The CPA will be responsible for the Metering Installation procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The Metering Installation would be preferable installed at the Point of Supply, which is defined as the commercial boundary between customer (CPA implementer) and the Transmitter organization.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

### **Gigawatt Global - Coordinating/managing entity**

The CME will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Receiving monitored data collected by the CPA implementing entity.
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices, and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

### **Training**

Before the implementation of a CPA or the start of the crediting period of the CPA, whichever occurs later, 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

## **PART II. Generic component project activity (CPA)**

### **CPA TYPE II: GREENFIELD LARGE-SCALE SOLAR PV POWER PLANTS/UNITS IN RWANDA APPLYING FIRST-OF-ITS-KIND ANALYSIS**

#### **SECTION A. General description of a generic CPA**

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

The generic Component Project Activity (CPA) will involve the implementation and operation of a large-scale solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant). The project activity will generate electricity from renewable sources, which will be fed into Rwanda's national electricity grid, displacing fossil fuel based electricity generation, thus, leading to emission reductions.

The CPA is being pursued as a component of the PoA "Gigawatt Global Programme of Activities" with Gigawatt Global Cooperatief U.A. as the CME.

Demonstration of eligibility into the PoA is provided in section B.5 of the Generic CPA.

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

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

The CPA will apply the approved consolidated baseline and monitoring methodology ACM0002 (version 16.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 16.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 04.0)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)*
- *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)*
- *Tool to determine the remaining lifetime of equipment (version 01.0)*
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)*

The CPA will only apply the *Tool to calculate the emission factor for an electricity system (version 04.0)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*.

The *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)* will also not be used since the CPA will not generate CO<sub>2</sub> emissions from fossil fuel combustion for its operations. The *Tool to determine the remaining lifetime of equipment (version 01)* will not be used as the generic CPA is a Greenfield project while the *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)* is only applicable upon renewal of a crediting period.

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

The CPA qualifies as a Type I project activity and meets the applicability criteria in accordance with ACM0002 *Grid connected electricity generation from renewable sources* (version 16.0), as follows:

| Applicability criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Generic CPA justification                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>This methodology is applicable to grid-connected renewable power generation project activities that:</p> <ul style="list-style-type: none"> <li>(a) Install a Greenfield power plant;</li> <li>(b) Involve a capacity addition to (an) existing plant(s);</li> <li>(c) Involve a retrofit of (an) existing operating plants/units;</li> <li>(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or</li> <li>(e) Involve a replacement of (an) existing plant(s).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>CPAs will consist of solar PV power projects connected to the Rwanda National Grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant)</p> |
| <p>The methodology is applicable under the following conditions:</p> <ul style="list-style-type: none"> <li>(a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;</li> <li>(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.</li> </ul> | <p>The CPA will install a solar PV power plant, an eligible technology type under this methodology.</p> <p>n/a. CPAs under this PoA are Greenfield projects.</p>                                                                                      |
| <p>In case of hydro power plants, one of the following conditions shall apply</p> <ul style="list-style-type: none"> <li>(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</li> <li>(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than <math>4 \text{ W/m}^2</math>; or</li> <li>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than <math>4 \text{ W/m}^2</math>; or</li> <li>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is</li> </ul>                                                                                                  | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                                                                                                                                                                                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <p>lower than or equal to <math>4 \text{ W/m}^2</math>, all of the following conditions shall apply:</p> <ul style="list-style-type: none"> <li>i. The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than <math>4 \text{ W/m}^2</math>;</li> <li>ii. Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</li> <li>iii. Installed capacity of the power plant(s) with power density lower than or equal to <math>4 \text{ W/m}^2</math> shall be: <ul style="list-style-type: none"> <li>a) Lower than or equal to 15 MW; and</li> <li>b) Less than 10 per cent of the total installed capacity of integrated hydro power project.</li> </ul> </li> </ul>                                                                                                                                                                                                                                             |                                                                                   |
| <p>In the case of integrated hydro power projects, project proponent shall:</p> <p>(a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or</p> <p>(b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM 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.</p> | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                    |
| <p>The methodology is not applicable to:</p> <ul style="list-style-type: none"> <li>a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;</li> <li>b) Biogas fired power plants</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>n/a. CPAs under the PoA will only consist of Greenfield solar PV projects.</p> |
| <p>In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>n/a, CPAs under this PoA are Greenfield projects.</p>                          |

|                                                                  |  |
|------------------------------------------------------------------|--|
| project activity and undertaking business as usual maintenance". |  |
|------------------------------------------------------------------|--|

The CPA will be in compliance with the *Tool to calculate the emission factor for an electricity system* (version 04.0) as follows:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 since the generic CPA involves the generation of electricity from solar and its supply to the Rwandan grid system.                                                                                                                 |
| Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity. | The emission factor is calculated for either only grid connected power plants or both grid connected and off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" will be met. |
| 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.<br>Rwanda is not an Annex-I country.                                                                                                                                                                  |
| The value applied to the CO <sub>2</sub> emission factor of biofuels is zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Not applicable since no biofuels are used for grid-connected electricity generation in Rwanda.                                                                                                                                                             |

### B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. Rwandan national electricity grid). The project activity will therefore displace electricity generated by Rwandan fossil fuel grid-connected power plants and will therefore lead to emission reductions of CO<sub>2</sub>.

The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for solar PV energy CPAs are provided in the table below:

| Source           |                                                                                                                                                 | Gas              | Included | Justification/Explanation                                                                        |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|--------------------------------------------------------------------------------------------------|
| Baseline         | CO <sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity              | CO <sub>2</sub>  | Yes      | Main emission source                                                                             |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       | Minor emission source                                                                            |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       | Minor emission source                                                                            |
| Project activity | For geothermal power plants, fugitive emissions of CH <sub>4</sub> and CO <sub>2</sub> from non-condensable gases contained in geothermal steam | CO <sub>2</sub>  | No       | The CPAs in this PoA do not involve geothermal power plants therefore no emissions are included. |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | CO <sub>2</sub> emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants  | CO <sub>2</sub>  | No       | No on-site fossil fuel consumption will take place. Therefore no emissions are included          |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | For hydro power plants, emissions of CH <sub>4</sub> from the reservoir                                                                         | CO <sub>2</sub>  | No       | This PoA does not involve hydroelectric power plants, therefore no emissions are included        |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |

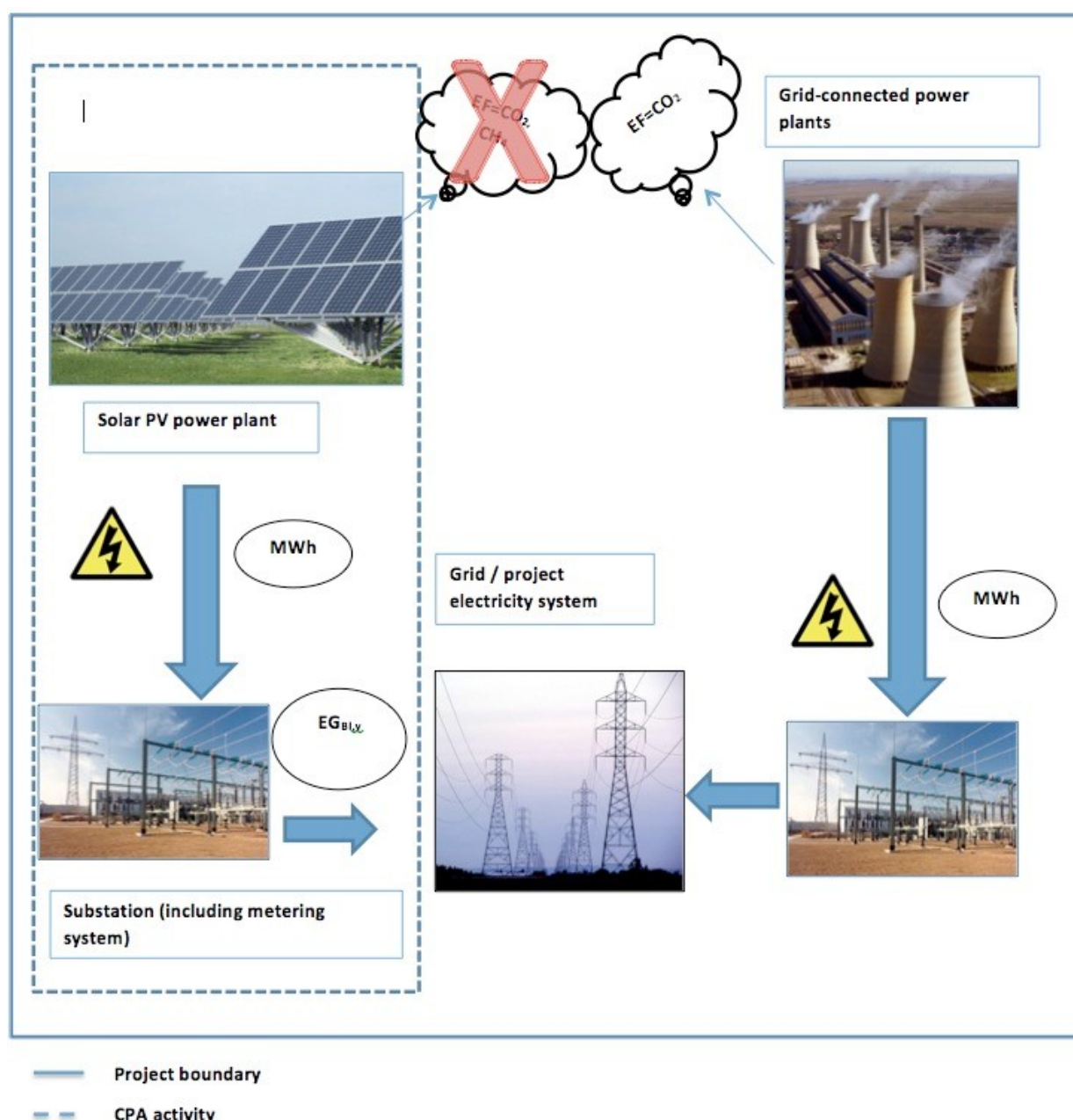


Figure 9: Flow diagram delineating the CPA boundary

#### B.4. Description of baseline scenario

In accordance with the large-scale consolidated methodology ACM0002 (version 16.0) *Grid-connected electricity generation from renewable sources*, the baseline scenario is “electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

##### Structure of the Rwanda Power sector

The power sector in Rwanda lies under the Ministry of Infrastructure (MININFRA), which has the primary responsibility of policy formulation and strategy setting for the energy sector, and for

coordinating developments in the electricity sub-sector.<sup>55</sup> The Government of Rwanda (GoR) launched the Economic Development and Poverty Reduction Strategy II (EDPRS II), 2013-2018, with an aim to boost economic growth.<sup>56</sup> Increasing the supply, access and stability of electricity have been identified as some of the core pillars for achieving this stated objective and increasing electricity generation from renewables has been particularly emphasized.<sup>57</sup>

The Rwanda Utilities Regulatory Authority (RURA) is the body that is tasked to oversee the energy sector together with other sectors in telecommunications, water, waste and transport. RURA was established on 13/01/2001 through the adoption of Law N°39/2001. This Law was further reviewed and replaced by Law N° 09/2013 of 01/03/2013, which further amended its mission, powers, organization and functions specifically in the energy sector. RURA is mandated to control and regulate electricity generation, transmission and distribution in order to ensure efficiency and sustainability in the sector. As such, it plays a supervisory role by among other things, granting licenses for generation, transmission and distribution of electricity in Rwanda.<sup>58</sup>

Apart from MININFRA and the Rwanda Utilities Regulator (RURA), the utility company, the newly established utility company, the Rwanda Energy Group Limited (REG)<sup>59</sup> is the other key player in the energy sector. The 100% state owned company is the largest electricity generator accounting for over 90% of the total electricity generated and also responsible for transmission, distribution and supply of electricity in Rwanda.<sup>60</sup>

Since the early 2000, Rwanda has gradually moved towards power sector reforms focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths but have typically involved the passing of electricity laws, the establishment of a regulatory body overseeing the power sector, some form of unbundling of the power sector and the introduction of Independent Power Producers (IPPs). Rwanda has also introduced Feed-in-Tariff policies starting with small hydro projects with the rest of renewable energy technologies to be included in future. The Renewable Energy Feed-in-Tariff (REFIT) adopted in 2012, is a direct result of the governments Green Growth Strategy adopted in 2011 to foster the uptake of renewable energy in the national grid.<sup>61</sup>

Previously, EWSA was responsible for providing both electricity and water thereby hindering its ability to make real progress in improving energy supply in Rwanda. As a consequence, the company was separated into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC) with different and independent roles in providing energy and water services respectively. This move is expected to promote efficiency and transparency in the generation and distribution of electricity in Rwanda.

### **Installed Generation Capacity**

Rwanda's installed capacity has increased significantly from a mere 25MW in 1994 to 110MW in 2013.<sup>62</sup> The five-year average<sup>63</sup> of the national electricity generation mix is dominated by thermal sources (58.7%), hydro (41.2%) and the remaining 0.1% for solar PV.

<sup>55</sup> [http://www.mininfra.gov.rw/Mission\\_and\\_Purpose](http://www.mininfra.gov.rw/Mission_and_Purpose); Accessed on 18 December 2014

<sup>56</sup> Economic Development and Poverty Reduction Strategy II (EDPRS II)

<sup>57</sup> Republic of Rwanda (2000), Rwanda Vision 2020

<sup>58</sup> [www.rura.rw/about-rura/](http://www.rura.rw/about-rura/); Accessed on 18 December 2014

<sup>59</sup> Formerly the utility company was Energy Water and Sanitation Company (EWSA)

<sup>60</sup> [www.reg.rw/home](http://www.reg.rw/home); Accessed on 18 December 2014

<sup>61</sup> [www.rura.rw](http://www.rura.rw); Accessed on 18 December 2014

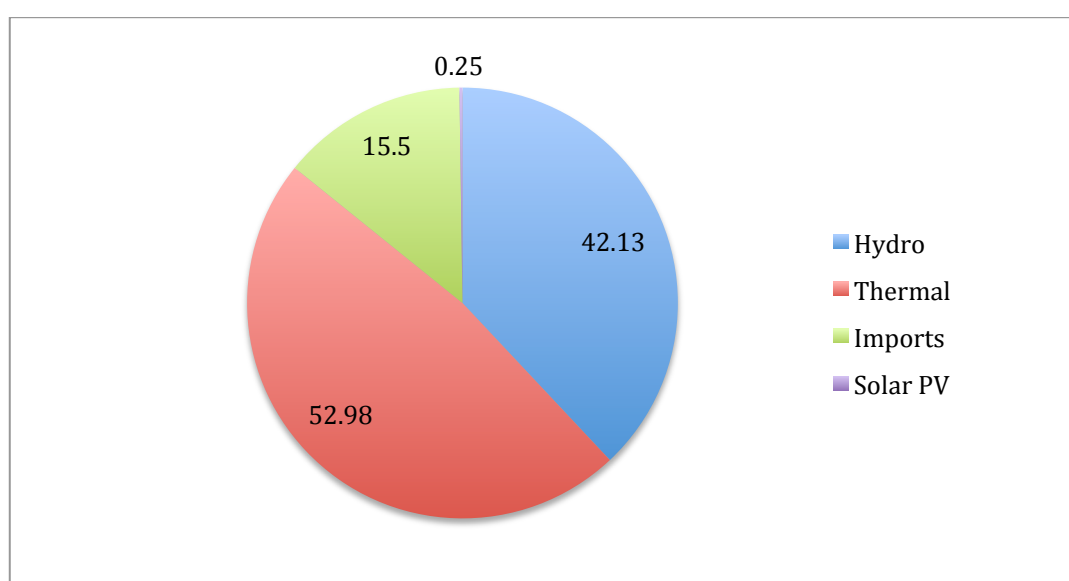
<sup>62</sup> <http://www.ewsarw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>63</sup> Electricity data provided by EWSA for the period 2009 -2013

By June 2013, the total installed capacity in Rwanda reached 110MW<sup>64</sup>. The country's electricity generation was dominated by thermal power accounting for about 52.08 MW of the total generation followed by hydropower at 42.13 MW. Electricity imports from the regional countries accounted for about 15.5 MW. However, the available capacity fluctuated between 80MW and 92 MW. Of this capacity, grid connected solar accounted for only 0.25MW,<sup>65</sup> which represents 0.1% of the total installed capacity.

According to the former utility company, EWSA, generation from thermal sources accounting for more than half the national generation mix, directly translated to high cost of fuel consumption estimated at USD 40 million annually and an average electricity cost of USD 0.26/kWh.<sup>66</sup> This average electricity costs in Rwanda is almost double the overall global average of USD 0.14/kWh.<sup>67</sup> The Rwandan government has consequently been forced to provide electricity subsidies in order to keep the tariff comparable with the regional average.

This information on Rwanda energy generation mix is summarised graphically as follows:



**Figure 10: Installed grid electricity capacity by type in Rwanda**

### **Future Generation**

Rwanda's electricity consumption constitutes only 4% of the overall primary energy consumption with biomass forming the largest proportion at 85% and petroleum accounting for 11%.<sup>68</sup> On one hand, these percentages present the electricity subsector as the least developed in the energy sector while on the other hand, the figures illustrate a high dependency on wood fuel in Rwanda.

<sup>64</sup> RURA annual report 2012-2013 reports 110MW. However electricity data from the utility company (used in the GEF spread sheet) indicates the capacity to be about 127.45 MW. The former has been used since its publicly available information while data from EWSA is not.

<sup>65</sup> Electricity data provided by EWSA for the period 2009 -2013

<sup>66</sup> <http://www.ewsarw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>67</sup> Rapid Assessment of a National Energy and Low Carbon path for Rwanda (May 2009)

<sup>68</sup> RURA Annual Report 2012/2013, Page 77

The GoR recognizes that the availability of reliable power supply is a pre-requisite for economic growth, social prosperity, as well as human development. The government, therefore, aims at increasing and diversifying electricity generation in the country through a rollout programme that will rapidly increase supply. Already some positive results have been posted following the implementation of the initial phase of the government initiative and increasing electricity access by a remarkable 160% between the year 2008 and 2011.<sup>69</sup> Nonetheless, only 16% (350,000) of Rwanda's households are connected to the grid as shown in the table below. In this regard, the government has revised its target to expand electricity access to households to approximately 70% by 2017.<sup>70</sup> The expansion plan is aimed at increasing the electricity generation capacity by an additional 1000MW in 2017<sup>71</sup> and 1300MW by 2020.<sup>72</sup> The 1,000MW additional installed capacity in 2017 will comprise of 340 MW of hydropower, 310MW of geothermal power, 300MW of natural gas (methane-based) power, 200MW of peat-based power and 20MW of diesel thermal plants and 5 MW from solar PV.<sup>73</sup>

The table below shows the growth in electricity service from the year 2000 to 2012:

**Table 10: Growth in electricity service (2000 - 2012)**

| Year                  | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Peak Load (MW)        |      |      |      |      |      |      |      | 47   | 51   | 56   | 64   | 78   | 92   |
| Sales (GWh)           | 204  | 209  | 225  | 235  | 204  | 194  | 230  | 249  | 277  | 308  | 353  | 417  |      |
| Losses                |      |      | 35   |      |      |      | 22   | 18   | 18   | 20   | 19   | 19   |      |
| No. of customers '000 | 49   | 49   | 58   | 67   | 68   | 70   | 77   | 86   | 109  | 140  | 175  | 280  | 350  |
| Access %              |      |      |      |      |      |      |      |      | 4    | 8    | 13   | 14   | 16   |

Source: EWSA

**Table 11: Target Capacity Additions in Rwanda by 2017**

| Generation type | Target installed capacity (MW) |
|-----------------|--------------------------------|
| Peat            | 200                            |
| Geothermal      | 310                            |
| Hydro Power     | 340                            |
| Methane         | 300                            |
| Diesel          | 20                             |
| Solar           | 5 <sup>74</sup>                |
| Total           | 1,175                          |

<sup>69</sup> Rwanda Energy Sector Review and Action Plan (2013), Page 31

<sup>70</sup> Rwanda Energy Sector Review and Action Plan, Page 8

<sup>71</sup> Energy Policy and Strategy, page 54

<sup>72</sup> Energy Policy and Strategy, page 52

<sup>73</sup> The summation of these capacities yield about 1,175MW against the indicated 1000MW. Other sources indicate a capacity target of 20MW for solar PV in Rwanda. We have however chosen to stick with the capacity target as documented in the policy document.

<sup>74</sup> The Electricity policy and strategy indicates 5 MW although other sources indicate 20MW. The later has been picked since its more realistic. Besides, the Rwanda development Board lists two solar PV projects of 10MW each to be under development.

| Year | Based on EDPRS and Vision 2020 |                         |              | Based on Targets Set in 2010 by the New Government |                         |              |
|------|--------------------------------|-------------------------|--------------|----------------------------------------------------|-------------------------|--------------|
|      | Access (%)                     | Installed Capacity (MW) | Energy (GWH) | Access (%)                                         | Installed Capacity (MW) | Energy (GWH) |
| 2008 | 6.0                            | 45                      | 225.0        | 6.0                                                | 45                      | 225          |
| 2010 | 11.0                           | 85                      | 353          | 11.0                                               | 85                      | 353          |
| 2015 | 22                             | 200                     | 965.5        | 35.0                                               | 800                     | 1200         |
| 2017 | 28.0                           | 300                     | 1,200.0      | 50.0                                               | 1000                    | 1400         |
| 2020 | 32                             | 400                     | 1,478.0      | 90                                                 | 1200                    | 1950         |
| 2025 | 40.0                           |                         | 2,148.4      | 94.0                                               | 1500                    | 3300         |

**Figure 11: Vision 2020 vs. New Electricity generation targets** Source: Electricity Master Plan (2011), Seven-Year Electricity (2011)

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

### 16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

### 16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>75</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

#### **16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 (version 16.0)

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

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<sup>75</sup> <http://cdm.unfccc.int/>

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies. ACM0002 (version 16.0) para 33 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality*".

In line with the above *Tool for the demonstration and assessment of additionality* (version 7.0.0), the following eligibility criteria have been formulated to prove additionality:

**Step 0: Demonstration whether the proposed CPA is the first-of-its-kind**

In accordance with the *Guidelines on additionality of first-of-its-kind project activities* (version 02, EB 69, Annex 7), now revised to methodological tool *on additionality of first-of-its-kind project activities* (version 03.0, EB 84, Annex 6), a CPA is considered as its first-of-its-kind if:

- The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;
- The project implements one or more of the measures;
  - Fuel and feedstock switch (example: switch from naphtha to natural gas for energy generation, or switch from limestone to gypsum in cement clinker production);
  - Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on renewable energy);

- Methane destruction (example: landfill gas flaring);
- Methane formation avoidance (example: use of biomass that would have been left to decay in a solid waste disposal site resulting in the formation and emission of methane, for energy generation).
- The project participants selected a crediting period for the project activity that is “a maximum of 10 years with no option of renewal”.
- Output is goods/services produced by the project activity including, among other things, heat, steam, electricity, methane, and biogas unless otherwise specified in the applied methodology.

Different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed clean development mechanism (CDM) project activity and applicable geographical area):

- Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);
- Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon- intensive fuels);
- Size of installation (power capacity)/energy savings:
  - Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6);
  - Small (as defined in paragraph 28 of decision 1/CMP.2);
  - Large.

According to the above definition, solar PV and solar thermal technologies are considered to be the same as both technologies can be used to generate grid-connected electricity. Therefore, the CPA will consider both technologies in the first-of-its kind analysis process.

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of Rwanda. The applicable geographical area is therefore the host country Rwanda. As per eligibility criteria 3.2 the CPA has also evidenced that it involves the use of solar PV technology, a renewable energy, which is one of the applicable measures as per paragraph 9 of the methodological tool: *Additionality of first-of-its-kind project activities version 03*. For CPAs to be included in the PoA, output is defined as electricity generation being fed into the Rwanda National Grid.

**Eligibility Criteria 6.1:** The CME has confirmed that the CPA is applying a technology which is different from any other project in Rwanda that supplies electricity to the Rwanda National Grid and has started commercial operation before the CME notified the secretariat and the DNA of its intention seek CDM status, or before the inclusion of the CPA in the PoA or before the start date of the CPA (as defined in eligibility criterion 4), whichever is applicable and earlier. This will be evidenced by a comparison with all grid-connected power plants located in Rwanda based on data, which has been made available by Rwanda Utilities Regulatory Authority (RURA), Rwanda Energy Group (REG) and/or the Ministry of Infrastructure (MININFRA) or any other credible source.

**Eligibility Criteria 6.2:** The project participants selected a crediting period for the CPA that is a maximum of 10 years with no option of renewal. This will be evidenced as per section A.9 of the CPA-DD.

If the proposed CPA is the first-of-its-kind as shown above, its additionality is demonstrated in accordance with paragraph 13 of the methodological tool: *Additionality of first-of-its-kind project activities*.

**16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>76</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>77</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party (ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small- scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

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<sup>76</sup> National Policy on Environment, Rwanda (2003)

<sup>77</sup> EIA Regulations, Rwanda

**16 I. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

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

### **B.6.1. Explanation of methodological choices**

The generic CPA will focus on grid-connected renewable electricity generation from solar PV power. The generic CPA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (Greenfield plant).

The emission factor of the grid is calculated in a transparent and conservative manner using the combined margin (CM) consisting of the operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

#### **Baseline emissions**

Baseline emissions include CO<sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. In line with ACM0002 (version 16.0), the baseline emissions are to be calculated as follows (**equation 7**):

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

Where:

|                  |   |                                                                                                                                                                                                                                |
|------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $BE_y$           | = | Baseline Emissions in year y (t CO <sub>2</sub> /yr)                                                                                                                                                                           |
| $EG_{PJ,y}$      | = | Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)                                                                 |
| $EF_{grid,CM,y}$ | = | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate emission factor for an electricity system” (tCO <sub>2</sub> /MWh) |

#### **Calculation of $EG_{PJ,y}$**

CPAs under the PoA involve the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield projects), therefore  $EG_{PJ,y}$  is estimated as per **equation 8**:

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

Where:

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

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

The emission factor will be calculated in a transparent and conservative manner using option (a), the combined margin (CM), consisting of the combination of operating margin (OM) and build

margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

The grid emission factor will be calculated for the Rwandan electricity system and will be applied to each CPA of the PoA. Equations and source of data to calculate the grid emission factor for Rwanda are provided below.

### **Step 1. Identify the relevant electric power system**

For calculating the grid emission factor, the project activity has identified the Rwanda National Grid as the relevant project electricity system.

The identification of the Rwanda National Grid as the relevant project electricity system is based on the following arguments:

- The Rwandan DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the Rwandan grid system
- Although the Rwandan grid is connected to a number of its neighbouring countries' grids including Uganda, Burundi and DRC Congo, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary. Those countries will however be considered as connected electricity systems and the electricity imported into the Rwandan grid (project electricity system) will be included as imports.
- Finally, Rwanda does not have a layered dispatch system and the country has only one grid system that serves the entire country. Therefore, and in line with version 04.0 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

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

The project activity has selected either Option I where only grid power plants are included in the calculation or Option II where both grid and off-grid power plants are included in the calculation.

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

The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

- a) Simple OM
- b) Simple adjusted OM
- c) Dispatch data analysis OM
- d) Average OM

It is stated under the *Tool to calculate the emission factor for an electricity system* that simple OM can only be used if low-cost/must-run resources constitute less than 50 per cent of total grid generation. In line with a five-year electricity generation data during the period of 2009 and 2013, low-cost/must-run resources in Rwanda, which are mainly hydro, constitute about 41% of total grid generation. Therefore, since this condition has been met, the simple OM method is used.

The CPAs will use the *ex-ante* option and the OM will be calculated once at the validation stage using a three years generation-weighted average.

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

The simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub> emissions per unit net electricity generation (t CO<sub>2</sub>/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

**Option A:** Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit; or,

**Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A has been chosen to calculate the operating margin emission factor of power plants serving the grid.

The Simple OM emission factor is calculated using equation 1 as follows:

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

Where:

- $EF_{grid,OMsimple,y}$  = Simple operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  = All grid power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

#### Determining $EF_{EL,m,y}$

For the calculation of the emission factor for each power plant  $m$ , option A1 has been selected as fuel consumption is normally provided. Therefore, equation 2 will be used as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type  $i$  in year  $y$  (GJ/mass or volume unit)
- $EF_{CO2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $i$  = All fuel types combusted in power unit  $m$  in year  $y$

$y$  = The relevant year as per the data vintage chosen in Step 3

However, in some instances where there is missing data on the fuel consumption amounts, option A.2 will be selected and therefore equation 3 used as follows:

Where several fuel types are used in the power unit, the fuel type with the lowest CO<sub>2</sub> emission factor for  $EF_{CO_2,m,i,y}$  is to be used.

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (t CO<sub>2</sub>/MWh)
- $EF_{CO_2,m,i,y}$  = Average CO<sub>2</sub> emission factor of fuel type  $i$  used in power unit  $m$  in year  $y$  (t CO<sub>2</sub>/GJ)
- $\eta_{m,y}$  = Average net energy conversion efficiency of power unit  $m$  in year  $y$  (ratio)
- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

#### Determination of $FC_{i,m,y}$

Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit) was based on published records from REG/EWSA and IPP power plants.

(Insert fuel consumption data for latest 3 years)

| Name  | Type | Fuel Consumption data (Litres/year) |        |        |
|-------|------|-------------------------------------|--------|--------|
|       |      | Year 1                              | Year 2 | Year 3 |
|       |      |                                     |        |        |
|       |      |                                     |        |        |
| Total |      |                                     |        |        |

#### Determination of $EG_{m,y}$

For grid power plants,  $EG_{m,y}$  is based on published records and data obtained directly from REG/EWSA and IPP power plants. The grid emission factor calculations are based on the publicly available data in Rwanda, i.e. REG/EWSA and IPP power plants which represents the total electricity generated in the Rwandan grid.

(Insert electricity data for thermal power plants for latest 3 years)

| Name  | Type | Generation data (MWh) |        |        |
|-------|------|-----------------------|--------|--------|
|       |      | Year 1                | Year 2 | Year 3 |
|       |      |                       |        |        |
|       |      |                       |        |        |
| Total |      |                       |        |        |

For off-grid power plants,  $EG_{m,y}$  is based on paragraph 32 of the *Tool to calculate the emission factor for an electricity system*. The tool states that a default value of 10 per cent of the total electricity generation by grid power plants in the electricity system can be used to determine  $EG_{m,y}$  for the purpose of the operating margin determination.

(Insert electricity data for all power plants serving the grid for latest 3 years)

| Name     | Type | Generation data (MWh) |        |        |
|----------|------|-----------------------|--------|--------|
|          |      | Year 1                | Year 2 | Year 3 |
|          |      |                       |        |        |
|          |      |                       |        |        |
| Total    |      |                       |        |        |
| Off-grid |      |                       |        |        |

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

For the calculation of the build margin (BM) emission factor, **Option 1** data vintage will be chosen. Hence, for the first crediting period, the build margin emission factor shall be calculated, *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CPA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require the emission factor to be monitored during the first crediting period.

The build margin emission factor is thus calculated using **equation 13** of the “*Tool to calculate the emission factor for an electricity system*”, as shown below:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year *y* (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit *m* in year *y* (tCO<sub>2</sub>/MWh)
- m* = Power units included in the build margin
- y* = Most recent historical year for which power generation data is available

The CO<sub>2</sub> emission factor of each power unit *m* ( $EF_{EL,m,y}$ ) will be determined as per the guidance in section 6.4.1 for the simple OM, using equation (2) under option A1 or equation 3 under option A2, depending on availability of data, and using for *y* the most recent historical year for which grid power generation data is available, and using for *m* the power *units* included in the build margin.

If the power units included in the build margin *m* correspond to the sample group *SETsample-CDM->10yrs*, then, as a conservative approach, only Option A2 from guidance in Step 4 section 6.4.1 can be used and the default values provided in appendix 1 shall be used to determine the parameter  $\eta_{m,y}$  for the power units that started to supply electricity to the grid more than 10 years ago.

For option A1,  $EF_{EL,m,y}$  is calculated in accordance with equation 2 as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit *m* in year *y* (tCO<sub>2</sub>/MWh)

|                 |                                                                                                       |
|-----------------|-------------------------------------------------------------------------------------------------------|
| $FC_{i,m,y}$    | = Amount of fuel type $i$ consumed by power unit $m$ in year $y$ (Mass or volume unit)                |
| $NCV_{i,y}$     | = Net calorific value (energy content) of fuel type $i$ in year $y$ (GJ/mass or volume unit)          |
| $EF_{CO_2,i,y}$ | = CO <sub>2</sub> emission factor of fuel type $i$ in year $y$ (tCO <sub>2</sub> /GJ)                 |
| $EG_{m,y}$      | = Net quantity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (MWh) |
| $m$             | = The power units included in the build margin                                                        |
| $i$             | = All fuel types combusted in power unit $m$ in year $y$                                              |
| $y$             | = The relevant year as per the data vintage chosen in Step 3                                          |

For option A2,  $EF_{EL,m,y}$  is calculated in accordance with equation 3 as follows:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

|                   |                                                                                                                       |
|-------------------|-----------------------------------------------------------------------------------------------------------------------|
| $EF_{EL,m,y}$     | = CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (t CO <sub>2</sub> /MWh)                              |
| $EF_{CO_2,m,i,y}$ | = Average CO <sub>2</sub> emission factor of fuel type $i$ used in power unit $m$ in year $y$ (t CO <sub>2</sub> /GJ) |
| $\eta_{m,y}$      | = Average net energy conversion efficiency of power unit $m$ in year $y$ (ratio)                                      |
| $m$               | = The power units included in the build margin                                                                        |
| $y$               | = The relevant year as per the data vintage chosen in Step 3                                                          |

The sample group of power units  $m$  used to calculate the build margin will be determined in accordance with the “*Tool to calculate the grid emission factor for an electricity system*”.

Below is a table with all power plants in the project electricity system (Source: Rwanda Energy Group (REG) / Energy, Water and Sanitation - EWSA). The power plants are ranked according to commissioning date.

|   | Name of power plant | Commissioning date | Electricity generation 2009-2011 (MWh) | % |
|---|---------------------|--------------------|----------------------------------------|---|
| 1 |                     |                    |                                        |   |
| 2 |                     |                    |                                        |   |
| 3 |                     |                    |                                        |   |
| 4 |                     |                    |                                        |   |

#### Step 6: Calculate the Combined Margin

Option (a) i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated as follows:

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

Where:

|                  |   |                                                                                  |
|------------------|---|----------------------------------------------------------------------------------|
| $EF_{grid,BM,y}$ | = | Build margin CO <sub>2</sub> emission factor in year y (tCO <sub>2</sub> /MWh)   |
| $EF_{grid,OM,y}$ | = | Operating margin CO <sub>2</sub> emission factor in year (tCO <sub>2</sub> /MWh) |
| $W_{OM}$         | = | Weighting of operating margin emissions factor (%)                               |
| $W_{BM}$         | = | Weighting of build margin emissions factor (%)                                   |

For solar power generation projects the following default values are used for  $W_{OM}$  and  $W_{BM}$ :

$$W_{OM} = 0.75$$

$$W_{BM} = 0.25$$

### **Project emissions**

For most renewable energy projects, such as solar PV energy project activities,  $PE_y = 0$ . Project emissions will be considered following the procedures described in ACM0002, version 16.0 using **equation (1)**:

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

Where:

|             |   |                                                                                                                                               |
|-------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------|
| $PE_y$      | = | Project emissions in year y (tCO <sub>2</sub> e/yr)                                                                                           |
| $PE_{FF,y}$ | = | Project emissions from fossil fuel consumption in year y (tCO <sub>2</sub> /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 <sub>2</sub> e/yr) |
| $PE_{HP,y}$ | = | Project emissions from water reservoirs of hydro power plants in year y (tCO <sub>2</sub> e/yr)                                               |

#### **Project emissions from fossil fuel consumption ( $PE_{FF,y}$ )**

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels.

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

This CPA involves solar PV power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

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

This CPA involves solar PV power plants, not hydro power plants with water reservoirs. Therefore there are no emissions from hydro power plants.

This CPA, which involves a solar PV power project, has project emissions ( $PE_y$ ) considered 0.

### **Leakage emissions**

No leakage emissions are considered in accordance with ACM0002 (version 16.0)

### **Emission reductions**

In line with ACM0002 (version 16.0) the emission reductions are calculated using **(equation 13)** as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$  = Emission reductions in year  $y$  (t CO<sub>2</sub>/y)

$BE_y$  = Baseline Emissions in year  $y$  (t CO<sub>2</sub>/y)

$PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>/y)

### B.6.2. Data and parameters fixed ex-ante

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>NCV_{i,y}</math></b>                                                                                                                                                                           |
| Data unit:                                            | GJ/kg                                                                                                                                                                                                   |
| Description:                                          | Net calorific value (energy content) of fossil fuel type $i$ in year $y$                                                                                                                                |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>EF_{CO_2,i,y} / EF_{CO_2,m,i,y}</math></b>                                                                                                                                                     |
| Data unit:                                            | tCO <sub>2</sub> /GJ                                                                                                                                                                                    |
| Description:                                          | CO <sub>2</sub> emission factor of fossil fuel type $i$ in year $y$                                                                                                                                     |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>EG_{m,y}</math></b>                                                                                                                                                                                                                                                                                                                                  |
| Data unit:                                            | MWh                                                                                                                                                                                                                                                                                                                                                           |
| Description:                                          | Net electricity generated by power plant/unit $m$ in year $y$                                                                                                                                                                                                                                                                                                 |
| Source of data:                                       | Rwanda Energy Group (REG)/Energy Water and Sanitation (EWSA)                                                                                                                                                                                                                                                                                                  |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                                                                                                                                                                        |
| Choice of data or Measurement methods and procedures: | Data on electricity generation has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants.                                                                                                                                                                                                                                  |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                             |
| Additional comment:                                   | Applicable only to grid emission factor calculations<br><br>Rwanda Energy Group (REG) is the newly established utility company taking over responsibilities from EWSA. The company was established following the separation of EWSA into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC). |

|                                                       |                                                                                                                                                  |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>FC_{i,m,y}</math></b>                                                                                                                   |
| Data unit:                                            | Kg/year                                                                                                                                          |
| Description:                                          | Amount of fossil fuel type $i$ consumed by power plant / unit $m$ in year $y$                                                                    |
| Source of data:                                       | Rwanda Energy Group (REG) / Energy Water and Sanitation (EWSA)                                                                                   |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                           |
| Choice of data or Measurement methods and procedures: | Data on fuel consumption from thermal power plants has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants. |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                             |

|                                                       |                                                                                                              |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>\eta_{m,y}</math></b>                                                                               |
| Data unit:                                            | Percentage                                                                                                   |
| Description:                                          | Average net energy conversion efficiency of power unit $m$ in year $y$ (ratio)                               |
| Source of data:                                       | Defaults from the tool for average net energy of combined cycle engines.                                     |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                       |
| Choice of data or Measurement methods and procedures: | Data will be obtained based on publicly available information or the REG/EWSA, the utility company in Rwanda |
| Purpose of data                                       | Calculation of baseline emissions                                                                            |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                         |

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

#### Baseline emissions

The baseline emissions for CPAs involving solar PV power are to be calculated as follows:

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

Calculation of  $EG_{facility,y}$

| Parameter         | Value          | Unit   | Source          |
|-------------------|----------------|--------|-----------------|
| $EG_{facility,y}$ | [insert value] | MWh/yr | [insert source] |

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

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

Values to determine  $EF_{grid,CM,y}$  for solar PV power CPAs:

| Parameter           | Value    | Unit                  | Source           |
|---------------------|----------|-----------------------|------------------|
| $EF_{grid,BM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{BM}$            | 0.25     |                       | Default value    |
| $EF_{grid,OM-DD,y}$ | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{OM}$            | 0.75     |                       | Default value    |
| $EF_{grid,CM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |

Therefore:

$$EF_{grid,CM,y} = [\text{Insert}] \text{ tCO}_2/\text{MWh}$$

$$BE_y = [\text{Insert}] * [\text{Insert}] = [\text{Insert}] \text{ tCO}_2/\text{year}$$

### **Project emissions**

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels. As no geothermal or hydro technology types will be implemented, project emissions ( $PE_y$ ) is considered 0.

### **Leakage emissions**

Leakage emissions are not considered in accordance with ACM0002 (version 16.0)

### **Emission reductions**

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including Solar PV:  $[\text{insert value of } BE_y] - 0 = [\text{insert value of } ER_y]$

## **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**

| <b>Data / Parameter:</b>            | <b><math>EG_{facility,y}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data unit:                          | MWh/year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 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                    | To be reported in the specific CPA-DD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Measurement methods and procedures: | <p>The metering equipment installed at the CPA site should be in line with the provisions of the Power Purchase Agreement and the Rwandan Electricity Grid Code.</p> <p>This parameter should 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.</p> <p>In case it is calculated then the following parameters shall be measured:</p> <p>(a) The quantity of electricity supplied by the project plant/unit to the grid; and</p> <p>(b) The quantity of electricity delivered to the project plant/unit from the grid</p> |
| Monitoring frequency:               | The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with the PPA and the relevant industry levels.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| QA/QC procedures:                   | <p>Cross-check results with records of sold electricity.</p> <p>Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Purpose of data                     | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Additional comment:                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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

Overall authority and responsibility for monitoring will rest with the CME, who will also be responsible for managing the emission reduction monitoring and verification process.

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

#### CPA implementing entity

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on-site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

| Parameter              | Description                                                                            | Type of CPA |
|------------------------|----------------------------------------------------------------------------------------|-------------|
| $EG_{PJ, facility, y}$ | Quantity of net electricity supplied by the project plant/unit to the grid in year $y$ | All         |

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year  $y$  ( $EG_{facility, y}$ ). The CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the electricity off-taker. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity 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 or the last issuance of CERs, whichever is later.

Metering will be conducted with calibrated measurement equipment in accordance to relevant industry standards. The Rwandan Utilities Regulatory Authority (RURA) has adopted the metering standards (SANS 474:2008, NRS 057:2011, IEC 62056) as outlined in the *Metering Code*, part of the Rwandan Grid Code. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations, which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers and associated test facilities.

The CPA will be responsible for the Metering Installation procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The Metering Installation would be preferable installed at the Point of Supply, which is defined as the commercial boundary between customer (CPA implementer) and the Transmitter organization.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

**Gigawatt Global - Coordinating/managing entity**

The CME will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Receiving monitored data collected by the CPA implementing entity.
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices, and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

**Training**

Before the implementation of a CPA or the start of the crediting period of the CPA, whichever occurs later, 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

## **PART II. Generic component project activity (CPA)**

### **CPA TYPE III: GREENFIELD LARGE-SCALE SOLAR PV POWER PLANTS/UNITS IN RWANDA APPLYING INVESTMENT ANALYSIS**

#### **SECTION A. General description of a generic CPA**

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

The generic Component Project Activity (CPA) will involve the implementation and operation of a large-scale solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant). The project activity will generate electricity from renewable sources, which will be fed into Rwanda's national electricity grid, displacing fossil fuel based electricity generation, thus, leading to emission reductions.

The CPA is being pursued as a component of the PoA "Gigawatt Global Programme of Activities" with Gigawatt Global Cooperatief U.A. as the CME.

Demonstration of eligibility into the PoA is provided in section B.5 of the Generic CPA.

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

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

The CPA will apply the approved consolidated baseline and monitoring methodology ACM0002 (version 16.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 16.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 04.0)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)*
- *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)*
- *Tool to determine the remaining lifetime of equipment (version 01.0)*
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)*

The CPA will only apply the *Tool to calculate the emission factor for an electricity system (version 04.0)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*.

The *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)* will also not be used since the CPA will not generate CO<sub>2</sub> emissions from fossil fuel combustion for its operations. The *Tool to determine the remaining lifetime of equipment (version 01)* will not be used as the generic CPA is a Greenfield project while the *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)* is only applicable upon renewal of a crediting period.

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

The CPA qualifies as a Type I project activity and meets the applicability criteria in accordance with ACM0002 *Grid connected electricity generation from renewable sources* (version 16.0), as follows:

| Applicability criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Generic CPA justification                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>This methodology is applicable to grid-connected renewable power generation project activities that:</p> <ul style="list-style-type: none"> <li>(a) Install a Greenfield power plant;</li> <li>(b) Involve a capacity addition to (an) existing plant(s);</li> <li>(c) Involve a retrofit of (an) existing operating plants/units;</li> <li>(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or</li> <li>(e) Involve a replacement of (an) existing plant(s).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>CPAs will consist of solar PV power projects connected to the Rwanda National Grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant)</p> |
| <p>The methodology is applicable under the following conditions:</p> <ul style="list-style-type: none"> <li>(a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;</li> <li>(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.</li> </ul> | <p>The CPA will install a solar PV power plant, an eligible technology type under this methodology.</p> <p>n/a. CPAs under this PoA are Greenfield projects.</p>                                                                                      |
| <p>In case of hydro power plants, one of the following conditions shall apply</p> <ul style="list-style-type: none"> <li>(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</li> <li>(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is</li> </ul>                                                                                                                        | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                                                                                                                                                                                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <p>lower than or equal to <math>4 \text{ W/m}^2</math>, all of the following conditions shall apply:</p> <ul style="list-style-type: none"> <li>i. The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than <math>4 \text{ W/m}^2</math>;</li> <li>ii. Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</li> <li>iii. Installed capacity of the power plant(s) with power density lower than or equal to <math>4 \text{ W/m}^2</math> shall be: <ul style="list-style-type: none"> <li>a) Lower than or equal to 15 MW; and</li> <li>b) Less than 10 per cent of the total installed capacity of integrated hydro power project.</li> </ul> </li> </ul>                                                                                                                                                                                                                                             |                                                                                   |
| <p>In the case of integrated hydro power projects, project proponent shall:</p> <p>(a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or</p> <p>(b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM 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.</p> | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                    |
| <p>The methodology is not applicable to:</p> <ul style="list-style-type: none"> <li>a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;</li> <li>b) Biogas fired power plants</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>n/a. CPAs under the PoA will only consist of Greenfield solar PV projects.</p> |
| <p>In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>n/a, CPAs under this PoA are Greenfield projects.</p>                          |

|                                                                  |  |
|------------------------------------------------------------------|--|
| project activity and undertaking business as usual maintenance". |  |
|------------------------------------------------------------------|--|

The CPA will be in compliance with the *Tool to calculate the emission factor for an electricity system* (version 04.0) as follows:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 since the generic CPA involves the generation of electricity from solar and its supply to the Rwandan grid system.                                                                                                                 |
| Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity. | The emission factor is calculated for either only grid connected power plants or both grid connected and off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" will be met. |
| 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.<br>Rwanda is not an Annex-I country.                                                                                                                                                                  |
| The value applied to the CO <sub>2</sub> emission factor of biofuels is zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Not applicable since no biofuels are used for grid-connected electricity generation in Rwanda.                                                                                                                                                             |

### B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. Rwandan national electricity grid). The project activity will therefore displace electricity generated by Rwandan fossil fuel grid-connected power plants and will therefore lead to emission reductions of CO<sub>2</sub>.

The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for solar PV energy CPAs are provided in the table below:

| Source           |                                                                                                                                                 | Gas              | Included | Justification/Explanation                                                                        |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|--------------------------------------------------------------------------------------------------|
| Baseline         | CO <sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity              | CO <sub>2</sub>  | Yes      | Main emission source                                                                             |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       | Minor emission source                                                                            |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       | Minor emission source                                                                            |
| Project activity | For geothermal power plants, fugitive emissions of CH <sub>4</sub> and CO <sub>2</sub> from non-condensable gases contained in geothermal steam | CO <sub>2</sub>  | No       | The CPAs in this PoA do not involve geothermal power plants therefore no emissions are included. |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | CO <sub>2</sub> emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants  | CO <sub>2</sub>  | No       | No on-site fossil fuel consumption will take place. Therefore no emissions are included          |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | For hydro power plants, emissions of CH <sub>4</sub> from the reservoir                                                                         | CO <sub>2</sub>  | No       | This PoA does not involve hydroelectric power plants, therefore no emissions are included        |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |

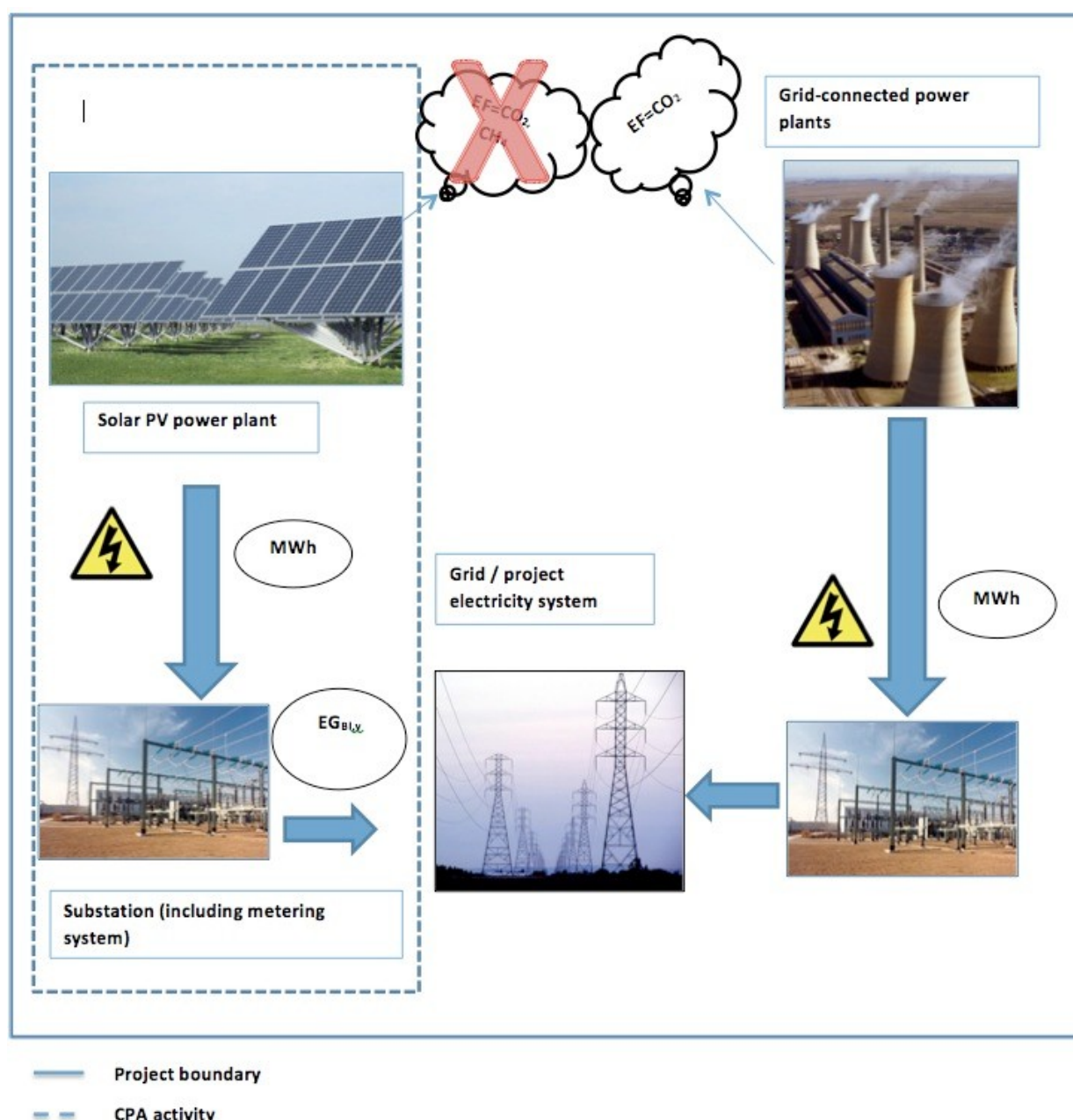


Figure 12: Flow diagram delineating the CPA boundary

#### B.4. Description of baseline scenario

In accordance with the large-scale consolidated methodology ACM0002 (version 16.0) *Grid-connected electricity generation from renewable sources*, the baseline scenario is “electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

##### Structure of the Rwanda Power sector

The power sector in Rwanda lies under the Ministry of Infrastructure (MININFRA), which has the primary responsibility of policy formulation and strategy setting for the energy sector, and for

coordinating developments in the electricity sub-sector.<sup>78</sup> The Government of Rwanda (GoR) launched the Economic Development and Poverty Reduction Strategy II (EDPRS II), 2013-2018, with an aim to boost economic growth.<sup>79</sup> Increasing the supply, access and stability of electricity have been identified as some of the core pillars for achieving this stated objective and increasing electricity generation from renewables has been particularly emphasized.<sup>80</sup>

The Rwanda Utilities Regulatory Authority (RURA) is the body that is tasked to oversee the energy sector together with other sectors in telecommunications, water, waste and transport. RURA was established on 13/01/2001 through the adoption of Law N°39/2001. This Law was further reviewed and replaced by Law N° 09/2013 of 01/03/2013, which further amended its mission, powers, organization and functions specifically in the energy sector. RURA is mandated to control and regulate electricity generation, transmission and distribution in order to ensure efficiency and sustainability in the sector. As such, it plays a supervisory role by among other things, granting licenses for generation, transmission and distribution of electricity in Rwanda.<sup>81</sup>

Apart from MININFRA and the Rwanda Utilities Regulator (RURA), the utility company, the newly established utility company, the Rwanda Energy Group Limited (REG)<sup>82</sup> is the other key player in the energy sector. The 100% state owned company is the largest electricity generator accounting for over 90% of the total electricity generated and also responsible for transmission, distribution and supply of electricity in Rwanda.<sup>83</sup>

Since the early 2000, Rwanda has gradually moved towards power sector reforms focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths but have typically involved the passing of electricity laws, the establishment of a regulatory body overseeing the power sector, some form of unbundling of the power sector and the introduction of Independent Power Producers (IPPs). Rwanda has also introduced Feed-in-Tariff policies starting with small hydro projects with the rest of renewable energy technologies to be included in future. The Renewable Energy Feed-in-Tariff (REFIT) adopted in 2012, is a direct result of the governments Green Growth Strategy adopted in 2011 to foster the uptake of renewable energy in the national grid.<sup>84</sup>

Previously, EWSA was responsible for providing both electricity and water thereby hindering its ability to make real progress in improving energy supply in Rwanda. As a consequence, the company was separated into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC) with different and independent roles in providing energy and water services respectively. This move is expected to promote efficiency and transparency in the generation and distribution of electricity in Rwanda.

### **Installed Generation Capacity**

Rwanda's installed capacity has increased significantly from a mere 25MW in 1994 to 110MW in 2013.<sup>85</sup> The five-year average<sup>86</sup> of the national electricity generation mix is dominated by thermal sources (58.7%), hydro (41.2%) and the remaining 0.1% for solar PV.

<sup>78</sup> [http://www.mininfra.gov.rw/Mission\\_and\\_Purpose](http://www.mininfra.gov.rw/Mission_and_Purpose); Accessed on 18 December 2014

<sup>79</sup> Economic Development and Poverty Reduction Strategy II (EDPRS II)

<sup>80</sup> Republic of Rwanda (2000), Rwanda Vision 2020

<sup>81</sup> [www.rura.rw/about-rura/](http://www.rura.rw/about-rura/); Accessed on 18 December 2014

<sup>82</sup> Formerly the utility company was Energy Water and Sanitation Company (EWSA)

<sup>83</sup> [www.reg.rw/home](http://www.reg.rw/home); Accessed on 18 December 2014

<sup>84</sup> [www.rura.rw](http://www.rura.rw); Accessed on 18 December 2014

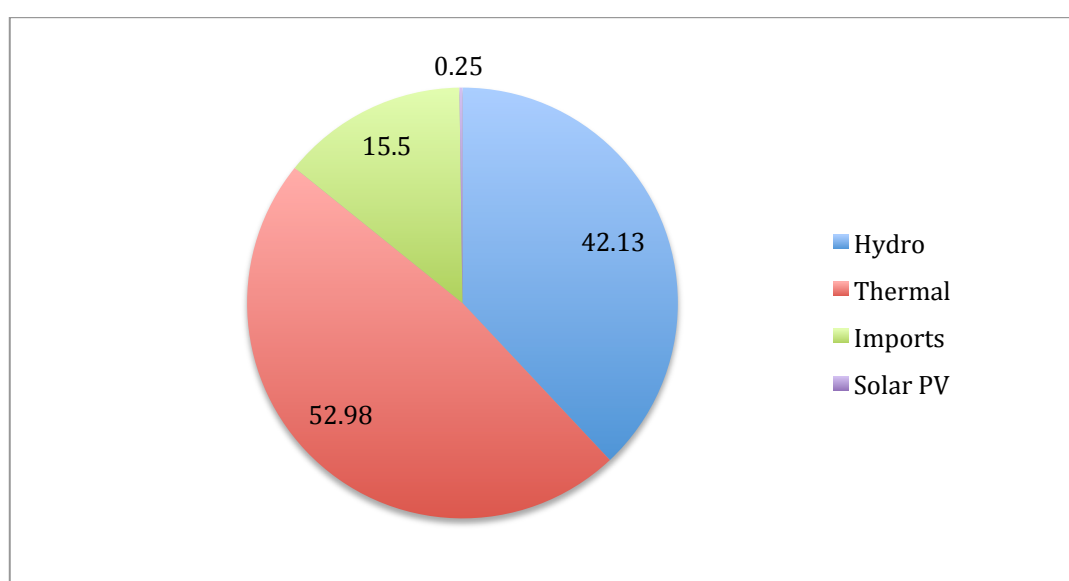
<sup>85</sup> <http://www.ewsarw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>86</sup> Electricity data provided by EWSA for the period 2009 -2013

By June 2013, the total installed capacity in Rwanda reached 110MW<sup>87</sup>. The country's electricity generation was dominated by thermal power accounting for about 52.08 MW of the total generation followed by hydropower at 42.13 MW. Electricity imports from the regional countries accounted for about 15.5 MW. However, the available capacity fluctuated between 80MW and 92 MW. Of this capacity, grid connected solar accounted for only 0.25MW,<sup>88</sup> which represents 0.1% of the total installed capacity.

According to the former utility company, EWSA, generation from thermal sources accounting for more than half the national generation mix, directly translated to high cost of fuel consumption estimated at USD 40 million annually and an average electricity cost of USD 0.26/kWh.<sup>89</sup> This average electricity costs in Rwanda is almost double the overall global average of USD 0.14/kWh.<sup>90</sup> The Rwandan government has consequently been forced to provide electricity subsidies in order to keep the tariff comparable with the regional average.

This information on Rwanda energy generation mix is summarised graphically as follows:



**Figure 13: Installed grid electricity capacity by type in Rwanda**

### **Future Generation**

Rwanda's electricity consumption constitutes only 4% of the overall primary energy consumption with biomass forming the largest proportion at 85% and petroleum accounting for 11%.<sup>91</sup> On one hand, these percentages present the electricity subsector as the least developed in the energy sector while on the other hand, the figures illustrate a high dependency on wood fuel in Rwanda.

<sup>87</sup> RURA annual report 2012-2013 reports 110MW. However electricity data from the utility company (used in the GEF spread sheet) indicates the capacity to be about 127.45 MW. The former has been used since its publicly available information while data from EWSA is not.

<sup>88</sup> Electricity data provided by EWSA for the period 2009 -2013

<sup>89</sup> <http://www.ewsa.rw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>90</sup> Rapid Assessment of a National Energy and Low Carbon path for Rwanda (May 2009)

<sup>91</sup> RURA Annual Report 2012/2013, Page 77

The GoR recognizes that the availability of reliable power supply is a pre-requisite for economic growth, social prosperity, as well as human development. The government, therefore, aims at increasing and diversifying electricity generation in the country through a rollout programme that will rapidly increase supply. Already some positive results have been posted following the implementation of the initial phase of the government initiative and increasing electricity access by a remarkable 160% between the year 2008 and 2011.<sup>92</sup> Nonetheless, only 16% (350,000) of Rwanda's households are connected to the grid as shown in the table below. In this regard, the government has revised its target to expand electricity access to households to approximately 70% by 2017.<sup>93</sup> The expansion plan is aimed at increasing the electricity generation capacity by an additional 1000MW in 2017<sup>94</sup> and 1300MW by 2020.<sup>95</sup> The 1,000MW additional installed capacity in 2017 will comprise of 340 MW of hydropower, 310MW of geothermal power, 300MW of natural gas (methane-based) power, 200MW of peat-based power and 20MW of diesel thermal plants and 5 MW from solar PV.<sup>96</sup>

The table below shows the growth in electricity service from the year 2000 to 2012:

**Table 12: Growth in electricity service (2000 - 2012)**

| Year                  | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Peak Load (MW)        |      |      |      |      |      |      |      | 47   | 51   | 56   | 64   | 78   | 92   |
| Sales (GWh)           | 204  | 209  | 225  | 235  | 204  | 194  | 230  | 249  | 277  | 308  | 353  | 417  |      |
| Losses                |      |      | 35   |      |      |      | 22   | 18   | 18   | 20   | 19   | 19   |      |
| No. of customers '000 | 49   | 49   | 58   | 67   | 68   | 70   | 77   | 86   | 109  | 140  | 175  | 280  | 350  |
| Access %              |      |      |      |      |      |      |      |      | 4    | 8    | 13   | 14   | 16   |

Source: EWSA

**Table 13: Target Capacity Additions in Rwanda by 2017**

| Generation type | Target installed capacity (MW) |
|-----------------|--------------------------------|
| Peat            | 200                            |
| Geothermal      | 310                            |
| Hydro Power     | 340                            |
| Methane         | 300                            |
| Diesel          | 20                             |
| Solar           | 5 <sup>97</sup>                |
| Total           | 1,175                          |

<sup>92</sup> Rwanda Energy Sector Review and Action Plan (2013), Page 31

<sup>93</sup> Rwanda Energy Sector Review and Action Plan, Page 8

<sup>94</sup> Energy Policy and Strategy, page 54

<sup>95</sup> Energy Policy and Strategy, page 52

<sup>96</sup> The summation of these capacities yield about 1,175MW against the indicated 1000MW. Other sources indicate a capacity target of 20MW for solar PV in Rwanda. We have however chosen to stick with the capacity target as documented in the policy document.

<sup>97</sup> The Electricity policy and strategy indicates 5 MW although other sources indicate 20MW. The later has been picked since its more realistic. Besides, the Rwanda development Board lists two solar PV projects of 10MW each to be under development.

| Year | Based on EDPRS and Vision 2020 |                         |              | Based on Targets Set in 2010 by the New Government |                         |              |
|------|--------------------------------|-------------------------|--------------|----------------------------------------------------|-------------------------|--------------|
|      | Access (%)                     | Installed Capacity (MW) | Energy (GWH) | Access (%)                                         | Installed Capacity (MW) | Energy (GWH) |
| 2008 | 6.0                            | 45                      | 225.0        | 6.0                                                | 45                      | 225          |
| 2010 | 11.0                           | 85                      | 353          | 11.0                                               | 85                      | 353          |
| 2015 | 22                             | 200                     | 965.5        | 35.0                                               | 800                     | 1200         |
| 2017 | 28.0                           | 300                     | 1,200.0      | 50.0                                               | 1000                    | 1400         |
| 2020 | 32                             | 400                     | 1,478.0      | 90                                                 | 1200                    | 1950         |
| 2025 | 40.0                           |                         | 2,148.4      | 94.0                                               | 1500                    | 3300         |

**Figure 14: Vision 2020 vs. New Electricity generation targets** Source: Electricity Master Plan (2011), Seven-Year Electricity (2011)

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

### 16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

### 16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>98</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

#### **16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 (version 16.0)

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

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<sup>98</sup> <http://cdm.unfccc.int/>

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies. ACM0002, version 16.0 para 33 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality*". The latest version of the tool is version 07.0.0. Furthermore, ACM0002 stipulates that: "When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

- Technical and economic parameters that are technology specific (e.g. ranges of load factors, sizes of installation, wind speed);
- Parameters reflecting the investment climate:
  - Subsidies or other financial flows;
  - Tariffs;
  - Depreciation;
  - Power purchase agreements;
  - Other parameters determining market circumstances;
- Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

Since CPAs under this type will prove additionality with investment analysis as explained below, the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), paragraph 13 (a) shows that when investment analysis is used for demonstrating additionality, two options can be used. For CPAs under this type Option (i) will be used, whereby investment analysis will be conducted for each CPA. In this case, the input parameters to be used in the investment analysis and a description of how to obtain those parameters for each CPA will be defined at the CPA level. Since

the PoA will not use Option (ii), paragraph 69 of the methodology ACM0002 version 16.0 will not be applicable.

In accordance with the standard, in case option (i) is used, the coordinating/managing entity is required to define the input parameters that will be used in the investment analysis in the PoA-DD, together with a description of how the values for these parameters will be obtained for each CPA. The additionality of each CPA shall then be assessed by using the actual values, applicable to the CPA at the time of inclusion, in the investment analysis conducted for the purpose of demonstrating the additionality of the CPA.

The following sources will thereby be valid to determine input values for the below outlined parameters:

- Documentation that has been prepared by an experienced third party
- Documentation that has been approved or issued by Rwandan governmental authorities
- Documentation that has been submitted to or received from financing institutions like banks and equity providers
- Documentation submitted for official purposes such as documents submitted to Rwandan authorities.

**Table 14: CAPEX input parameter - Project Development**

| <b>CAPEX Item</b>                | <b>Description</b>                                                                                                                                              |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Project Development costs</b> |                                                                                                                                                                 |
| Consulting costs                 | Consulting costs can for instance be costs for pre- and full feasibility studies, EIA studies, financial and legal advisory                                     |
| Permits and licensing            | Costs of permitting and licensing does for instance include EIA license costs, Solar resource licensing costs, Development, Construction and Generation permits |
| Land acquisition                 | Land acquisition costs account for costs of acquiring land required for the construction and operation of the power plant                                       |
| Administration costs             | Administration costs include all costs related to all managerial and administrative costs occurring during the development and construction phase               |
| Community development projects   | Costs related to financial contributions to community projects as agreed with the community surrounding the power plant, e.g. schools, housing, hospitals.      |

**Table 15: CAPEX input parameter - Equipment costs**

| <b>CAPEX Item</b>                                 | <b>Description</b>                                                                                   |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------|
| <b>Equipment costs</b>                            |                                                                                                      |
| Initial civil works (drainage, access roads etc.) | Costs for Civil works costs, e.g. roads, drainage if not included in EPC costs                       |
| EPC (Plant) or equivalent EPC costs               | EPC or equivalent EPC costs, e.g. procurement of equipment, installation, testing and commissioning. |
| Interconnection                                   | Costs of grid connection, if not included in EPC costs or EPC equivalent costs                       |

**Table 16: CAPEX input parameter - Other costs**

| <b>CAPEX Item</b>            | <b>Description</b>                                                                                                                        |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Other costs</b>           |                                                                                                                                           |
| Contingency (DEV+EQU+PD)     | Contingency costs applicable to development, equipment and project management costs.                                                      |
| Interest during construction | Interest during construction costs (IDC) are charged by the lending institution for debt interest accrued during the construction period. |

|                                     |                                                                                                                                                                           |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Commitment fees                     | Commitment fees are typically being charged by the lending institution on non-withdrawn loan amount.                                                                      |
| Front end fees                      | Front-end fees are typically charged by the lending institution as a fee for arranging debt finance                                                                       |
| Debt Service Reserve Account (DSRA) | The establishment of a debt service reserve account is typically required by the lending institution.                                                                     |
| Other financing costs               | Other financing cost include other fees potentially charged by debt or equity financiers                                                                                  |
| Working capital                     | Working capital costs are usually being capitalized to assure liquidity during the initial project phases and can potentially also include cash used to pay up-front VAT. |

Table 17: OPEX input parameter

| <u>OPEX Item</u>                            | <u>Description</u>                                                                                                                      |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Land leasing fees                           | Costs of land lease include costs for leasing land required for the operation of the power plant in case the land has not been acquired |
| Plant O&M expense                           | Costs associated with the operation and maintenance of the plant.                                                                       |
| Costs related to socio-economic development | Costs related to financial commitments made to the community residing nearby the power plant, during the power plant operational period |

Table 18: Economic / financial input parameter

| <u>Economic/financial data</u> | <u>Description</u>                                                                                                                                                                                                                                                                        |
|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inflation rates                | Inflation rates are being applied to escalate cost items over time. Different inflation rates will be used according to origin of cost items, e.g. USD costs will use USD inflation rates, Rwandan Franc (RWF) costs will use RWF inflation, EUR cost items will apply EUR inflation etc. |
| Exchange rates                 | Exchange rates will be used to translate costs items of different origin to one common currency applied in the financial model.                                                                                                                                                           |
| Corporate tax                  | Applicable corporate tax rate will be applied to income before tax                                                                                                                                                                                                                        |
| Equipment Lifetime             | Equipment lifetime will be utilized to calculate project fair value at the end of the 20 year modeling horizon                                                                                                                                                                            |
| Debt/equity gearing            | Applicable debt/equity gearing will be applied to calculate Project IRR or Equity IRR                                                                                                                                                                                                     |
| Interest rates                 | Interest rates applicable to debt finance will be considered                                                                                                                                                                                                                              |
| Grace period                   | Grace period on debt principal's payments will be considered                                                                                                                                                                                                                              |
| Loan tenor                     | Loan tenor applicable to debt finance will be considered                                                                                                                                                                                                                                  |

Table 19: PPA input parameter

| <u>PPA parameter</u> | <u>Description</u>                                                                                                                                                               |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Tariff</u>        | Applicable tariff (inclusive of capacity and energy charge) as well as applicable portions of escalation will be applied as per information provided by the Government of Rwanda |

The application of the above parameters will be limited to the stipulations in the methodological tool: Investment analysis version 06.0. For that matter, some of them will not be used depending on the indicator choice of the project. For instance if the project has selected the project IRR, the cost of financing expenditures (i.e. loan repayments and interest) shall not be included in the calculation of project IRR in line with paragraph 14 of the methodological tool: Investment analysis version 06.0. Likewise, if the project has selected equity IRR option, only the portion of investment costs which is financed by equity will be considered as the net cash outflow, the portion of the investment costs which is financed by debt should not be considered a cash outflow.

In line with the above guidelines, the following eligibility criteria have been formulated to prove additionality:

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

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

According to para 8 of the *Tool for the demonstration and assessment of additionality* (version 07.0.0), project activities that apply the tool in the context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity.

Alternative 2: 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* (version 04.0.0).

No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Rwanda National Energy Policy and Strategy. These laws and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in Rwanda.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful in accordance with the Rwanda National Energy Policy and Strategy. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Rwanda National Energy Policy and Strategy applies to all types of generation technology including renewable power generation technology. Therefore the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of Greenfield grid-connected solar PV power capacity to the Rwanda grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the Rwanda National Energy Policy and Strategy covers the establishment of new power generation sources from solar PV power technologies in Rwanda.

There are no further applicable national laws or regulations, which require the application as a CDM project activity.

**Step 2: Investment analysis**

The following steps will be taken to demonstrate that the CPA is financially additional:

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

The *Tool for the demonstration and assessment of additionality* (version 07.0.0) provides three methods for carrying out investment analysis:

- Simple cost analysis (Option I),
- Investment comparison analysis (Option II)
- Benchmark analysis (Option III).

The CPAs included in the PoA are expected to generate financial and economic benefits other than CDM related income (income from the sales of electricity) therefore the simple cost analysis (Option I) can not be applied.

In line with ACM0002 version 16.0, the baseline scenario for the project activities 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”. Therefore, the baseline scenario does not necessarily require investment and is outside the control of the project developers. Option III, benchmark analysis is selected as the appropriate analysis method for the project activities.

***Eligibility Criteria 6.1:*** The CPA has carried out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet.

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

In line with the *Guidelines on the assessment of investment analysis* (version 05), now reclassified as methodological tool: Investment analysis version 6.0 (EB 85 annex 12), CPAs will use one of the following two benchmark indicators:

- Pre-tax nominal Weighted Average Cost of Capital (WACC)
- Post-tax nominal Return on Equity

The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR.

The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations. The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.

***Eligibility criteria 6.2:*** The CPA has applied (a) the pre-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR, as explained below. This will be evidenced through the investment analysis spread sheet.

For CPAs applying option (a), the following formula will be used to determine the pre-tax nominal WACC:

$$WACC = r_e \times W_e + r_d \times W_d \times (1 - T_c)$$

Where:

WACC = Weighted Average Cost of Capital

wd = Percentage of debt financing

we = Percentage of equity financing

rd = Average cost of debt financing

$r_e$  = Average cost of equity financing

$T_c$  = Corporate Tax

The values of  $W_d$  and  $W_e$  will be determined and evidenced at the CPA inclusion stage.

The default value for the cost of equity financing is provided as a real term, post-tax value in the methodological tool: Investment analysis (version 6.0). Therefore, the following two steps were undertaken to convert the value to a nominal, pre-tax value:

CPAs will add the inflation rate to convert the real value into a nominal value using the Fisher Equation:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on one of the following options:

- The inflation forecast of the National Bank of Rwanda for the duration of the CPA crediting period.
- The target inflation of the National Bank of Rwanda.
- The average forecasted inflation rate for Rwanda published by the IMF or the World Bank for the next five years after start of the project activity<sup>99</sup>

The post-tax default value will be further converted to a pre-tax value by dividing the post-tax value by  $(1 - \text{tax rate})$ . The tax rate used will be 30% in line with the Rwandan income tax.

For CPAs applying option (b), the use of the post-tax, nominal Return on Equity as a benchmark to compare with the Equity IRR, the following steps will be taken to determine the post-tax, nominal Return on Equity:

The Return on Equity will be based on the default value as provided in the latest version of the methodological tool: Investment analysis (version 6.0) for Group 1 projects in Rwanda. The default value is provided as a real term, post-tax value therefore, the following procedure is followed to convert the value to a nominal, post-tax value:

To convert the real value into a nominal value the Fisher Equation is used:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on:

- The inflation forecast of the National Bank of Rwanda for the duration of the CPA crediting period
- The target inflation of the National Bank of Rwanda
- The average forecasted inflation rate for Rwanda published by the IMF or the World Bank for the next five years after start of the project activity<sup>100</sup>

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

After determination and calculation of the benchmark, the CPA will determine the Project IRR or Equity IRR, as applicable. In line with the methodological tool: Investment analysis (version 6.0) all values used in the investment analysis will be applicable at the time of the investment decision. For the purpose of the PoA, the time of the investment decision will be either the date on which the plant load factor has become available to the board based on which the board has decided to

<sup>99</sup> To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of investment decision.

<sup>100</sup> To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of investment decision.

proceed with the project, or the date on which significant resources have been committed towards the implementation of the project.

The following eligibility criteria have been formulated to assess the calculation and comparison of financial indicators.

**Eligibility criteria 6.3:** Without the CER revenue, the CPA has a less favourable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spreadsheet.

**Eligibility criteria 6.4:** All input values applied in the investment analysis are applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.

**Eligibility criteria 6.5:** The date of the investment decision is either based on the date on which the project has received the solar assessment report and the board has decided to proceed with the project or the date on which the project has committed significant financial resources towards the implementation of the project. This will be evidenced by the solar assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project.

The following additional considerations will be made in terms of the input parameters in the investment analysis:

#### Revenues:

Revenues from electricity sales will be calculated based on the following parameters and consideration:

The electricity generation will be based on the energy yield and net plant load factor as determined by a third party in line with the requirements under the *Guidelines for the reporting and validation of plant load factors (version 01.0)*. The net plant load factor will be based on the P50 forecast and will include losses including but not limited to plant availability, maintenance, equipment degradation, etc.

The tariff used will be based on the PPA, or if not available yet, the one provided to banks and equity financiers, or to the government while applying for implementation approval.

The following eligibility criteria with regard to project revenues will apply to CPAs included in the PoA:

**Eligibility criteria 6.6:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 6.7:** The CPA has used a tariff based on the PPA, or if not available yet, the one provided to banks and equity financiers, or to the government while applying for implementation approval.

#### Capital investment (CAPEX)

CAPEX costs included in the calculation of the IRR will include the cost of the solar photovoltaic modules as well as the Balance of Plant (BoP) costs depending on the type of module used. CAPEX costs will be evidenced by quotations from modules suppliers or contracts with modules suppliers. If at the time of the investment decision no quotations or contracts from modules suppliers are available, alternative evidences can be used including quotations or contracts from the same modules supplier for other projects in Rwanda or the region, or email quotations. In the

latter case (email), the conservativeness of the quotation will be crosschecked with quotations received after the date of the investment decision.

Additional CAPEX costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to CAPEX will apply to CPAs included in the PoA:

**Eligibility criteria 6.8:** The CAPEX used in the investment analysis included the costs of the solar photovoltaic modules, and if applicable the BoP costs. Those costs are evidenced by quotations from modules suppliers or contracts with modules suppliers. If at the time of the investment decision no quotations or contracts from modules suppliers are available, alternative evidences can be used including quotations or contracts from the same modules supplier for other projects in Rwanda or the region, or email quotations.

#### Operating cost:

Currently, there is no public information available regarding operating costs for large-scale, solar PV projects in Rwanda or East Africa. This is due to the absence of large-scale, solar PV projects in the region. It is expected that some of the operating cost items will be lower than in the rest of the world but these cost gains will be offset by lack of experience and inefficiencies in the system.

Operating costs will at least include:

- Costs related to land leases or land acquisition
- Service and warranty costs
- Operation and maintenance costs
- Administrative costs
- Costs related to socio-economic development

Additional operating costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to operating costs will apply to CPAs included in the PoA:

**Eligibility criteria 6.9:** The operating costs used in the investment analysis will at least include costs related to land leases or land acquisition, service and warranty costs, operation and maintenance costs, administrative costs, and costs related to socio-economic development. The operating costs will be evidenced by land lease, quotations for service and warranty, quotations from the operation and maintenance contractor and if relevant, agreements with the local communities for implementation of development activities. These will be documented in the investment analysis spread sheet

#### Taxation:

In accordance with the Rwandan Fiscal Laws and Regulations, income tax for Resident Corporate entities in Rwanda is levied at a rate of 30%.

**Eligibility criteria 6.10:** The CPA has used an income tax rate in line with the Rwanda regulations. This will be evidenced by the latest version of the Rwandan Fiscal Laws and Regulations and documented in the investment analysis spread sheet.

#### Exchange rates

Exchange rates provided by the National Bank of Rwanda will be used. Alternatively, the exchange rate reported by commercial banks in Rwanda on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

**Eligibility criteria 6.11:** In terms of exchange rates, the exchange rates provided by the National Bank of Rwanda will be used. Alternatively, the exchange rate reported by commercial banks in Rwanda on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

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

**Eligibility criteria 6.12:** The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis:

- Investment cost
- Electricity generation
- Operating and maintenance cost
- Tariff

**Eligibility criteria 6.13:** The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.

#### Step 4: Common practice analysis

In line with the *Tool for the demonstration and assessment of additionality* (version 07.0.0) and the *Guidelines on common practice* (version 02.0), currently revised to methodological tool: common practice (version 03.1), it can be concluded that the CPA is not common practice as F is lower than 0.2 and  $N_{all} - N_{diff}$  is lower than 3. The common practice analysis will be based on publicly available data and information from RURA, REG/EWSA and/or the MININFRA or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

**Eligibility criteria 6.14:** The CPA has confirmed that the results of common practice analysis show F to be lower than 0.2 and  $N_{all} - N_{diff}$  is lower than 3.

#### **16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>101</sup> and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>102</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In

<sup>101</sup> National Policy on Environment, Rwanda (2003)

<sup>102</sup> EIA Regulations, Rwanda

addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

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

**B.6.1. Explanation of methodological choices**

The generic CPA will focus on grid-connected renewable electricity generation from solar PV power. The generic CPA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (Greenfield plant).

The emission factor of the grid is calculated in a transparent and conservative manner using the combined margin (CM) consisting of the operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

### **Baseline emissions**

Baseline emissions include CO<sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. In line with ACM0002 (version 16.0), the baseline emissions are to be calculated as follows (**equation 7**):

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

Where:

|                  |   |                                                                                                                                                                                                                                |
|------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $BE_y$           | = | Baseline Emissions in year y (t CO <sub>2</sub> /yr)                                                                                                                                                                           |
| $EG_{PJ,y}$      | = | Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)                                                                 |
| $EF_{grid,CM,y}$ | = | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate emission factor for an electricity system” (tCO <sub>2</sub> /MWh) |

### **Calculation of $EG_{PJ,y}$**

CPAs under the PoA involve the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield projects), therefore  $EG_{PJ,y}$  is estimated as per **equation 8**:

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

Where:

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

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

The emission factor will be calculated in a transparent and conservative manner using option (a), the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

The grid emission factor will be calculated for the Rwandan electricity system and will be applied to each CPA of the PoA. Equations and source of data to calculate the grid emission factor for Rwanda are provided below.

### ***Step 1. Identify the relevant electric power system***

For calculating the grid emission factor, the project activity has identified the Rwanda National Grid as the relevant project electricity system.

The identification of the Rwanda National Grid as the relevant project electricity system is based on the following arguments:

- The Rwandan DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the Rwandan grid system
- Although the Rwandan grid is connected to a number of its neighbouring countries' grids including Uganda, Burundi and DRC Congo, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary. Those countries will however be considered as connected electricity systems and the electricity imported into the Rwandan grid (project electricity system) will be included as imports.
- Finally, Rwanda does not have a layered dispatch system and the country has only one grid system that serves the entire country. Therefore, and in line with version 04.0 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

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

The project activity has selected either Option I where only grid power plants are included in the calculation or Option II where both grid and off-grid power plants are included in the calculation.

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

The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

- a) Simple OM
- b) Simple adjusted OM
- c) Dispatch data analysis OM
- d) Average OM

It is stated under the *Tool to calculate the emission factor for an electricity system* that simple OM can only be used if low-cost/must-run resources constitute less than 50 per cent of total grid generation. In line with a five-year electricity generation data during the period of 2009 and 2013, low-cost/must-run resources in Rwanda, which are mainly hydro, constitute about 41% of total grid generation. Therefore, since this condition has been met, the simple OM method is used.

The CPAs will use the *ex-ante* option and the OM will be calculated once at the validation stage using a three years generation-weighted average.

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

The simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub> emissions per unit net electricity generation (t CO<sub>2</sub>/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

**Option A:** Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit; or,

**Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A has been chosen to calculate the operating margin emission factor of power plants serving the grid.

The Simple OM emission factor is calculated using equation 1 as follows:

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

Where:

- $EF_{grid,OMsimple,y}$  = Simple operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  = All grid power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

#### Determining $EF_{EL,m,y}$

For the calculation of the emission factor for each power plant  $m$ , option A1 has been selected as fuel consumption is normally provided. Therefore, equation 2 will be used as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type  $i$  in year  $y$  (GJ/mass or volume unit)
- $EF_{CO2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $i$  = All fuel types combusted in power unit  $m$  in year  $y$
- $y$  = The relevant year as per the data vintage chosen in Step 3

However, in some instances where there is missing data on the fuel consumption amounts, option A.2 will be selected and therefore equation 3 used as follows:

Where several fuel types are used in the power unit, the fuel type with the lowest CO<sub>2</sub> emission factor for  $EF_{CO2,m,i,y}$  is to be used.

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

Where:

|                   |   |                                                                                                                     |
|-------------------|---|---------------------------------------------------------------------------------------------------------------------|
| $EF_{EL,m,y}$     | = | CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (t CO <sub>2</sub> /MWh)                              |
| $EF_{CO_2,m,i,y}$ | = | Average CO <sub>2</sub> emission factor of fuel type $i$ used in power unit $m$ in year $y$ (t CO <sub>2</sub> /GJ) |
| $\eta_{m,y}$      | = | Average net energy conversion efficiency of power unit $m$ in year $y$ (ratio)                                      |
| $m$               | = | All power units serving the grid in year $y$ except low-cost/must-run power units                                   |
| $y$               | = | The relevant year as per the data vintage chosen in Step 3                                                          |

#### Determination of $FC_{i,m,y}$

Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit) was based on published records from REG/EWSA and IPP power plants.

(Insert fuel consumption data for latest 3 years)

| Name  | Type | Fuel Consumption data (Litres/year) |        |        |
|-------|------|-------------------------------------|--------|--------|
|       |      | Year 1                              | Year 2 | Year 3 |
|       |      |                                     |        |        |
|       |      |                                     |        |        |
| Total |      |                                     |        |        |

#### Determination of $EG_{m,y}$

For grid power plants,  $EG_{m,y}$  is based on published records and data obtained directly from REG/EWSA and IPP power plants. The grid emission factor calculations are based on the publicly available data in Rwanda, i.e. REG/EWSA and IPP power plants which represents the total electricity generated in the Rwandan grid.

(Insert electricity data for thermal power plants for latest 3 years)

| Name  | Type | Generation data (MWh) |        |        |
|-------|------|-----------------------|--------|--------|
|       |      | Year 1                | Year 2 | Year 3 |
|       |      |                       |        |        |
|       |      |                       |        |        |
| Total |      |                       |        |        |

For off-grid power plants,  $EG_{m,y}$  is based on paragraph 32 of the *Tool to calculate the emission factor for an electricity system*. The tool states that a default value of 10 per cent of the total electricity generation by grid power plants in the electricity system can be used to determine  $EG_{m,y}$  for the purpose of the operating margin determination.

(Insert electricity data for all power plants serving the grid for latest 3 years)

| Name     | Type | Generation data (MWh) |        |        |
|----------|------|-----------------------|--------|--------|
|          |      | Year 1                | Year 2 | Year 3 |
|          |      |                       |        |        |
|          |      |                       |        |        |
| Total    |      |                       |        |        |
| Off-grid |      |                       |        |        |

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

For the calculation of the build margin (BM) emission factor, **Option 1** data vintage will be chosen. Hence, for the first crediting period, the build margin emission factor shall be calculated, *ex ante* based on the most recent information available on units already built for sample group  $m$  at the

time of CPA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require the emission factor to be monitored during the first crediting period.

The build margin emission factor is thus calculated using **equation 13** of the “*Tool to calculate the emission factor for an electricity system*”, as shown below:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  = Power units included in the build margin
- $y$  = Most recent historical year for which power generation data is available

The CO<sub>2</sub> emission factor of each power unit  $m$  ( $EF_{EL,m,y}$ ) will be determined as per the guidance in section 6.4.1 for the simple OM, using equation (2) under option A1 or equation 3 under option A2, depending on availability of data, and using for  $y$  the most recent historical year for which grid power generation data is available, and using for  $m$  the power *units* included in the build margin.

If the power units included in the build margin  $m$  correspond to the sample group *SETsample-CDM->10yrs*, then, as a conservative approach, only Option A2 from guidance in Step 4 section 6.4.1 can be used and the default values provided in appendix 1 shall be used to determine the parameter  $\eta_{m,y}$  for the power units that started to supply electricity to the grid more than 10 years ago.

For option A1,  $EF_{EL,m,y}$  is calculated in accordance with equation 2 as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type  $i$  in year  $y$  (GJ/mass or volume unit)
- $EF_{CO2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $m$  = The power units included in the build margin
- $i$  = All fuel types combusted in power unit  $m$  in year  $y$
- $y$  = The relevant year as per the data vintage chosen in Step 3

For option A2,  $EF_{EL,m,y}$  is calculated in accordance with equation 3 as follows:

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

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (t CO<sub>2</sub>/MWh)
- $EF_{CO2,m,i,y}$  = Average CO<sub>2</sub> emission factor of fuel type  $i$  used in power unit  $m$  in year  $y$  (t CO<sub>2</sub>/GJ)
- $\eta_{m,y}$  = Average net energy conversion efficiency of power unit  $m$  in year  $y$  (ratio)
- $m$  = The power plants included in the build margin
- $y$  = The relevant year as per the data vintage chosen in Step 3

The sample group of power units  $m$  used to calculate the build margin will be determined in accordance with the “*Tool to calculate the grid emission factor for an electricity system*”.

Below is a table with all power plants in the project electricity system (Source: Rwanda Energy Group (REG) / Energy, Water and Sanitation - EWSA). The power plants are ranked according to commissioning date.

|   | Name of power plant | Commissioning date | Electricity generation 2009-2011 (MWh) | % |
|---|---------------------|--------------------|----------------------------------------|---|
| 1 |                     |                    |                                        |   |
| 2 |                     |                    |                                        |   |
| 3 |                     |                    |                                        |   |
| 4 |                     |                    |                                        |   |

### Step 6: Calculate the Combined Margin

Option (a) i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated as follows:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EF_{grid,OM,y}$  = Operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $W_{OM}$  = Weighting of operating margin emissions factor (%)
- $W_{BM}$  = Weighting of build margin emissions factor (%)

For solar power generation projects the following default values are used for  $W_{OM}$  and  $W_{BM}$ :

$$W_{OM} = 0.75$$

$$W_{BM} = 0.25$$

### Project emissions

For most renewable energy projects, such as solar PV energy project activities,  $PE_y = 0$ . Project emissions will be considered following the procedures described in ACM0002, version 16.0 using **equation (1)**:

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

Where:

- $PE_y$  = Project emissions in year  $y$  (tCO<sub>2</sub>e/yr)
- $PE_{FF,y}$  = Project emissions from fossil fuel consumption in year  $y$  (tCO<sub>2</sub>/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<sub>2</sub>e/yr)
- $PE_{HP,y}$  = Project emissions from water reservoirs of hydro power plants in year  $y$  (tCO<sub>2</sub>e/yr)

#### Project emissions from fossil fuel consumption ( $PE_{FF,y}$ )

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels.

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

This CPA involves solar PV power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

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

This CPA involves solar PV power plants, not hydro power plants with water reservoirs. Therefore there are no emissions from hydro power plants.

This CPA, which involves a solar PV power project, has project emissions ( $PE_y$ ) considered 0.

### **Leakage emissions**

No leakage emissions are considered in accordance with ACM0002 (version 16.0)

### **Emission reductions**

In line with ACM0002 (version 16.0) the emission reductions are calculated using **(equation 13)** as follows:

$$ER_y = BE_y - PE_y$$

Where:

- $ER_y$  = Emission reductions in year  $y$  (t CO<sub>2</sub>/y)
- $BE_y$  = Baseline Emissions in year  $y$  (t CO<sub>2</sub>/y)
- $PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>/y)

#### **B.6.2. Data and parameters fixed ex-ante**

|                   |                                                                          |
|-------------------|--------------------------------------------------------------------------|
| Data / Parameter: | $NCV_{i,y}$                                                              |
| Data unit:        | GJ/kg                                                                    |
| Description:      | Net calorific value (energy content) of fossil fuel type $i$ in year $y$ |

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | $EF_{CO_2,i,y} / EF_{CO_2,m,i,y}$                                                                                                                                                                       |
| Data unit:                                            | tCO <sub>2</sub> /GJ                                                                                                                                                                                    |
| Description:                                          | CO <sub>2</sub> emission factor of fossil fuel type <i>i</i> in year <i>y</i>                                                                                                                           |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | $EG_{m,y}$                                                                                                                                                                                                                                                                                                                                                    |
| Data unit:                                            | MWh                                                                                                                                                                                                                                                                                                                                                           |
| Description:                                          | Net electricity generated by power plant/unit <i>m</i> in year <i>y</i>                                                                                                                                                                                                                                                                                       |
| Source of data:                                       | Rwanda Energy Group (REG)/Energy Water and Sanitation (EWSA)                                                                                                                                                                                                                                                                                                  |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                                                                                                                                                                        |
| Choice of data or Measurement methods and procedures: | Data on electricity generation has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants.                                                                                                                                                                                                                                  |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                             |
| Additional comment:                                   | Applicable only to grid emission factor calculations<br><br>Rwanda Energy Group (REG) is the newly established utility company taking over responsibilities from EWSA. The company was established following the separation of EWSA into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC). |

|                                                       |                                                                                                                                                  |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | $FC_{i,m,y}$                                                                                                                                     |
| Data unit:                                            | Kg/year                                                                                                                                          |
| Description:                                          | Amount of fossil fuel type <i>i</i> consumed by power plant / unit <i>m</i> in year <i>y</i>                                                     |
| Source of data:                                       | Rwanda Energy Group (REG) / Energy Water and Sanitation (EWSA)                                                                                   |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                           |
| Choice of data or Measurement methods and procedures: | Data on fuel consumption from thermal power plants has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants. |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                             |

|                                                       |                                                                                                              |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | $\eta_{m,y}$                                                                                                 |
| Data unit:                                            | Percentage                                                                                                   |
| Description:                                          | Average net energy conversion efficiency of power unit m in year y (ratio)                                   |
| Source of data:                                       | Defaults from the tool for average net energy of combined cycle engines.                                     |
| Value(s) applied:                                     | To be determined in the Specific CPA-DD                                                                      |
| Choice of data or Measurement methods and procedures: | Data will be obtained based on publicly available information or the REG/EWSA, the utility company in Rwanda |
| Purpose of data                                       | Calculation of baseline emissions                                                                            |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                         |

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

#### Baseline emissions

The baseline emissions for CPAs involving solar PV power are to be calculated as follows:

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

Calculation of  $EG_{facility,y}$

| Parameter         | Value          | Unit   | Source          |
|-------------------|----------------|--------|-----------------|
| $EG_{facility,y}$ | [insert value] | MWh/yr | [insert source] |

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

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

Values to determine  $EF_{grid,CM,y}$  for solar PV power CPAs:

| Parameter           | Value    | Unit                  | Source           |
|---------------------|----------|-----------------------|------------------|
| $EF_{grid,BM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{BM}$            | 0.25     |                       | Default value    |
| $EF_{grid,OM-DD,y}$ | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{OM}$            | 0.75     |                       | Default value    |
| $EF_{grid,CM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |

Therefore:

$$EF_{grid,CM,y} = [\text{Insert}] \text{ tCO}_2/\text{MWh}$$

$$BE_y = [\text{Insert}] * [\text{Insert}] = [\text{Insert}] \text{ tCO}_2/\text{year}$$

#### Project emissions

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels. As no geothermal or hydro technology types will be implemented, project emissions ( $PE_y$ ) is considered 0.

#### Leakage emissions

Leakage emissions are not considered in accordance with ACM0002 (version 16.0)

### **Emission reductions**

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including Solar PV: [insert value of  $BE_y$ ] - 0 = [insert value of  $ER_y$ ]

## **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**

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>            | <b><math>EG_{facility,y}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Data unit:                          | MWh/year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 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                    | To be reported in the specific CPA-DD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Measurement methods and procedures: | <p>The metering equipment installed at the CPA site should be in line with the provisions of the Power Purchase Agreement and the Rwandan Electricity Grid Code.</p> <p>This parameter should 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.</p> <p>In case it is calculated then the following parameters shall be measured:</p> <p>(a) The quantity of electricity supplied by the project plant/unit to the grid; and</p> <p>(b) The quantity of electricity delivered to the project plant/unit from the grid</p> |
| Monitoring frequency:               | The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with the PPA and the relevant industry levels.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| QA/QC procedures:                   | <p>Cross-check results with records of sold electricity.</p> <p>Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Purpose of data                     | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Additional comment:                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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

Overall authority and responsibility for monitoring will rest with the CME, who will also be responsible for managing the emission reduction monitoring and verification process.

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

#### CPA implementing entity

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on- site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

| Parameter              | Description                                                                            | Type of CPA |
|------------------------|----------------------------------------------------------------------------------------|-------------|
| $EG_{PJ, facility, y}$ | Quantity of net electricity supplied by the project plant/unit to the grid in year $y$ | All         |

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year  $y$  ( $EG_{facility, y}$ ). The CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the electricity off-taker. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity 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 or the last issuance of CERs, whichever is later.

Metering will be conducted with calibrated measurement equipment in accordance to relevant industry standards. The Rwandan Utilities Regulatory Authority (RURA) has adopted the metering standards (SANS 474:2008, NRS 057:2011, IEC 62056) as outlined in the *Metering Code*, part of the Rwandan Grid Code. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations, which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers and associated test facilities.

The CPA will be responsible for the Metering Installation procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The Metering Installation would be preferable installed at the Point of Supply, which is defined as the commercial boundary between customer (CPA implementer) and the Transmitter organization.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

#### **Gigawatt Global - Coordinating/managing entity**

The CME will be responsible for the following:

- Training of CPAs on CDM monitoring requirements

- Receiving monitored data collected by the CPA implementing entity.
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices, and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

## **Training**

Before the implementation of a CPA or the start of the crediting period of the CPA, whichever occurs later, 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

## **PART II. Generic component project activity (CPA)**

### **CPA TYPE IV: GREENFIELD LARGE-SCALE SOLAR PV POWER PLANTS/UNITS IN RWANDA APPLYING BARRIER ANALYSIS**

#### **SECTION A. General description of a generic CPA**

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

The generic Component Project Activity (CPA) will involve the implementation and operation of a large-scale solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant). The project activity will generate electricity from renewable sources, which will be fed into Rwanda's national electricity grid, displacing fossil fuel based electricity generation, thus, leading to emission reductions.

The CPA is being pursued as a component of the PoA "Gigawatt Global Programme of Activities" with Gigawatt Global Cooperatief U.A. as the CME.

Demonstration of eligibility into the PoA is provided in section B.5 of the Generic CPA.

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

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

The CPA will apply the approved consolidated baseline and monitoring methodology ACM0002 (version 16.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 16.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 04.0)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)*
- *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)*
- *Tool to determine the remaining lifetime of equipment (version 01.0)*
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)*

The CPA will only apply the *Tool to calculate the emission factor for an electricity system (version 04.0)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*.

The *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)* will also not be used since the CPA will not generate CO<sub>2</sub> emissions from fossil fuel combustion for its operations. The *Tool to determine the remaining lifetime of equipment (version 01)* will not be used as the generic CPA is a Greenfield project while the *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)* is only applicable upon renewal of a crediting period.

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

The CPA qualifies as a Type I project activity and meets the applicability criteria in accordance with ACM0002 *Grid connected electricity generation from renewable sources* (version 16.0), as follows:

| Applicability criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Generic CPA justification                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>This methodology is applicable to grid-connected renewable power generation project activities that:</p> <ul style="list-style-type: none"> <li>(a) Install a Greenfield power plant;</li> <li>(b) Involve a capacity addition to (an) existing plant(s);</li> <li>(c) Involve a retrofit of (an) existing operating plants/units;</li> <li>(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or</li> <li>(e) Involve a replacement of (an) existing plant(s).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>CPAs will consist of solar PV power projects connected to the Rwanda National Grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant)</p> |
| <p>The methodology is applicable under the following conditions:</p> <ul style="list-style-type: none"> <li>(a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;</li> <li>(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.</li> </ul> | <p>The CPA will install a solar PV power plant, an eligible technology type under this methodology.</p> <p>n/a. CPAs under this PoA are Greenfield projects.</p>                                                                                      |
| <p>In case of hydro power plants, one of the following conditions shall apply</p> <ul style="list-style-type: none"> <li>(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</li> <li>(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is</li> </ul>                                                                                                                        | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                                                                                                                                                                                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <p>lower than or equal to <math>4 \text{ W/m}^2</math>, all of the following conditions shall apply:</p> <ul style="list-style-type: none"> <li>i. The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than <math>4 \text{ W/m}^2</math>;</li> <li>ii. Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</li> <li>iii. Installed capacity of the power plant(s) with power density lower than or equal to <math>4 \text{ W/m}^2</math> shall be: <ul style="list-style-type: none"> <li>a) Lower than or equal to 15 MW; and</li> <li>b) Less than 10 per cent of the total installed capacity of integrated hydro power project.</li> </ul> </li> </ul>                                                                                                                                                                                                                                             |                                                                                   |
| <p>In the case of integrated hydro power projects, project proponent shall:</p> <p>(a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or</p> <p>(b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM 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.</p> | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                    |
| <p>The methodology is not applicable to:</p> <ul style="list-style-type: none"> <li>a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;</li> <li>b) Biogas fired power plants</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>n/a. CPAs under the PoA will only consist of Greenfield solar PV projects.</p> |
| <p>In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>n/a, CPAs under this PoA are Greenfield projects.</p>                          |

|                                                                  |  |
|------------------------------------------------------------------|--|
| project activity and undertaking business as usual maintenance". |  |
|------------------------------------------------------------------|--|

The CPA will be in compliance with the *Tool to calculate the emission factor for an electricity system* (version 04.0) as follows:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 since the generic CPA involves the generation of electricity from solar and its supply to the Rwandan grid system.                                                                                                                 |
| Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity. | The emission factor is calculated for either only grid connected power plants or both grid connected and off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" will be met. |
| 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.<br>Rwanda is not an Annex-I country.                                                                                                                                                                  |
| The value applied to the CO <sub>2</sub> emission factor of biofuels is zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Not applicable since no biofuels are used for grid-connected electricity generation in Rwanda.                                                                                                                                                             |

### B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. Rwandan national electricity grid). The project activity will therefore displace electricity generated by Rwandan fossil fuel grid-connected power plants and will therefore lead to emission reductions of CO<sub>2</sub>.

The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for solar PV energy CPAs are provided in the table below:

| Source           |                                                                                                                                                 | Gas              | Included | Justification/Explanation                                                                        |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|--------------------------------------------------------------------------------------------------|
| Baseline         | CO <sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity              | CO <sub>2</sub>  | Yes      | Main emission source                                                                             |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       | Minor emission source                                                                            |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       | Minor emission source                                                                            |
| Project activity | For geothermal power plants, fugitive emissions of CH <sub>4</sub> and CO <sub>2</sub> from non-condensable gases contained in geothermal steam | CO <sub>2</sub>  | No       | The CPAs in this PoA do not involve geothermal power plants therefore no emissions are included. |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | CO <sub>2</sub> emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants  | CO <sub>2</sub>  | No       | No on-site fossil fuel consumption will take place. Therefore no emissions are included          |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | For hydro power plants, emissions of CH <sub>4</sub> from the reservoir                                                                         | CO <sub>2</sub>  | No       | This PoA does not involve hydroelectric power plants, therefore no emissions are included        |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |

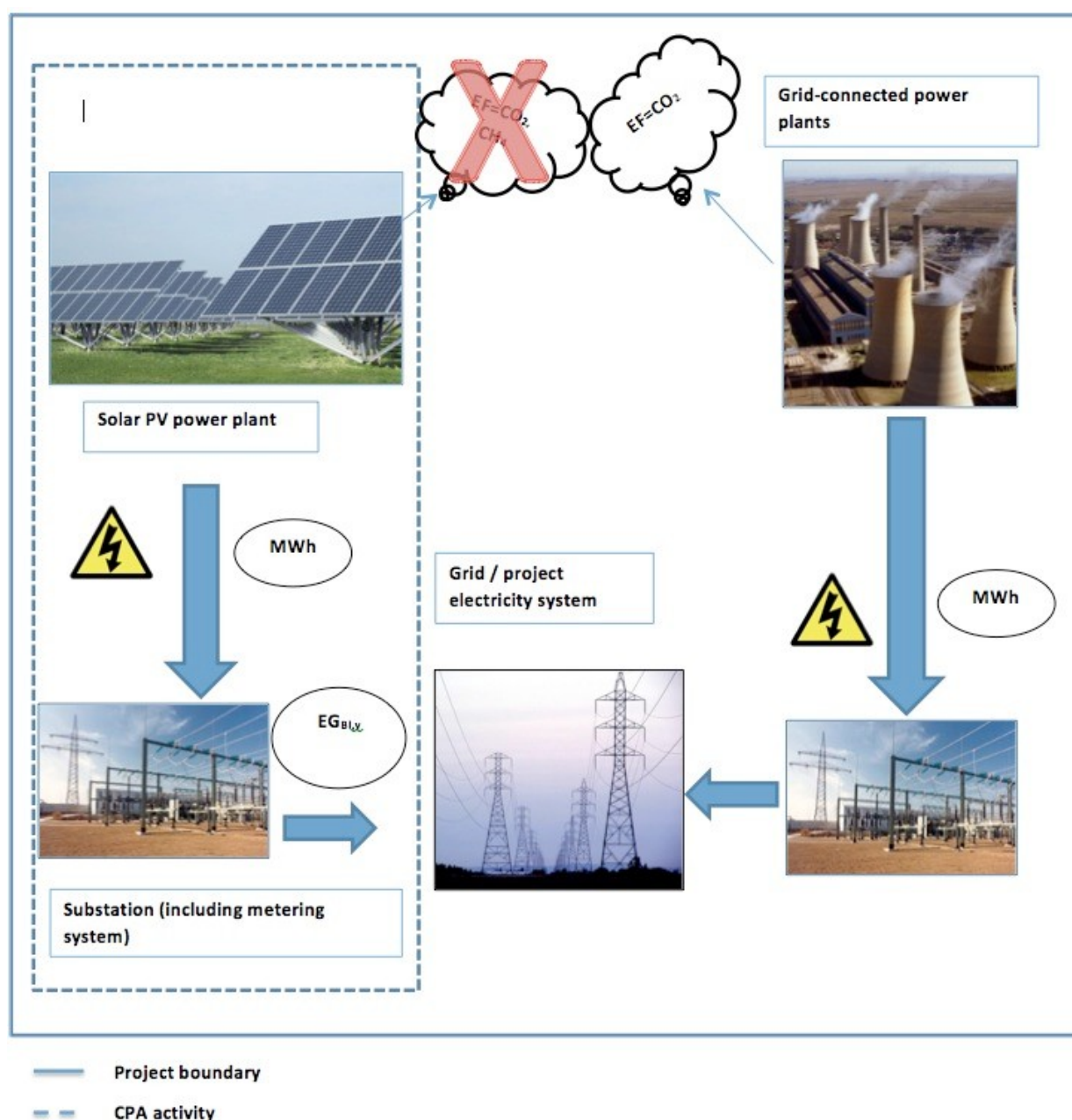


Figure 15: Flow diagram delineating the CPA boundary

#### B.4. Description of baseline scenario

In accordance with the large-scale consolidated methodology ACM0002 (version 16.0) *Grid-connected electricity generation from renewable sources*, the baseline scenario is “electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

##### Structure of the Rwanda Power sector

The power sector in Rwanda lies under the Ministry of Infrastructure (MININFRA), which has the primary responsibility of policy formulation and strategy setting for the energy sector, and for

coordinating developments in the electricity sub-sector.<sup>103</sup> The Government of Rwanda (GoR) launched the Economic Development and Poverty Reduction Strategy II (EDPRS II), 2013-2018, with an aim to boost economic growth.<sup>104</sup> Increasing the supply, access and stability of electricity have been identified as some of the core pillars for achieving this stated objective and increasing electricity generation from renewables has been particularly emphasized.<sup>105</sup>

The Rwanda Utilities Regulatory Authority (RURA) is the body that is tasked to oversee the energy sector together with other sectors in telecommunications, water, waste and transport. RURA was established on 13/01/2001 through the adoption of Law N°39/2001. This Law was further reviewed and replaced by Law N° 09/2013 of 01/03/2013, which further amended its mission, powers, organization and functions specifically in the energy sector. RURA is mandated to control and regulate electricity generation, transmission and distribution in order to ensure efficiency and sustainability in the sector. As such, it plays a supervisory role by among other things, granting licenses for generation, transmission and distribution of electricity in Rwanda.<sup>106</sup>

Apart from MININFRA and the Rwanda Utilities Regulator (RURA), the utility company, the newly established utility company, the Rwanda Energy Group Limited (REG)<sup>107</sup> is the other key player in the energy sector. The 100% state owned company is the largest electricity generator accounting for over 90% of the total electricity generated and also responsible for transmission, distribution and supply of electricity in Rwanda.<sup>108</sup>

Since the early 2000, Rwanda has gradually moved towards power sector reforms focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths but have typically involved the passing of electricity laws, the establishment of a regulatory body overseeing the power sector, some form of unbundling of the power sector and the introduction of Independent Power Producers (IPPs). Rwanda has also introduced Feed-in-Tariff policies starting with small hydro projects with the rest of renewable energy technologies to be included in future. The Renewable Energy Feed-in-Tariff (REFIT) adopted in 2012, is a direct result of the governments Green Growth Strategy adopted in 2011 to foster the uptake of renewable energy in the national grid.<sup>109</sup>

Previously, EWSA was responsible for providing both electricity and water thereby hindering its ability to make real progress in improving energy supply in Rwanda. As a consequence, the company was separated into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC) with different and independent roles in providing energy and water services respectively. This move is expected to promote efficiency and transparency in the generation and distribution of electricity in Rwanda.

### **Installed Generation Capacity**

Rwanda's installed capacity has increased significantly from a mere 25MW in 1994 to 110MW in 2013.<sup>110</sup> The five-year average<sup>111</sup> of the national electricity generation mix is dominated by thermal sources (58.7%), hydro (41.2%) and the remaining 0.1% for solar PV.

<sup>103</sup> [http://www.mininfra.gov.rw/Mission\\_and\\_Purpose](http://www.mininfra.gov.rw/Mission_and_Purpose); Accessed on 18 December 2014

<sup>104</sup> Economic Development and Poverty Reduction Strategy II (EDPRS II)

<sup>105</sup> Republic of Rwanda (2000), Rwanda Vision 2020

<sup>106</sup> [www.rura.rw/about-rura/](http://www.rura.rw/about-rura/); Accessed on 18 December 2014

<sup>107</sup> Formerly the utility company was Energy Water and Sanitation Company (EWSA)

<sup>108</sup> [www.reg.rw/home](http://www.reg.rw/home); Accessed on 18 December 2014

<sup>109</sup> [www.rura.rw](http://www.rura.rw); Accessed on 18 December 2014

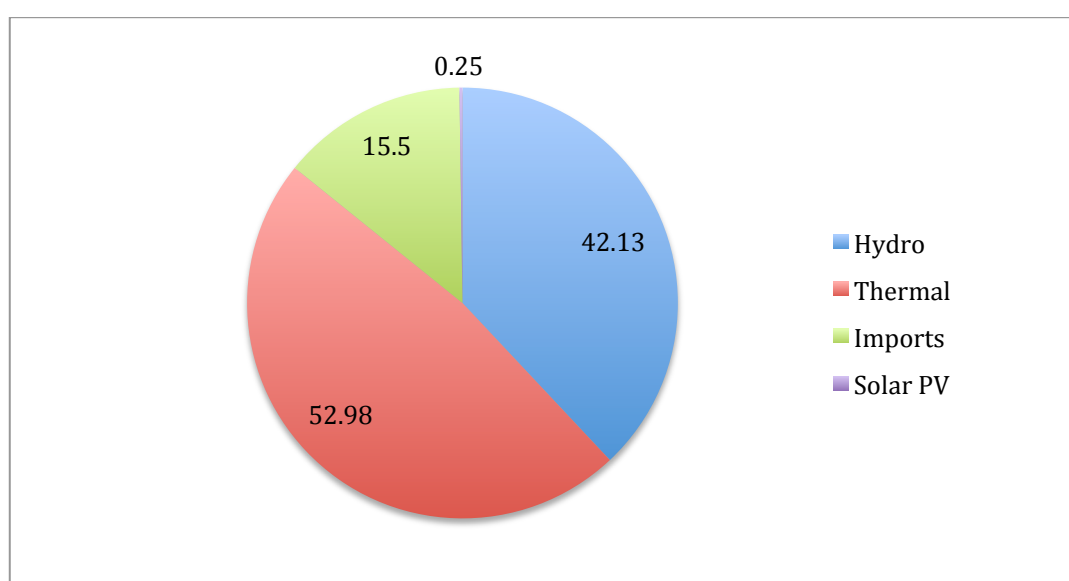
<sup>110</sup> <http://www.ewsa.rw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>111</sup> Electricity data provided by EWSA for the period 2009 -2013

By June 2013, the total installed capacity in Rwanda reached 110MW<sup>112</sup>. The country's electricity generation was dominated by thermal power accounting for about 52.08 MW of the total generation followed by hydropower at 42.13 MW. Electricity imports from the regional countries accounted for about 15.5 MW. However, the available capacity fluctuated between 80MW and 92 MW. Of this capacity, grid connected solar accounted for only 0.25MW,<sup>113</sup> which represents 0.1% of the total installed capacity.

According to the former utility company, EWSA, generation from thermal sources accounting for more than half the national generation mix, directly translated to high cost of fuel consumption estimated at USD 40 million annually and an average electricity cost of USD 0.26/kWh.<sup>114</sup> This average electricity costs in Rwanda is almost double the overall global average of USD 0.14/kWh.<sup>115</sup> The Rwandan government has consequently been forced to provide electricity subsidies in order to keep the tariff comparable with the regional average.

This information on Rwanda energy generation mix is summarised graphically as follows:



**Figure 16: Installed grid electricity capacity by type in Rwanda**

### **Future Generation**

Rwanda's electricity consumption constitutes only 4% of the overall primary energy consumption with biomass forming the largest proportion at 85% and petroleum accounting for 11%.<sup>116</sup> On one hand, these percentages present the electricity subsector as the least developed in the energy sector while on the other hand, the figures illustrate a high dependency on wood fuel in Rwanda.

<sup>112</sup> RURA annual report 2012-2013 reports 110MW. However electricity data from the utility company (used in the GEF spread sheet) indicates the capacity to be about 127.45 MW. The former has been used since its publicly available information while data from EWSA is not.

<sup>113</sup> Electricity data provided by EWSA for the period 2009 -2013

<sup>114</sup> <http://www.ewsarw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>115</sup> Rapid Assessment of a National Energy and Low Carbon path for Rwanda (May 2009)

<sup>116</sup> RURA Annual Report 2012/2013, Page 77

The GoR recognizes that the availability of reliable power supply is a pre-requisite for economic growth, social prosperity, as well as human development. The government, therefore, aims at increasing and diversifying electricity generation in the country through a rollout programme that will rapidly increase supply. Already some positive results have been posted following the implementation of the initial phase of the government initiative and increasing electricity access by a remarkable 160% between the year 2008 and 2011.<sup>117</sup> Nonetheless, only 16% (350,000) of Rwanda's households are connected to the grid as shown in the table below. In this regard, the government has revised its target to expand electricity access to households to approximately 70% by 2017.<sup>118</sup> The expansion plan is aimed at increasing the electricity generation capacity by an additional 1000MW in 2017<sup>119</sup> and 1300MW by 2020.<sup>120</sup> The 1,000MW additional installed capacity in 2017 will comprise of 340 MW of hydropower, 310MW of geothermal power, 300MW of natural gas (methane-based) power, 200MW of peat-based power and 20MW of diesel thermal plants and 5 MW from solar PV.<sup>121</sup>

The table below shows the growth in electricity service from the year 2000 to 2012:

**Table 20: Growth in electricity service (2000 - 2012)**

| Year                  | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Peak Load (MW)        |      |      |      |      |      |      |      | 47   | 51   | 56   | 64   | 78   | 92   |
| Sales (GWh)           | 204  | 209  | 225  | 235  | 204  | 194  | 230  | 249  | 277  | 308  | 353  | 417  |      |
| Losses                |      |      | 35   |      |      |      | 22   | 18   | 18   | 20   | 19   | 19   |      |
| No. of customers '000 | 49   | 49   | 58   | 67   | 68   | 70   | 77   | 86   | 109  | 140  | 175  | 280  | 350  |
| Access %              |      |      |      |      |      |      |      |      | 4    | 8    | 13   | 14   | 16   |

Source: EWSA

**Table 21: Target Capacity Additions in Rwanda by 2017**

| Generation type | Target installed capacity (MW) |
|-----------------|--------------------------------|
| Peat            | 200                            |
| Geothermal      | 310                            |
| Hydro Power     | 340                            |
| Methane         | 300                            |
| Diesel          | 20                             |
| Solar           | 5 <sup>122</sup>               |
| Total           | 1,175                          |

<sup>117</sup> Rwanda Energy Sector Review and Action Plan (2013), Page 31

<sup>118</sup> Rwanda Energy Sector Review and Action Plan, Page 8

<sup>119</sup> Energy Policy and Strategy, page 54

<sup>120</sup> Energy Policy and Strategy, page 52

<sup>121</sup> The summation of these capacities yield about 1,175MW against the indicated 1000MW. Other sources indicate a capacity target of 20MW for solar PV in Rwanda. We have however chosen to stick with the capacity target as documented in the policy document.

<sup>122</sup> The Electricity policy and strategy indicates 5 MW although other sources indicate 20MW. The later has been picked since its more realistic. Besides, the Rwanda development Board lists two solar PV projects of 10MW each to be under development.

| Year | Based on EDPRS and Vision 2020 |                         |              | Based on Targets Set in 2010 by the New Government |                         |              |
|------|--------------------------------|-------------------------|--------------|----------------------------------------------------|-------------------------|--------------|
|      | Access (%)                     | Installed Capacity (MW) | Energy (GWH) | Access (%)                                         | Installed Capacity (MW) | Energy (GWH) |
| 2008 | 6.0                            | 45                      | 225.0        | 6.0                                                | 45                      | 225          |
| 2010 | 11.0                           | 85                      | 353          | 11.0                                               | 85                      | 353          |
| 2015 | 22                             | 200                     | 965.5        | 35.0                                               | 800                     | 1200         |
| 2017 | 28.0                           | 300                     | 1,200.0      | 50.0                                               | 1000                    | 1400         |
| 2020 | 32                             | 400                     | 1,478.0      | 90                                                 | 1200                    | 1950         |
| 2025 | 40.0                           |                         | 2,148.4      | 94.0                                               | 1500                    | 3300         |

**Figure 17: Vision 2020 vs. New Electricity generation targets** Source: Electricity Master Plan (2011), Seven-Year Electricity (2011)

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

### 16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

### 16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>123</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

#### **16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 version 16.0

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

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<sup>123</sup> <http://cdm.unfccc.int/>

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies. ACM0002 (version 16.0) para 33 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality*". The latest version of the tool is version 07.0.0.

Furthermore, ACM0002 stipulates that: "When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

- Technical and economic parameters that are technology specific (e.g. ranges of load factors, sizes of installation, wind speed);
- Parameters reflecting the investment climate:
  - Subsidies or other financial flows;
  - Tariffs;
  - Depreciation;
  - Power purchase agreements;
  - Other parameters determining market circumstances;
- Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

**Step 1: Identification of alternatives to the project activity consistent with current laws and regulations****Sub-step 1a: Define alternatives to the project activity:**

According to para 8 of the *Tool for the demonstration and assessment of additionality* (version 07.0.0), project activities that apply the tool in the context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that

would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity.

Alternative 2: 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* (version 04.0.0).

No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Rwanda National Energy Policy and Strategy. These laws and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in Rwanda.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful in accordance with the Rwanda National Energy Policy and Strategy. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Rwanda National Energy Policy and Strategy applies to all types of generation technology including renewable power generation technology. Therefore the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of Greenfield grid-connected solar PV power capacity to the Rwanda grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the Rwanda National Energy Policy and Strategy covers the establishment of new power generation sources from solar PV power technologies in Rwanda.

There are no further applicable national laws or regulations, which require the application as a CDM project activity.

### **Step 3: Barrier analysis**

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. The *Guidelines for objective demonstration and assessment of barriers* (version 1), has been used when applying this step in line with para. 46 of the “*Tool for the demonstration and assessment of additionality*.”

CPAs using barrier analysis will determine whether the proposed project activities faces barriers that:

- a) Prevent the implementation of this type of proposed project activity; and
- b) Do not prevent the implementation of at least one of the alternatives.

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

The *Guidelines for objective demonstration and assessment of barriers* states that “ 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. Projects in Least Developed Countries are not bound

by the provisions in this guideline and may use other approaches that are more adapted to the local circumstances.”

CPAs under the programme will therefore be at liberty to claim barriers as best adapted to Rwanda. The individual CPAs may claim other barriers in addition to these highlighted below:

- Barriers related to lack of capital
- Technological barriers
- Barriers due to skilled labor
- Barriers due to increased risks of damage
- Barriers due to prevailing practice

However, in accordance with the *Guidelines for objective demonstration and assessment of barriers*, barriers that can be mitigated by additional financial means can be quantified and represented as costs and will not be identified as a barrier for implementation of project while conducting the barrier analysis. Instead, these will be considered into the framework of the investment analysis. For instance, the necessary trained labor to operate and maintain new clean technologies may not be available right away. However, this would not necessarily prevent implementation of a solar PV project since most O&M contractors in collaboration with the EPC contractors are able to provide sufficient training and/or even provide themselves staff to operate the plant. This, therefore, adds additional costs (salaries, training costs, service fees) those would be considered in the NPV/IRR analysis.

*Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)*

The CPA implementing entity shall provide transparent and documented evidence, and offer conservative interpretations of this documented evidence, as to how it demonstrates the existence and significance of the identified barriers and whether alternatives are prevented by these barriers. The type of evidence to be provided should include at least one of the following:

- a) Relevant legislation, regulatory information or industry norms;
- b) Relevant (sectoral) studies or surveys (e.g. market surveys, technology studies, etc.) undertaken by universities, research institutions, industry associations, companies, bilateral/multilateral institutions, etc.;
- c) Relevant statistical data from national or international statistics;
- d) Documentation of relevant market data (e.g. market prices, tariffs, rules);
- e) Written documentation of independent expert judgments from industry, educational institutions (e.g. universities, technical schools, training centres), industry associations and others.

**Eligibility 6.1:** The CPA has confirmed that the barriers provided are real. This will be evidenced by objective and transparent references from credible sources such as independent third parties, relevant legislation, relevant sectoral studies, and relevant statistical data. From national and international statistics, documentation of relevant market data and expert opinion.

**Eligibility 6.2:** The CME has confirmed that the identified barriers prevent the implementation of the project activity but does not prevent the implementation of at least one of the alternatives.

#### **Step 4: Common practice analysis**

In line with the *Tool for the demonstration and assessment of additionality* (version 07.0.0) and the *Guidelines on common practice* (version 02.0), currently revised to methodological tool: common practice (version 03.1), it can be concluded that the CPA is not common practice as  $F$  is lower than 0.2 and  $N_{all} - N_{diff}$  is lower than 3. The common practice analysis will be based on publicly available data and information from RURA, REG/EWSA and/or the MININFRA or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

**Eligibility criteria 6.3:** The CPA has confirmed that the results of common practice analysis show F to be lower than 0.2 and Nall –Ndiff is lower than 3

**16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>124</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>125</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

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<sup>124</sup> National Policy on Environment, Rwanda (2003)

<sup>125</sup> EIA Regulations, Rwanda

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

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

### **B.6.1. Explanation of methodological choices**

The generic CPA will focus on grid-connected renewable electricity generation from solar PV power. The generic CPA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (Greenfield plant).

The emission factor of the grid is calculated in a transparent and conservative manner using the combined margin (CM) consisting of the operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

#### **Baseline emissions**

Baseline emissions include CO<sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. In line with ACM0002 (version 16.0), the baseline emissions are to be calculated as follows (**equation 7**):

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

Where:

|                  |   |                                                                                                                                                                                                                                |
|------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $BE_y$           | = | Baseline Emissions in year y (t CO <sub>2</sub> /yr)                                                                                                                                                                           |
| $EG_{PJ,y}$      | = | Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)                                                                 |
| $EF_{grid,CM,y}$ | = | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate emission factor for an electricity system” (tCO <sub>2</sub> /MWh) |

#### **Calculation of $EG_{PJ,y}$**

CPAs under the PoA involve the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield projects), therefore  $EG_{PJ,y}$  is estimated as per **equation 8**:

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

Where:

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

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

The emission factor will be calculated in a transparent and conservative manner using option (a), the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

The grid emission factor will be calculated for the Rwandan electricity system and will be applied to each CPA of the PoA. Equations and source of data to calculate the grid emission factor for Rwanda are provided below.

#### **Step 1. Identify the relevant electric power system**

For calculating the grid emission factor, the project activity has identified the Rwanda National Grid as the relevant project electricity system.

The identification of the Rwanda National Grid as the relevant project electricity system is based on the following arguments:

- The Rwandan DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the Rwandan grid system
- Although the Rwandan grid is connected to a number of its neighbouring countries' grids including Uganda, Burundi and DRC Congo, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary. Those countries will therefore be considered as connected electricity systems and the electricity imported into the Rwandan grid (project electricity system) will be included as imports.
- Finally, Rwanda does not have a layered dispatch system and the country has only one grid system that serves the entire country. Therefore, and in line with version 04.0 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

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

The project activity has selected either Option I where only grid power plants are included in the calculation or Option II where both grid and off-grid power plants are included in the calculation.

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

The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

- a. Simple OM
- b. Simple adjusted OM
- c. Dispatch data analysis OM
- d. Average OM

It is stated under the *Tool to calculate the emission factor for an electricity system* that simple OM can only be used if low-cost/must-run resources constitute less than 50 per cent of total grid generation. In line with a five-year electricity generation data during the period of 2009 and 2013, low-cost/must-run resources in Rwanda, which are mainly hydro, constitute about 41% of total grid generation. Therefore, since this condition has been met, the simple OM method is used.

The CPAs will use the *ex-ante* option and the OM will be calculated once at the validation stage using a three years generation-weighted average.

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

The simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub> emissions per unit net electricity generation (t CO<sub>2</sub>/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

**Option A:** Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit; or,

**Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A has been chosen to calculate the operating margin emission factor of power plants serving the grid.

The Simple OM emission factor is calculated using equation 1 as follows:

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

Where:

- $EF_{grid,OMsimple,y}$  = Simple operating margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  = All grid power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

Determining  $EF_{EL,m,y}$

For the calculation of the emission factor for each power plant  $m$ , option A1 has been selected as fuel consumption is normally provided. Therefore, equation 2 will be used as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type  $i$  in year  $y$  (GJ/mass or volume unit)
- $EF_{CO2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)

- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $i$  = All fuel types combusted in power unit  $m$  in year  $y$
- $y$  = The relevant year as per the data vintage chosen in Step 3

However, in some instances where there is missing data on the fuel consumption amounts, option A.2 will be selected and therefore equation 3 used as follows:

Where several fuel types are used in the power unit, use the fuel type with the lowest CO<sub>2</sub> emission factor for  $EF_{CO_2,m,i,y}$  is to be used.

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (t CO<sub>2</sub>/MWh)
- $EF_{CO_2,m,i,y}$  = Average CO<sub>2</sub> emission factor of fuel type  $i$  used in power unit  $m$  in year  $y$  (t CO<sub>2</sub>/GJ)
- $\eta_{m,y}$  = Average net energy conversion efficiency of power unit  $m$  in year  $y$  (ratio)
- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

#### Determination of $FC_{i,m,y}$

Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit) was based on published records from REG/EWSA and IPP power plants.

(Insert fuel consumption data for latest 3 years)

| Name  | Type | Fuel Consumption data (Litres/year) |        |        |
|-------|------|-------------------------------------|--------|--------|
|       |      | Year 1                              | Year 2 | Year 3 |
|       |      |                                     |        |        |
|       |      |                                     |        |        |
| Total |      |                                     |        |        |

#### Determination of $EG_{m,y}$

For grid power plants,  $EG_{m,y}$  is based on published records and data obtained directly from REG/EWSA and IPP power plants. The grid emission factor calculations are based on the publicly available data in Rwanda, i.e. REG/EWSA and IPP power plants which represents the total electricity generated in the Rwandan grid.

(Insert electricity data for thermal power plants for latest 3 years)

| Name  | Type | Generation data (MWh) |        |        |
|-------|------|-----------------------|--------|--------|
|       |      | Year 1                | Year 2 | Year 3 |
|       |      |                       |        |        |
|       |      |                       |        |        |
| Total |      |                       |        |        |

For off-grid power plants,  $EG_{m,y}$  is based on paragraph 32 of the *Tool to calculate the emission factor for an electricity system*. The tool states that a default value of 10 per cent of the total electricity generation by grid power plants in the electricity system can be used to determine  $EG_{m,y}$  for the purpose of the operating margin determination.

(Insert electricity data for all power plants serving the grid for latest 3 years)

| Name     | Type | Generation data (MWh) |        |        |
|----------|------|-----------------------|--------|--------|
|          |      | Year 1                | Year 2 | Year 3 |
|          |      |                       |        |        |
|          |      |                       |        |        |
| Total    |      |                       |        |        |
| Off-grid |      |                       |        |        |

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

For the calculation of the build margin (BM) emission factor, **Option 1** data vintage will be chosen. Hence, for the first crediting period, the build margin emission factor shall be calculated, *ex ante* based on the most recent information available on units already built for sample group  $m$  at the time of CPA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require the emission factor to be monitored during the first crediting period.

The build margin emission factor is thus calculated using **equation 13** of the “*Tool to calculate the emission factor for an electricity system*”, as shown below:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  = Power units included in the build margin
- $y$  = Most recent historical year for which power generation data is available

The CO<sub>2</sub> emission factor of each power unit  $m$  ( $EF_{EL,m,y}$ ) will be determined as per the guidance in section 6.4.1 for the simple OM, using equation (2) under option A1 or equation 3 under option A2, depending on availability of data, and using for  $y$  the most recent historical year for which grid power generation data is available, and using for  $m$  the power units included in the build margin.

If the power units included in the build margin  $m$  correspond to the sample group SETsample-CDM->10yrs, then, as a conservative approach, only Option A2 from guidance in Step 4 section 6.4.1 can be used and the default values provided in appendix 1 shall be used to determine the parameter  $\eta_{m,y}$  for the power units that started to supply electricity to the grid more than 10 years ago.

For option A1,  $EF_{EL,m,y}$  is calculated in accordance with equation 2 as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type  $i$  in year  $y$  (GJ/mass or volume unit)
- $EF_{CO2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $m$  = The power units included in the build margin
- $i$  = All fuel types combusted in power unit  $m$  in year  $y$
- $y$  = The relevant year as per the data vintage chosen in Step 3

For option A2,  $EF_{EL,m,y}$  is calculated in accordance with equation 3 as follows:

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

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (t CO<sub>2</sub>/MWh)
- $EF_{CO2,m,i,y}$  = Average CO<sub>2</sub> emission factor of fuel type  $i$  used in power unit  $m$  in year  $y$  (t CO<sub>2</sub>/GJ)
- $\eta_{m,y}$  = Average net energy conversion efficiency of power unit  $m$  in year  $y$  (ratio)
- $m$  = The power plants included in the build margin
- $y$  = The relevant year as per the data vintage chosen in Step 3

The sample group of power units  $m$  used to calculate the build margin will be determined in accordance with the “*Tool to calculate the grid emission factor for an electricity system*”.

Below is a table with all power plants in the project electricity system (Source: Rwanda Energy Group (REG) / Energy, Water and Sanitation - EWSA). The power plants are ranked according to commissioning date.

|   | Name of power plant | Commissioning date | Electricity generation 2009-2011 (MWh) | % |
|---|---------------------|--------------------|----------------------------------------|---|
| 1 |                     |                    |                                        |   |
| 2 |                     |                    |                                        |   |
| 3 |                     |                    |                                        |   |
| 4 |                     |                    |                                        |   |

#### Step 6: Calculate the Combined Margin

Option (a) i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated as follows:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)
- $EF_{grid,OM,y}$  = Operating margin CO<sub>2</sub> emission factor in year y (tCO<sub>2</sub>/MWh)
- $W_{OM}$  = Weighting of operating margin emissions factor (%)
- $W_{BM}$  = Weighting of build margin emissions factor (%)

For solar power generation projects the following default values are used for  $W_{OM}$  and  $W_{BM}$ :

$$W_{OM} = 0.75$$

$$W_{BM} = 0.25$$

### **Project emissions**

For most renewable energy projects, such as solar PV energy project activities,  $PE_y = 0$ . Project emissions will be considered following the procedures described in ACM0002, version 16.0 using **equation (1)**:

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

Where:

- $PE_y$  = Project emissions in year y (tCO<sub>2</sub>e/yr)
- $PE_{FF,y}$  = Project emissions from fossil fuel consumption in year y (tCO<sub>2</sub>/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<sub>2</sub>e/yr)
- $PE_{HP,y}$  = Project emissions from water reservoirs of hydro power plants in year y (tCO<sub>2</sub>e/yr)

#### **Project emissions from fossil fuel consumption ( $PE_{FF,y}$ )**

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels.

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

This CPA involves solar PV power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

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

This CPA involves solar PV power plants, not hydro power plants with water reservoirs. Therefore there are no emissions from hydro power plants.

This CPA, which involves a solar PV power project, has project emissions ( $PE_y$ ) considered 0.

### **Leakage emissions**

No leakage emissions are considered in accordance with ACM0002 (version 16.0)

### **Emission reductions**

In line with ACM0002 (version16.0) the emission reductions are calculated using (**equation 13**) as follows:

$$ER_y = BE_y - PE_y$$

Where:

$ER_y$  = Emission reductions in year  $y$  (t CO<sub>2</sub>/y)

$BE_y$  = Baseline Emissions in year  $y$  (t CO<sub>2</sub>/y)

$PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>/y)

### B.6.2. Data and parameters fixed ex-ante

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>NCV_{i,y}</math></b>                                                                                                                                                                           |
| Data unit:                                            | GJ/kg                                                                                                                                                                                                   |
| Description:                                          | Net calorific value (energy content) of fossil fuel type $i$ in year $y$                                                                                                                                |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>EF_{CO_2,i,y} / EF_{CO_2,m,i,y}</math></b>                                                                                                                                                     |
| Data unit:                                            | tCO <sub>2</sub> /GJ                                                                                                                                                                                    |
| Description:                                          | CO <sub>2</sub> emission factor of fossil fuel type $i$ in year $y$                                                                                                                                     |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                              |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>EG_{m,y}</math></b>                                                                                                 |
| Data unit:                                            | MWh                                                                                                                          |
| Description:                                          | Net electricity generated by power plant/unit min year $y$                                                                   |
| Source of data:                                       | Rwanda Energy Group (REG)/Energy Water and Sanitation (EWSA)                                                                 |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                       |
| Choice of data or Measurement methods and procedures: | Data on electricity generation has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants. |

|                     |                                                                                                                                                                                                                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose of data     | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                             |
| Additional comment: | Applicable only to grid emission factor calculations<br><br>Rwanda Energy Group (REG) is the newly established utility company taking over responsibilities from EWSA. The company was established following the separation of EWSA into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC). |

|                                                       |                                                                                                                                                  |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>FC_{i,m,y}</math></b>                                                                                                                   |
| Data unit:                                            | Kg/year                                                                                                                                          |
| Description:                                          | Amount of fossil fuel type i consumed by power plant / unit m in year y                                                                          |
| Source of data:                                       | Rwanda Energy Group (REG) / Energy Water and Sanitation (EWSA)                                                                                   |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                           |
| Choice of data or Measurement methods and procedures: | Data on fuel consumption from thermal power plants has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants. |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                             |

|                                                       |                                                                                                              |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>\eta_{m,y}</math></b>                                                                               |
| Data unit:                                            | Percentage                                                                                                   |
| Description:                                          | Average net energy conversion efficiency of power unit m in year y (ratio)                                   |
| Source of data:                                       | Defaults from the tool for average net energy of combined cycle engines.                                     |
| Value(s) applied:                                     | To be determined in the specific CPA-DD                                                                      |
| Choice of data or Measurement methods and procedures: | Data will be obtained based on publicly available information or the REG/EWSA, the utility company in Rwanda |
| Purpose of data                                       | Calculation of baseline emissions                                                                            |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                         |

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

#### Baseline emissions

The baseline emissions for CPAs involving solar PV power are to be calculated as follows:

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

Calculation of  $EG_{facility,y}$

| Parameter         | Value          | Unit   | Source          |
|-------------------|----------------|--------|-----------------|
| $EG_{facility,y}$ | [insert value] | MWh/yr | [insert source] |

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

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

Values to determine  $EF_{grid,CM,y}$  for solar PV power CPAs:

| Parameter           | Value    | Unit                  | Source           |
|---------------------|----------|-----------------------|------------------|
| $EF_{grid,BM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $W_{BM}$            | 0.25     |                       | Default value    |
| $EF_{grid,OM-DD,y}$ | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $W_{OM}$            | 0.75     |                       | Default value    |
| $EF_{grid,CM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |

Therefore:

$$EF_{grid,CM,y} = [\text{Insert}] \text{ tCO}_2/\text{MWh}$$

$$BE_y = [\text{Insert}] * [\text{Insert}] = [\text{Insert}] \text{ tCO}_2/\text{year}$$

### **Project emissions**

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels. As no geothermal or hydro technology types will be implemented, project emissions ( $PE_y$ ) is considered 0.

### **Leakage emissions**

Leakage emissions are not considered in accordance with ACM0002 (version 16.0)

### **Emission reductions**

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including Solar PV: [insert value of  $BE_y$ ] - 0 = [insert value of  $ER_y$ ]

## **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/year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 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                    | To be reported in the specific CPA-DD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Measurement methods and procedures: | <p>The metering equipment installed at the CPA site should be in line with the provisions of the Power Purchase Agreement and the Rwandan Electricity Grid Code.</p> <p>This parameter should 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.</p> <p>In case it is calculated then the following parameters shall be measured:</p> <p>(a) The quantity of electricity supplied by the project plant/unit to the grid; and</p> <p>(b) The quantity of electricity delivered to the project plant/unit from the grid</p> |
| Monitoring frequency:               | The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with the PPA and the relevant industry levels.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

|                     |                                                                                                                                                                                                |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| QA/QC procedures:   | Cross-check results with records of sold electricity.<br><br>Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise. |
| Purpose of data     | Calculation of baseline emissions                                                                                                                                                              |
| Additional comment: | -                                                                                                                                                                                              |

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

Overall authority and responsibility for monitoring will rest with the CME, who will also be responsible for managing the emission reduction monitoring and verification process.

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

#### CPA implementing entity

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on- site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

| Parameter              | Description                                                                            | Type of CPA |
|------------------------|----------------------------------------------------------------------------------------|-------------|
| $EG_{PJ, facility, y}$ | Quantity of net electricity supplied by the project plant/unit to the grid in year $y$ | All         |

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year  $y$  ( $EG_{PJ, facility, y}$ ). The CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the electricity off-taker. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity 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 or the last issuance of CERs, whichever is later.

Metering will be conducted with calibrated measurement equipment in accordance to relevant industry standards. The Rwandan Utilities Regulatory Authority (RURA) has adopted the metering standards (SANS 474:2008, NRS 057:2011, IEC 62056) as outlined in the *Metering Code*, part of the Rwandan Grid Code. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations, which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers and associated test facilities.

The CPA will be responsible for the Metering Installation procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The Metering Installation would be preferable installed at the Point of Supply, which is defined as the commercial boundary between customer (CPA implementer) and the Transmitter organization.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

### **Gigawatt Global - Coordinating/managing entity**

The CME will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Receiving monitored data collected by the CPA implementing entity.
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices, and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

### **Training**

Before the implementation of a CPA or the start of the crediting period of the CPA, whichever occurs later, 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

## **PART II. Generic component project activity (CPA)**

### **CPA TYPE V: GREENFIELD LARGE-SCALE SOLAR PV POWER PLANTS/UNITS IN RWANDA APPLYING AUTOMATIC ADDITIONALITY**

#### **SECTION A. General description of a generic CPA**

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

The generic Component Project Activity (CPA) will involve the implementation and operation of a large-scale solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant). The project activity will generate electricity from renewable sources, which will be fed into Rwanda's national electricity grid, displacing fossil fuel based electricity generation, thus, leading to emission reductions.

The CPA is being pursued as a component of the PoA "Gigawatt Global Programme of Activities" with Gigawatt Global Cooperatief U.A. as the CME.

Demonstration of eligibility into the PoA is provided in section B.5 of the Generic CPA.

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

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

The CPA will apply the approved consolidated baseline and monitoring methodology ACM0002 (version 16.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 16.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 04.0)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)*
- *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)*
- *Tool to determine the remaining lifetime of equipment (version 01.0)*
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)*

The CPA will only apply the *Tool to calculate the emission factor for an electricity system (version 04.0)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*.

The *Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion (version 02)* will also not be used since the CPA will not generate CO<sub>2</sub> emissions from fossil fuel combustion for its operations. The *Tool to determine the remaining lifetime of equipment (version 01)* will not be used as the generic CPA is a Greenfield project while the *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)* is only applicable upon renewal of a crediting period.

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

The CPA qualifies as a Type I project activity and meets the applicability criteria in accordance with ACM0002 *Grid connected electricity generation from renewable sources* (version 16.0), as follows:

| Applicability criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Generic CPA justification                                                                                                                                                                                                                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>This methodology is applicable to grid-connected renewable power generation project activities that:</p> <ul style="list-style-type: none"> <li>(a) Install a Greenfield power plant;</li> <li>(b) Involve a capacity addition to (an) existing plant(s);</li> <li>(c) Involve a retrofit of (an) existing operating plants/units;</li> <li>(d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or</li> <li>(e) Involve a replacement of (an) existing plant(s).</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>CPAs will consist of solar PV power projects connected to the Rwanda National Grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield plant)</p> |
| <p>The methodology is applicable under the following conditions:</p> <ul style="list-style-type: none"> <li>(a) The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;</li> <li>(b) In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.</li> </ul> | <p>The CPA will install a solar PV power plant, an eligible technology type under this methodology.</p> <p>n/a. CPAs under this PoA are Greenfield projects.</p>                                                                                      |
| <p>In case of hydro power plants, one of the following conditions shall apply</p> <ul style="list-style-type: none"> <li>(a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or</li> <li>(b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m<sup>2</sup>; or</li> <li>(d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is</li> </ul>                                                                                                                        | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                                                                                                                                                                                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| <p>lower than or equal to <math>4 \text{ W/m}^2</math>, all of the following conditions shall apply:</p> <ul style="list-style-type: none"> <li>i. The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than <math>4 \text{ W/m}^2</math>;</li> <li>ii. Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity;</li> <li>iii. Installed capacity of the power plant(s) with power density lower than or equal to <math>4 \text{ W/m}^2</math> shall be: <ul style="list-style-type: none"> <li>a) Lower than or equal to 15 MW; and</li> <li>b) Less than 10 per cent of the total installed capacity of integrated hydro power project.</li> </ul> </li> </ul>                                                                                                                                                                                                                                             |                                                                                   |
| <p>In the case of integrated hydro power projects, project proponent shall:</p> <p>(a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or</p> <p>(b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM 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.</p> | <p>n/a. CPAs consist of Solar PV projects, not hydro power</p>                    |
| <p>The methodology is not applicable to:</p> <ul style="list-style-type: none"> <li>a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;</li> <li>b) Biogas fired power plants</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>n/a. CPAs under the PoA will only consist of Greenfield solar PV projects.</p> |
| <p>In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p>n/a, CPAs under this PoA are Greenfield projects.</p>                          |

|                                                                  |  |
|------------------------------------------------------------------|--|
| project activity and undertaking business as usual maintenance". |  |
|------------------------------------------------------------------|--|

The CPA will be in compliance with the *Tool to calculate the emission factor for an electricity system* (version 04.0) as follows:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 since the generic CPA involves the generation of electricity from solar and its supply to the Rwandan grid system.                                                                                                                 |
| Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity. | The emission factor is calculated for either only grid connected power plants or both grid connected and off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" will be met. |
| 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.<br>Rwanda is not an Annex-I country.                                                                                                                                                                  |
| The value applied to the CO <sub>2</sub> emission factor of biofuels is zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Not applicable since no biofuels are used for grid-connected electricity generation in Rwanda.                                                                                                                                                             |

### B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. Rwandan national electricity grid). The project activity will therefore displace electricity generated by Rwandan fossil fuel grid-connected power plants and will therefore lead to emission reductions of CO<sub>2</sub>.

The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for solar PV energy CPAs are provided in the table below:

| Source           |                                                                                                                                                 | Gas              | Included | Justification/Explanation                                                                        |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------|--------------------------------------------------------------------------------------------------|
| Baseline         | CO <sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity              | CO <sub>2</sub>  | Yes      | Main emission source                                                                             |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       | Minor emission source                                                                            |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       | Minor emission source                                                                            |
| Project activity | For geothermal power plants, fugitive emissions of CH <sub>4</sub> and CO <sub>2</sub> from non-condensable gases contained in geothermal steam | CO <sub>2</sub>  | No       | The CPAs in this PoA do not involve geothermal power plants therefore no emissions are included. |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | CO <sub>2</sub> emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants  | CO <sub>2</sub>  | No       | No on-site fossil fuel consumption will take place. Therefore no emissions are included          |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |
|                  | For hydro power plants, emissions of CH <sub>4</sub> from the reservoir                                                                         | CO <sub>2</sub>  | No       | This PoA does not involve hydroelectric power plants, therefore no emissions are included        |
|                  |                                                                                                                                                 | CH <sub>4</sub>  | No       |                                                                                                  |
|                  |                                                                                                                                                 | N <sub>2</sub> O | No       |                                                                                                  |

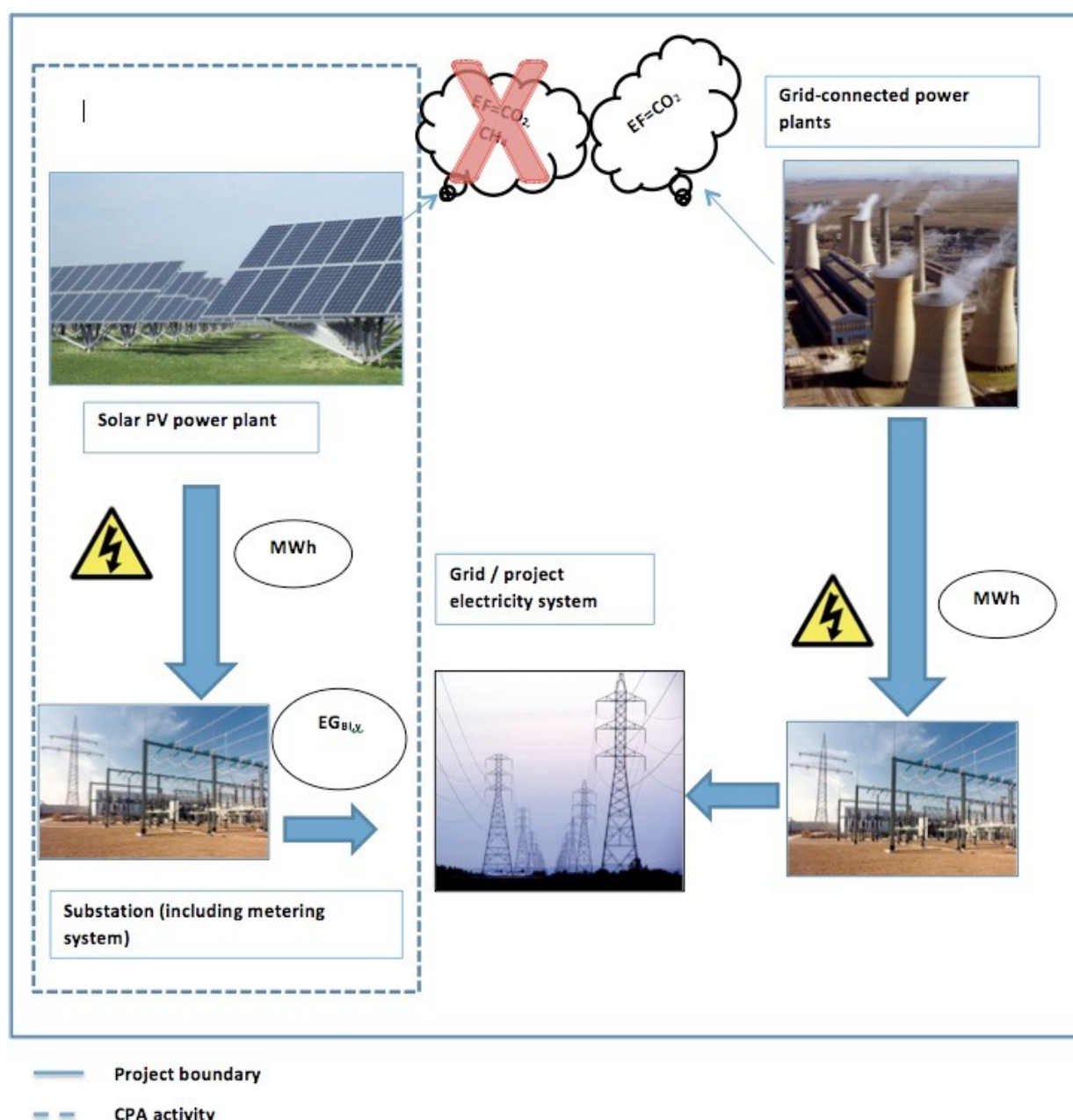


Figure 18: Flow diagram delineating the CPA boundary

#### B.4. Description of baseline scenario

In accordance with the large-scale consolidated methodology ACM0002 (version 16.0) *Grid-connected electricity generation from renewable sources*, the baseline scenario is “electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

##### Structure of the Rwanda Power sector

The power sector in Rwanda lies under the Ministry of Infrastructure (MININFRA), which has the primary responsibility of policy formulation and strategy setting for the energy sector, and for

coordinating developments in the electricity sub-sector.<sup>126</sup> The Government of Rwanda (GoR) launched the Economic Development and Poverty Reduction Strategy II (EDPRS II), 2013-2018, with an aim to boost economic growth.<sup>127</sup> Increasing the supply, access and stability of electricity have been identified as some of the core pillars for achieving this stated objective and increasing electricity generation from renewables has been particularly emphasized.<sup>128</sup>

The Rwanda Utilities Regulatory Authority (RURA) is the body that is tasked to oversee the energy sector together with other sectors in telecommunications, water, waste and transport. RURA was established on 13/01/2001 through the adoption of Law N°39/2001. This Law was further reviewed and replaced by Law N° 09/2013 of 01/03/2013, which further amended its mission, powers, organization and functions specifically in the energy sector. RURA is mandated to control and regulate electricity generation, transmission and distribution in order to ensure efficiency and sustainability in the sector. As such, it plays a supervisory role by among other things, granting licenses for generation, transmission and distribution of electricity in Rwanda.<sup>129</sup>

Apart from MININFRA and the Rwanda Utilities Regulator (RURA), the utility company, the newly established utility company, the Rwanda Energy Group Limited (REG)<sup>130</sup> is the other key player in the energy sector. The 100% state owned company is the largest electricity generator accounting for over 90% of the total electricity generated and also responsible for transmission, distribution and supply of electricity in Rwanda.<sup>131</sup>

Since the early 2000, Rwanda has gradually moved towards power sector reforms focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths but have typically involved the passing of electricity laws, the establishment of a regulatory body overseeing the power sector, some form of unbundling of the power sector and the introduction of Independent Power Producers (IPPs). Rwanda has also introduced Feed-in-Tariff policies starting with small hydro projects with the rest of renewable energy technologies to be included in future. The Renewable Energy Feed-in-Tariff (REFIT) adopted in 2012, is a direct result of the governments Green Growth Strategy adopted in 2011 to foster the uptake of renewable energy in the national grid.<sup>132</sup>

Previously, EWSA was responsible for providing both electricity and water thereby hindering its ability to make real progress in improving energy supply in Rwanda. As a consequence, the company was separated into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC) with different and independent roles in providing energy and water services respectively. This move is expected to promote efficiency and transparency in the generation and distribution of electricity in Rwanda.

### **Installed Generation Capacity**

Rwanda's installed capacity has increased significantly from a mere 25MW in 1994 to 110MW in 2013.<sup>133</sup> The five-year average<sup>134</sup> of the national electricity generation mix is dominated by thermal sources (58.7%), hydro (41.2%) and the remaining 0.1% for solar PV.

<sup>126</sup> [http://www.mininfra.gov.rw/Mission\\_and\\_Purpose](http://www.mininfra.gov.rw/Mission_and_Purpose); Accessed on 18 December 2014

<sup>127</sup> Economic Development and Poverty Reduction Strategy II (EDPRS II)

<sup>128</sup> Republic of Rwanda (2000), Rwanda Vision 2020

<sup>129</sup> [www.rura.rw/about-rura/](http://www.rura.rw/about-rura/); Accessed on 18 December 2014

<sup>130</sup> Formerly the utility company was Energy Water and Sanitation Company (EWSA)

<sup>131</sup> [www.reg.rw/home](http://www.reg.rw/home); Accessed on 18 December 2014

<sup>132</sup> [www.rura.rw](http://www.rura.rw); Accessed on 18 December 2014

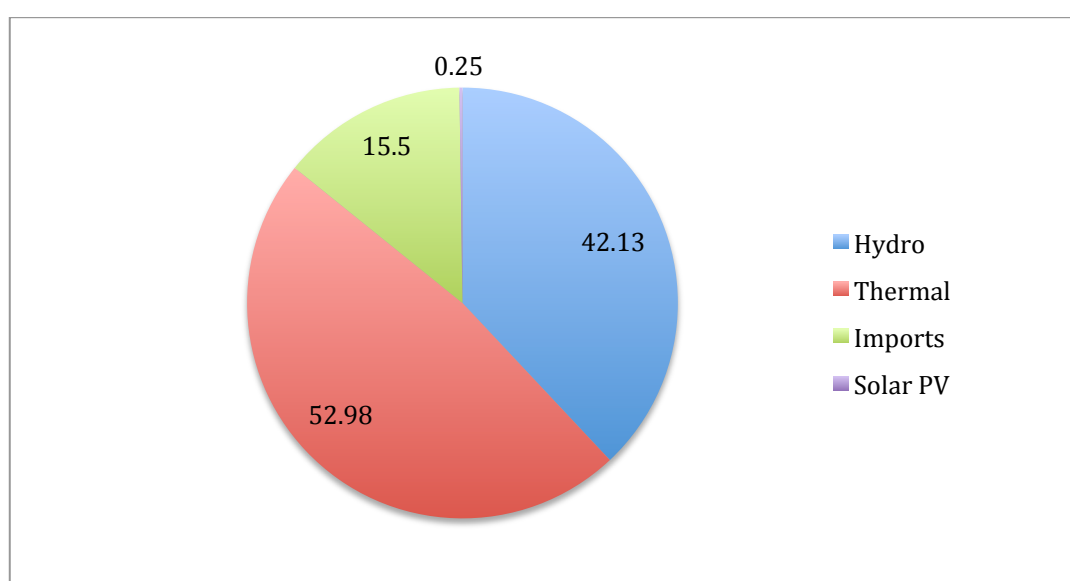
<sup>133</sup> <http://www.ewsa.rw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>134</sup> Electricity data provided by EWSA for the period 2009 -2013

By June 2013, the total installed capacity in Rwanda reached 110MW<sup>135</sup>. The country's electricity generation was dominated by thermal power accounting for about 52.08 MW of the total generation followed by hydropower at 42.13 MW. Electricity imports from the regional countries accounted for about 15.5 MW. However, the available capacity fluctuated between 80MW and 92 MW. Of this capacity, grid connected solar accounted for only 0.25MW,<sup>136</sup> which represents 0.1% of the total installed capacity.

According to the former utility company, EWSA, generation from thermal sources accounting for more than half the national generation mix, directly translated to high cost of fuel consumption estimated at USD 40 million annually and an average electricity cost of USD 0.26/kWh.<sup>137</sup> This average electricity costs in Rwanda is almost double the overall global average of USD 0.14/kWh.<sup>138</sup> The Rwandan government has consequently been forced to provide electricity subsidies in order to keep the tariff comparable with the regional average.

This information on Rwanda energy generation mix is summarised graphically as follows:



**Figure 19: Installed grid electricity capacity by type in Rwanda**

### **Future Generation**

Rwanda's electricity consumption constitutes only 4% of the overall primary energy consumption with biomass forming the largest proportion at 85% and petroleum accounting for 11%.<sup>139</sup> On one hand, these percentages present the electricity subsector as the least developed in the energy sector while on the other hand, the figures illustrate a high dependency on wood fuel in Rwanda.

<sup>135</sup> RURA annual report 2012-2013 reports 110MW. However electricity data from the utility company (used in the GEF spread sheet) indicates the capacity to be about 127.45 MW. The former has been used since its publicly available information while data from EWSA is not.

<sup>136</sup> Electricity data provided by EWSA for the period 2009 -2013

<sup>137</sup> <http://www.ewsarw/index.php/En/products-services/energy/introduction-energy>; Accessed on 18 December 2014

<sup>138</sup> Rapid Assessment of a National Energy and Low Carbon path for Rwanda (May 2009)

<sup>139</sup> RURA Annual Report 2012/2013, Page 77

The GoR recognizes that the availability of reliable power supply is a pre-requisite for economic growth, social prosperity, as well as human development. The government, therefore, aims at increasing and diversifying electricity generation in the country through a rollout programme that will rapidly increase supply. Already some positive results have been posted following the implementation of the initial phase of the government initiative and increasing electricity access by a remarkable 160% between the year 2008 and 2011.<sup>140</sup> Nonetheless, only 16% (350,000) of Rwanda's households are connected to the grid as shown in the table below. In this regard, the government has revised its target to expand electricity access to households to approximately 70% by 2017.<sup>141</sup> The expansion plan is aimed at increasing the electricity generation capacity by an additional 1000MW in 2017<sup>142</sup> and 1300MW by 2020.<sup>143</sup> The 1,000MW additional installed capacity in 2017 will comprise of 340 MW of hydropower, 310MW of geothermal power, 300MW of natural gas (methane-based) power, 200MW of peat-based power and 20MW of diesel thermal plants and 5 MW from solar PV.<sup>144</sup>

The table below shows the growth in electricity service from the year 2000 to 2012:

**Table 22: Growth in electricity service (2000 - 2012)**

| Year                  | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-----------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Peak Load (MW)        |      |      |      |      |      |      |      | 47   | 51   | 56   | 64   | 78   | 92   |
| Sales (GWh)           | 204  | 209  | 225  | 235  | 204  | 194  | 230  | 249  | 277  | 308  | 353  | 417  |      |
| Losses                |      |      | 35   |      |      |      | 22   | 18   | 18   | 20   | 19   | 19   |      |
| No. of customers '000 | 49   | 49   | 58   | 67   | 68   | 70   | 77   | 86   | 109  | 140  | 175  | 280  | 350  |
| Access %              |      |      |      |      |      |      |      |      | 4    | 8    | 13   | 14   | 16   |

Source: EWSA

**Table 23: Target Capacity Additions in Rwanda by 2017**

| Generation type | Target installed capacity (MW) |
|-----------------|--------------------------------|
| Peat            | 200                            |
| Geothermal      | 310                            |
| Hydro Power     | 340                            |
| Methane         | 300                            |
| Diesel          | 20                             |
| Solar           | 5 <sup>145</sup>               |
| Total           | 1,175                          |

<sup>140</sup> Rwanda Energy Sector Review and Action Plan (2013), Page 31

<sup>141</sup> Rwanda Energy Sector Review and Action Plan, Page 8

<sup>142</sup> Energy Policy and Strategy, page 54

<sup>143</sup> Energy Policy and Strategy, page 52

<sup>144</sup> The summation of these capacities yield about 1,175MW against the indicated 1000MW. Other sources indicate a capacity target of 20MW for solar PV in Rwanda. We have however chosen to stick with the capacity target as documented in the policy document.

<sup>145</sup> The Electricity policy and strategy indicates 5 MW although other sources indicate 20MW. The later has been picked since its more realistic. Besides, the Rwanda development Board lists two solar PV projects of 10MW each to be under development.

| Year | Based on EDPRS and Vision 2020 |                         |              | Based on Targets Set in 2010 by the New Government |                         |              |
|------|--------------------------------|-------------------------|--------------|----------------------------------------------------|-------------------------|--------------|
|      | Access (%)                     | Installed Capacity (MW) | Energy (GWH) | Access (%)                                         | Installed Capacity (MW) | Energy (GWH) |
| 2008 | 6.0                            | 45                      | 225.0        | 6.0                                                | 45                      | 225          |
| 2010 | 11.0                           | 85                      | 353          | 11.0                                               | 85                      | 353          |
| 2015 | 22                             | 200                     | 965.5        | 35.0                                               | 800                     | 1200         |
| 2017 | 28.0                           | 300                     | 1,200.0      | 50.0                                               | 1000                    | 1400         |
| 2020 | 32                             | 400                     | 1,478.0      | 90                                                 | 1200                    | 1950         |
| 2025 | 40.0                           |                         | 2,148.4      | 94.0                                               | 1500                    | 3300         |

**Figure 20: Vision 2020 vs. New Electricity generation targets** Source: Electricity Master Plan (2011), Seven-Year Electricity (2011)

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

### 16 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in Rwanda.

**Eligibility criteria 1:** The geographic boundary of the CPA is located in Rwanda. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in Rwanda (an EIA license for a proposed CPA issued by the Rwandan authorities would automatically imply that the CPA is located in Rwanda).

### 16 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website<sup>146</sup> that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C. The check by the CME will be presented in a signed confirmation letter from the CME.

Upon confirmation that double counting will not occur from the above steps, the generic CPA will, by definition, have also proven that the CPA was not excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs. Therefore, no separate eligibility criteria will be formulated to demonstrate this.

**Eligibility criteria 2.1:** The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

**Eligibility criteria 2.2:** The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

**Eligibility criteria 2.3:** The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

**Eligibility criteria 2.4:** The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in Rwanda. This will be evidenced by a signed confirmation letter from the CME.

#### **16 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;**

**Eligibility criteria 3.1:** The CPA has confirmed that it's a Greenfield project. This will be evidenced by project description reports including Feasibility Study Reports, Environmental Impact Assessment Reports or Technical Study Reports.

**Eligibility criteria 3.2:** The CPA involves the implementation of a solar PV power project supplying electricity to the Rwanda National Grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria for large-scale projects according to ACM0002 version 16.0

**Eligibility criteria 3.3:** The CPA's net load factor will be based on the P50 forecast. Net load factors are a function of solar irradiation, the type of solar module and losses in the system.

**Eligibility criteria 3.4:** The CPA will use average annual global horizontal solar irradiation data based on data reported by an independent third party, from internationally trusted sources, or onsite measurements.

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<sup>146</sup> <http://cdm.unfccc.int/>

**16 d. Conditions to check the start date of the CPA through documentary evidence;**

According to the *CDM Project Standard* (version 09.0) paragraph 225, the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date of notification of the intention to seek the CDM status by the coordinating/managing entity to the secretariat and the host country DNA. The CME of the proposed PoA notified the secretariat and the host country DNA of their intention to seek the CDM status on 15/01/2014. Acknowledgement for prior consideration was received from the host country on 28/01/2014. Furthermore, for the purpose of this PoA, the start date of the individual CPAs will be when the financial close has been reached. If, at the time of inclusion, the CPA has not yet secured financing for the project, the start date of the CPA will by definition be after 15/01/2014 and therefore, the CPA will have met the requirement of having a start date which is not prior to the date that the secretariat was notified by the CME of their intention of attaining CDM status.

**Eligibility criteria 4:** The start of the CPA occurs after 15/01/2014. This will be evidenced by the financial close agreements. If financial close has not yet been achieved at the time of inclusion of the CPA, the CPA start date will automatically be after 15/01/2014.

**16 e. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs**

**Eligibility criteria 5:** The CPA has confirmed its compliance with the applicability of ACM0002, version 16.0 in section D.2 of the CDM-CPA-DD-FORM

**16 f. The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;**

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 03.0), PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies. In accordance with para 29 of ACM0002 version 16.0, the simplified procedure to demonstrate additionality is applicable to the following grid connected electricity generation technologies (positive list):

- (a) Solar photovoltaic technologies;
- (b) Solar thermal electricity generation including *concentrating Solar Power* (CSP);
- (c) Off-shore wind technologies;
- (d) Marine wave technologies;
- (e) Marine tidal technologies.

A specific technology in the positive list is defined as automatically additional if at the time of PDD submission any of the following conditions is met:

- (a) The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country is equal to or less than two per cent; or
- (b) The total installed capacity of the technology in the host country is less than or equal to 50 MW.
- (c) The project proponents that apply simplified procedure to demonstrate additionality shall provide information on actual capital cost of the project activity or the CPA at the time of the first verification.

- (d) The above positive list of technologies is valid for three years from the date of entry into force of version 16.0 of ACM0002 on 28 November 2014

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of Rwanda. The applicable geographical area is therefore the host country Rwanda. As per eligibility criteria 3.2 the CPA has also evidenced that it involves the use of solar PV technology, a renewable energy, which is one of the applicable measures as per paragraph 29 of ACM0002 version 16.0.

Requirement (c) above shall be demonstrated at first verification of the specific CPA. In this regard, no eligibility criterion has been formulated for it at the registration or inclusion stage.

**Eligibility Criteria 6.1:** At the time of CPA-DD submission for inclusion, the percentage share of total installed capacity of the specific technology (solar PV) in the total installed grid connected power generation capacity in the host country is equal to or less than two per cent. This will be evidenced by a comparison with data of the total installed capacity for all grid-connected power plants located in Rwanda, which has been made available by Rwanda Utilities Regulatory Authority (RURA), REG and/or the Ministry of Infrastructure (MININFRA) or any other credible source.

OR

**Eligibility Criteria 6.2:** At the time of CPA-DD submission for inclusion, the total installed capacity of the technology in the host country is less than or equal to 50 MW. This will be evidenced by publicly available data from the Rwandan relevant Ministry, Energy Regulatory Authority or the utility company.

AND

**Eligibility Criteria 6.3:** At the time of CPA-DD submission for inclusion, the positive list of technologies will still be valid. This will be evidenced by the provisions in the latest version of ACM 0002 or the applicable CDM EB decision.

If the proposed CPA meets the eligibility as shown above, it will be deemed to be automatically additional in accordance with paragraph 30 of ACM0002 version 16.0

**16 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;**

In accordance with the requirements of the Rwandan National Policy on Environment (November 2003)<sup>147</sup>, and relevant ministerial order relating to the requirements and procedure for Environmental Impact Assessment (EIA) regulations (2008)<sup>148</sup>, the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations.

The Government of Rwanda EIA regulation of 2005 set out requirements for a public stakeholders' consultation as part of the EIA process. The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. In addition, the CPA is also required to carry out a separate CDM stakeholder consultation in line with the requirements of the CDM and DNA.

<sup>147</sup> National Policy on Environment, Rwanda (2003)

<sup>148</sup> EIA Regulations, Rwanda

**Eligibility criteria 7.1:** The CPA has carried out an Environmental Impact Assessment in line with Rwandan regulations. This will be evidenced through the issuance of a certificate of approval of Environmental Impact Assessment from the Rwanda Development Board.

**Eligibility criteria 7.2:** The CPA has carried out a stakeholder consultation meeting according to the requirements of the CDM and the DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

**16 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;**

**Eligibility criteria 8.1:** In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

**Eligibility criteria 8.2:** In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

**16 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);**

**Eligibility criteria 9:** The CPA is connected to the Rwandan grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

**16 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;**

The PoA and CPAs do not involve sampling.

**16 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;**

Individual CPAs under this CPA type will be large-scale.

**16 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.**

Individual CPAs under this CPA type will be large-scale.

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

### **B.6.1. Explanation of methodological choices**

The generic CPA will focus on grid-connected renewable electricity generation from solar PV power. The generic CPA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (Greenfield plant).

The emission factor of the grid is calculated in a transparent and conservative manner using the combined margin (CM) consisting of the operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

**Baseline emissions**

Baseline emissions include CO<sub>2</sub> emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. In line with ACM0002 (version 16.0), the baseline emissions are to be calculated as follows (**equation 7**):

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

Where:

|                  |   |                                                                                                                                                                                                                                  |
|------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $BE_y$           | = | Baseline Emissions in year $y$ (t CO <sub>2</sub> /yr)                                                                                                                                                                           |
| $EG_{PJ,y}$      | = | Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year $y$ (MWh/yr)                                                                 |
| $EF_{grid,CM,y}$ | = | Combined margin CO <sub>2</sub> emission factor for grid connected power generation in year $y$ calculated using the latest version of the “Tool to calculate emission factor for an electricity system” (tCO <sub>2</sub> /MWh) |

**Calculation of  $EG_{PJ,y}$** 

CPAs under the PoA involve the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfield projects), therefore  $EG_{PJ,y}$  is estimated as per **equation 8**:

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

Where:

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

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

The emission factor will be calculated in a transparent and conservative manner using option (a), the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures described in the *Tool to calculate the emission factor for an electricity system* (version 04.0).

The grid emission factor will be calculated for the Rwandan electricity system and will be applied to each CPA of the PoA. Equations and source of data to calculate the grid emission factor for Rwanda are provided below.

**Step 1. Identify the relevant electric power system**

For calculating the grid emission factor, the project activity has identified the Rwanda National Grid as the relevant project electricity system.

The identification of the Rwanda National Grid as the relevant project electricity system is based on the following arguments:

- The Rwandan DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the Rwandan grid system
- Although the Rwandan grid is connected to a number of its neighbouring countries' grids including Uganda, Burundi and DRC Congo, there is no data available to provide

proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.

- Finally, Rwanda does not have a layered dispatch system and the country has only one grid system that serves the entire country. Therefore, and in line with version 04.0 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

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

The project activity has selected either Option I where only grid power plants are included in the calculation or Option II where both grid and off-grid power plants are included in the calculation.

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

The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

- a) Simple OM
- b) Simple adjusted OM
- c) Dispatch data analysis OM
- d) Average OM

It is stated under the *Tool to calculate the emission factor for an electricity system* that simple OM can only be used if low-cost/must-run resources constitute less than 50 per cent of total grid generation. In line with a five-year electricity generation data during the period of 2009 and 2013, low-cost/must-run resources in Rwanda, which are mainly hydro, constitute about 41% of total grid generation. Therefore, since this condition has been met, the simple OM method is used.

The CPAs will use the *ex-ante* option and the OM will be calculated once at the validation stage using a three years generation-weighted average.

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

The simple OM emission factor is calculated as the generation-weighted average CO<sub>2</sub> emissions per unit net electricity generation (t CO<sub>2</sub>/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

**Option A:** Based on the net electricity generation and a CO<sub>2</sub> emission factor of each power unit; or,

**Option B:** Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A has been chosen to calculate the operating margin emission factor of power plants serving the grid.

The Simple OM emission factor is calculated using equation 1 as follows:

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

Where:

|                        |   |                                                                                                     |
|------------------------|---|-----------------------------------------------------------------------------------------------------|
| $EF_{grid,OMsimple,y}$ | = | Simple operating margin CO <sub>2</sub> emission factor in year $y$ (tCO <sub>2</sub> /MWh)         |
| $EG_{m,y}$             | = | Net quantity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (MWh) |
| $EF_{EL,m,y}$          | = | CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (tCO <sub>2</sub> /MWh)               |
| $m$                    | = | All grid power units serving the grid in year $y$ except low-cost/must-run power units              |
| $y$                    | = | The relevant year as per the data vintage chosen in Step 3                                          |

#### Determining $EF_{EL,m,y}$

For the calculation of the emission factor for each power plant  $m$ , option A1 has been selected as fuel consumption is normally provided. Therefore, equation 2 will be used as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

|                |   |                                                                                                     |
|----------------|---|-----------------------------------------------------------------------------------------------------|
| $EF_{EL,m,y}$  | = | CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (tCO <sub>2</sub> /MWh)               |
| $FC_{i,m,y}$   | = | Amount of fuel type $i$ consumed by power unit $m$ in year $y$ (Mass or volume unit)                |
| $NCV_{i,y}$    | = | Net calorific value (energy content) of fuel type $i$ in year $y$ (GJ/mass or volume unit)          |
| $EF_{CO2,i,y}$ | = | CO <sub>2</sub> emission factor of fuel type $i$ in year $y$ (tCO <sub>2</sub> /GJ)                 |
| $EG_{m,y}$     | = | Net quantity of electricity generated and delivered to the grid by power unit $m$ in year $y$ (MWh) |
| $m$            | = | All power units serving the grid in year $y$ except low-cost/must-run power units                   |
| $i$            | = | All fuel types combusted in power unit $m$ in year $y$                                              |
| $y$            | = | The relevant year as per the data vintage chosen in Step 3                                          |

However, in some instances where there is missing data on the fuel consumption amounts, option A.2 will be selected and therefore equation 3 used as follows:

Where several fuel types are used in the power unit, the fuel type with the lowest CO<sub>2</sub> emission factor for  $EF_{CO2,m,i,y}$  is to be used.

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

Where:

|                  |   |                                                                                                                     |
|------------------|---|---------------------------------------------------------------------------------------------------------------------|
| $EF_{EL,m,y}$    | = | CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (t CO <sub>2</sub> /MWh)                              |
| $EF_{CO2,m,i,y}$ | = | Average CO <sub>2</sub> emission factor of fuel type $i$ used in power unit $m$ in year $y$ (t CO <sub>2</sub> /GJ) |
| $\eta_{m,y}$     | = | Average net energy conversion efficiency of power unit $m$ in year $y$ (ratio)                                      |

- $m$  = All power units serving the grid in year  $y$  except low-cost/must-run power units
- $y$  = The relevant year as per the data vintage chosen in Step 3

#### Determination of $FC_{i,m,y}$

Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit) was based on published records from REG/EWSA and IPP power plants.

(Insert fuel consumption data for latest 3 years)

|       |      | Fuel Consumption data (Litres/year) |        |        |
|-------|------|-------------------------------------|--------|--------|
| Name  | Type | Year 1                              | Year 2 | Year 3 |
|       |      |                                     |        |        |
|       |      |                                     |        |        |
| Total |      |                                     |        |        |

#### Determination of $EG_{m,y}$

For grid power plants,  $EG_{m,y}$  is based on published records and data obtained directly from REG/EWSA and IPP power plants. The grid emission factor calculations are based on the publicly available data in Rwanda, i.e. REG/EWSA and IPP power plants which represents the total electricity generated in the Rwandan grid.

(Insert electricity data for thermal power plants for latest 3 years)

|       |      | Generation data (MWh) |        |        |
|-------|------|-----------------------|--------|--------|
| Name  | Type | Year 1                | Year 2 | Year 3 |
|       |      |                       |        |        |
|       |      |                       |        |        |
| Total |      |                       |        |        |

For off-grid power plants,  $EG_{m,y}$  is based on paragraph 32 of the *Tool to calculate the emission factor for an electricity system*. The tool states that a default value of 10 per cent of the total electricity generation by grid power plants in the electricity system can be used to determine  $EG_{m,y}$  for the purpose of the operating margin determination.

(Insert electricity data for all power plants serving the grid for latest 3 years)

|          |      | Generation data (MWh) |        |        |
|----------|------|-----------------------|--------|--------|
| Name     | Type | Year 1                | Year 2 | Year 3 |
|          |      |                       |        |        |
|          |      |                       |        |        |
| Total    |      |                       |        |        |
| Off-grid |      |                       |        |        |

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

For the calculation of the build margin (BM) emission factor, **Option 1** data vintage will be chosen. Hence, for the first crediting period, the build margin emission factor shall be calculated, *ex ante* based on the most recent information available on units already built for sample group  $m$  at the time of CPA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require the emission factor to be monitored during the first crediting period.

The build margin emission factor is thus calculated using **equation 13** of the “*Tool to calculate the emission factor for an electricity system*”, as shown below:

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

Where:

- $EF_{grid,BM,y}$  = Build margin CO<sub>2</sub> emission factor in year  $y$  (tCO<sub>2</sub>/MWh)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $m$  = Power units included in the build margin
- $y$  = Most recent historical year for which power generation data is available

The CO<sub>2</sub> emission factor of each power unit  $m$  ( $EF_{EL,m,y}$ ) will be determined as per the guidance in section 6.4.1 for the simple OM, using equation (2) under option A1 or equation 3 under option A2, depending on availability of data, and using for  $y$  the most recent historical year for which grid power generation data is available, and using for  $m$  the power *units* included in the build margin.

If the power units included in the build margin  $m$  correspond to the sample group SETsample-CDM->10yrs, then, as a conservative approach, only Option A2 from guidance in Step 4 section 6.4.1 can be used and the default values provided in appendix 1 shall be used to determine the parameter  $\eta_{m,y}$  for the power units that started to supply electricity to the grid more than 10 years ago.

For option A1,  $EF_{EL,m,y}$  is calculated in accordance with equation 2 as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

- $EF_{EL,m,y}$  = CO<sub>2</sub> emission factor of power unit  $m$  in year  $y$  (tCO<sub>2</sub>/MWh)
- $FC_{i,m,y}$  = Amount of fuel type  $i$  consumed by power unit  $m$  in year  $y$  (Mass or volume unit)
- $NCV_{i,y}$  = Net calorific value (energy content) of fuel type  $i$  in year  $y$  (GJ/mass or volume unit)
- $EF_{CO2,i,y}$  = CO<sub>2</sub> emission factor of fuel type  $i$  in year  $y$  (tCO<sub>2</sub>/GJ)
- $EG_{m,y}$  = Net quantity of electricity generated and delivered to the grid by power unit  $m$  in year  $y$  (MWh)
- $m$  = The power units included in the build margin
- $i$  = All fuel types combusted in power unit  $m$  in year  $y$
- $y$  = The relevant year as per the data vintage chosen in Step 3

For option A2,  $EF_{EL,m,y}$  is calculated in accordance with equation 3 as follows:

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

Where:

|                  |   |                                                                                                                     |
|------------------|---|---------------------------------------------------------------------------------------------------------------------|
| $EF_{EL,m,y}$    | = | CO <sub>2</sub> emission factor of power unit $m$ in year $y$ (t CO <sub>2</sub> /MWh)                              |
| $EF_{CO2,m,i,y}$ | = | Average CO <sub>2</sub> emission factor of fuel type $i$ used in power unit $m$ in year $y$ (t CO <sub>2</sub> /GJ) |
| $\eta_{m,y}$     | = | Average net energy conversion efficiency of power unit $m$ in year $y$ (ratio)                                      |
| $m$              | = | The power plants included in the build margin                                                                       |
| $y$              | = | The relevant year as per the data vintage chosen in Step 3                                                          |

The sample group of power units  $m$  used to calculate the build margin will be determined in accordance with the “*Tool to calculate the grid emission factor for an electricity system*”.

Below is a table with all power plants in the project electricity system (Source: Rwanda Energy Group (REG) / Energy, Water and Sanitation - EWSA). The power plants are ranked according to commissioning date.

|   | Name of power plant | Commissioning date | Electricity generation 2009-2011 (MWh) | % |
|---|---------------------|--------------------|----------------------------------------|---|
| 1 |                     |                    |                                        |   |
| 2 |                     |                    |                                        |   |
| 3 |                     |                    |                                        |   |
| 4 |                     |                    |                                        |   |

#### Step 6: Calculate the Combined Margin

Option (a) i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated as follows:

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

Where:

|                  |   |                                                                                  |
|------------------|---|----------------------------------------------------------------------------------|
| $EF_{grid,BM,y}$ | = | Build margin CO <sub>2</sub> emission factor in year $y$ (tCO <sub>2</sub> /MWh) |
| $EF_{grid,OM,y}$ | = | Operating margin CO <sub>2</sub> emission factor in year (tCO <sub>2</sub> /MWh) |
| $W_{OM}$         | = | Weighting of operating margin emissions factor (%)                               |
| $W_{BM}$         | = | Weighting of build margin emissions factor (%)                                   |

For solar power generation projects the following default values are used for  $W_{OM}$  and  $W_{BM}$ :

$$W_{OM} = 0.75$$

$$W_{BM} = 0.25$$

#### Project emissions

For most renewable energy projects, such as solar PV energy project activities,  $PE_y = 0$ . Project emissions will be considered following the procedures described in ACM0002, version 16.0 using equation (1):

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

Where:

|             |   |                                                                                                                                               |
|-------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------|
| $PE_y$      | = | Project emissions in year y (tCO <sub>2</sub> e/yr)                                                                                           |
| $PE_{FF,y}$ | = | Project emissions from fossil fuel consumption in year y (tCO <sub>2</sub> /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 <sub>2</sub> e/yr) |
| $PE_{HP,y}$ | = | Project emissions from water reservoirs of hydro power plants in year y (tCO <sub>2</sub> e/yr)                                               |

#### Project emissions from fossil fuel consumption ( $PE_{FF,y}$ )

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels.

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

This CPA involves solar PV power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

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

This CPA involves solar PV power plants, not hydro power plants with water reservoirs. Therefore there are no emissions from hydro power plants.

This CPA, which involves a solar PV power project, has project emissions ( $PE_y$ ) considered 0.

### **Leakage emissions**

No leakage emissions are considered in accordance with ACM0002 (version 16.0)

### **Emission reductions**

In line with ACM0002 (version 16.0) the emission reductions are calculated using (**equation 13**) as follows:

$$ER_y = BE_y - PE_y$$

Where:

|        |   |                                                      |
|--------|---|------------------------------------------------------|
| $ER_y$ | = | Emission reductions in year y (t CO <sub>2</sub> /y) |
| $BE_y$ | = | Baseline Emissions in year y (t CO <sub>2</sub> /y)  |
| $PE_y$ | = | Project emissions in year y (t CO <sub>2</sub> /y)   |

### **B.6.2. Data and parameters fixed ex-ante**

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | <b><math>NCV_{i,y}</math></b>                                                                                                                                                                           |
| Data unit:                                            | GJ/kg                                                                                                                                                                                                   |
| Description:                                          | Net calorific value (energy content) of fossil fuel type i in year y                                                                                                                                    |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |

|                     |                                                      |
|---------------------|------------------------------------------------------|
| Purpose of data     | Calculation of baseline emissions                    |
| Additional comment: | Applicable only to grid emission factor calculations |

|                                                       |                                                                                                                                                                                                         |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | $EF_{CO_2,i,y} / EF_{CO_2,m,i,y}$                                                                                                                                                                       |
| Data unit:                                            | tCO <sub>2</sub> /GJ                                                                                                                                                                                    |
| Description:                                          | CO <sub>2</sub> emission factor of fossil fuel type i in year y                                                                                                                                         |
| Source of data:                                       | IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                  |
| Choice of data or Measurement methods and procedures: | IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.                                                             |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                       |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                                                                                    |

|                                                       |                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | $EG_{m,y}$                                                                                                                                                                                                                                                                                                                                                    |
| Data unit:                                            | MWh                                                                                                                                                                                                                                                                                                                                                           |
| Description:                                          | Net electricity generated by power plant/unit in year y                                                                                                                                                                                                                                                                                                       |
| Source of data:                                       | Rwanda Energy Group (REG)/Energy Water and Sanitation (EWSA)                                                                                                                                                                                                                                                                                                  |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                                                                                                                                                                                                                                        |
| Choice of data or Measurement methods and procedures: | Data on electricity generation has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants.                                                                                                                                                                                                                                  |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                             |
| Additional comment:                                   | Applicable only to grid emission factor calculations<br><br>Rwanda Energy Group (REG) is the newly established utility company taking over responsibilities from EWSA. The company was established following the separation of EWSA into two entities in July 2014, namely, Rwanda Energy Group Ltd (REG) and the Water & Sanitation Corporation Ltd (WASAC). |

|                                                       |                                                                                                                                                  |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Data / Parameter:</b>                              | $FC_{i,m,y}$                                                                                                                                     |
| Data unit:                                            | Kg/year                                                                                                                                          |
| Description:                                          | Amount of fossil fuel type i consumed by power plant / unit m in year y                                                                          |
| Source of data:                                       | Rwanda Energy Group (REG) / Energy Water and Sanitation (EWSA)                                                                                   |
| Value(s) applied:                                     | To be described in the specific CPA-DD                                                                                                           |
| Choice of data or Measurement methods and procedures: | Data on fuel consumption from thermal power plants has been obtained from REG/EWSA, the utility company in Rwanda and owner of the power plants. |
| Purpose of data                                       | Calculation of baseline emissions                                                                                                                |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                                                             |

|                          |                                                                            |
|--------------------------|----------------------------------------------------------------------------|
| <b>Data / Parameter:</b> | $\eta_{m,y}$                                                               |
| Data unit:               | Percentage                                                                 |
| Description:             | Average net energy conversion efficiency of power unit m in year y (ratio) |
| Source of data:          | Defaults from the tool for average net energy of combined cycle engines.   |

|                                                       |                                                                                                               |
|-------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Value(s) applied:                                     | To be determined in the specific CPA-DD                                                                       |
| Choice of data or Measurement methods and procedures: | Data will be obtained based on publicly available information or the REG/EWSA, the utility company in Rwanda. |
| Purpose of data                                       | Calculation of baseline emissions                                                                             |
| Additional comment:                                   | Applicable only to grid emission factor calculations                                                          |

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

#### Baseline emissions

The baseline emissions for CPAs involving solar PV power are to be calculated as follows:

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

Calculation of  $EG_{facility,y}$

| Parameter         | Value          | Unit   | Source          |
|-------------------|----------------|--------|-----------------|
| $EG_{facility,y}$ | [insert value] | MWh/yr | [insert source] |

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

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

Values to determine  $EF_{grid,CM,y}$  for solar PV power CPAs:

| Parameter           | Value    | Unit                  | Source           |
|---------------------|----------|-----------------------|------------------|
| $EF_{grid,BM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{BM}$            | 0.25     |                       | Default value    |
| $EF_{grid,OM-DD,y}$ | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |
| $w_{OM}$            | 0.75     |                       | Default value    |
| $EF_{grid,CM,y}$    | [Insert] | tCO <sub>2</sub> /MWh | GEF calculations |

Therefore:

$$EF_{grid,CM,y} = [\text{Insert}] \text{ tCO}_2/\text{MWh}$$

$$BE_y = [\text{Insert}] * [\text{Insert}] = [\text{Insert}] \text{ tCO}_2/\text{year}$$

#### Project emissions

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels. As no geothermal or hydro technology types will be implemented, project emissions ( $PE_y$ ) is considered 0.

#### Leakage emissions

Leakage emissions are not considered in accordance with ACM0002 (version 16.0)

#### Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including Solar PV:  $[\text{insert value of } BE_y] - 0 = [\text{insert value of } ER_y]$

## 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:                   | $EG_{\text{facility},y}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data unit:                          | MWh/year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 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                    | To be reported in the specific CPA-DD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Measurement methods and procedures: | <p>The metering equipment installed at the CPA site should be in line with the provisions of the Power Purchase Agreement and the Rwandan Electricity Grid Code.</p> <p>This parameter should 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.</p> <p>In case it is calculated then the following parameters shall be measured:</p> <p>(a) The quantity of electricity supplied by the project plant/unit to the grid; and</p> <p>(b) The quantity of electricity delivered to the project plant/unit from the grid</p> |
| Monitoring frequency:               | The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with the PPA and the relevant industry levels.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| QA/QC procedures:                   | <p>Cross-check results with records of sold electricity.</p> <p>Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Purpose of data                     | Calculation of baseline emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Additional comment:                 | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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

Overall authority and responsibility for monitoring will rest with the CME, who will also be responsible for managing the emission reduction monitoring and verification process.

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

#### CPA implementing entity

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on- site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.

- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

| Parameter              | Description                                                                            | Type of CPA |
|------------------------|----------------------------------------------------------------------------------------|-------------|
| $EG_{PJ, facility, y}$ | Quantity of net electricity supplied by the project plant/unit to the grid in year $y$ | All         |

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year  $y$  ( $EG_{PJ, facility, y}$ ). The CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the electricity off-taker. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity 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 or the last issuance of CERs, whichever is later.

Metering will be conducted with calibrated measurement equipment in accordance to relevant industry standards. The Rwandan Utilities Regulatory Authority (RURA) has adopted the metering standards (SANS 474:2008, NRS 057:2011, IEC 62056) as outlined in the *Metering Code*, part of the Rwandan Grid Code. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations, which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers and associated test facilities.

The CPA will be responsible for the Metering Installation procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The Metering Installation would be preferable installed at the Point of Supply, which is defined as the commercial boundary between customer (CPA implementer) and the Transmitter organization.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

### **Gigawatt Global - Coordinating/managing entity**

The CME will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Receiving monitored data collected by the CPA implementing entity.
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices, and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

### **Training**

Before the implementation of a CPA or the start of the crediting period of the CPA, whichever occurs later, 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

## Appendix 1. Contact information of coordinating/managing entity and responsible person(s)/ entity(ies)

|                                              |                                                                                                                                                                                                                         |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CME and/or responsible person/ entity</b> | <input checked="" type="checkbox"/> CME<br><input type="checkbox"/> Responsible person/ entity for application of the selected methodology(ies) and, where applicable, the selected standardized baseline(s) to the PoA |
| <b>Organization</b>                          | Gigawatt Global Coöperatief U.A.                                                                                                                                                                                        |
| <b>Street/P.O. Box</b>                       | Rietland Park 125                                                                                                                                                                                                       |
| <b>Building</b>                              | -                                                                                                                                                                                                                       |
| <b>City</b>                                  | Amsterdam                                                                                                                                                                                                               |
| <b>State/Region</b>                          | -                                                                                                                                                                                                                       |
| <b>Postcode</b>                              | 1019 DT                                                                                                                                                                                                                 |
| <b>Country</b>                               | The Netherlands                                                                                                                                                                                                         |
| <b>Telephone</b>                             | +972 544844391                                                                                                                                                                                                          |
| <b>Fax</b>                                   | -                                                                                                                                                                                                                       |
| <b>E-mail</b>                                | <a href="mailto:michael@gigawattglobal.com">michael@gigawattglobal.com</a>                                                                                                                                              |
| <b>Website</b>                               | <a href="http://gigawattglobal.com/">http://gigawattglobal.com/</a>                                                                                                                                                     |
| <b>Contact person</b>                        | Michael Fichtenberg                                                                                                                                                                                                     |
| <b>Title</b>                                 | VP Finance                                                                                                                                                                                                              |
| <b>Salutation</b>                            | Mr                                                                                                                                                                                                                      |
| <b>Last name</b>                             | Fichtenberg                                                                                                                                                                                                             |
| <b>Middle name</b>                           | -                                                                                                                                                                                                                       |

|                                              |                                                                                                                                                                                                                         |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CME and/or responsible person/ entity</b> | <input type="checkbox"/> CME<br><input checked="" type="checkbox"/> Responsible person/ entity for application of the selected methodology(ies) and, where applicable, the selected standardized baseline(s) to the PoA |
| <b>Organization</b>                          | Carbon Africa Limited                                                                                                                                                                                                   |
| <b>Street/P.O. Box</b>                       | Muthangari Drive                                                                                                                                                                                                        |
| <b>Building</b>                              | Gath Plaza                                                                                                                                                                                                              |
| <b>City</b>                                  | Nairobi                                                                                                                                                                                                                 |
| <b>State/Region</b>                          | -                                                                                                                                                                                                                       |
| <b>Postcode</b>                              | 14938 -00800 Nairobi                                                                                                                                                                                                    |
| <b>Country</b>                               | Kenya                                                                                                                                                                                                                   |
| <b>Telephone</b>                             | +254 731 851 754 or +254 706 374 150                                                                                                                                                                                    |
| <b>Fax</b>                                   | -                                                                                                                                                                                                                       |
| <b>E-mail</b>                                | <a href="mailto:info@carbonafrica.co.ke">info@carbonafrica.co.ke</a>                                                                                                                                                    |
| <b>Website</b>                               | <a href="http://www.carbonafrica.co.ke">http://www.carbonafrica.co.ke</a>                                                                                                                                               |
| <b>Contact person</b>                        | Adriaan Tas                                                                                                                                                                                                             |
| <b>Title</b>                                 | Managing Director                                                                                                                                                                                                       |
| <b>Salutation</b>                            | Mr                                                                                                                                                                                                                      |
| <b>Last name</b>                             | Tas                                                                                                                                                                                                                     |
| <b>Middle name</b>                           | -                                                                                                                                                                                                                       |

## Appendix 2. Affirmation regarding public funding

No further information

## Appendix 3. Applicability of methodology(ies) and standardized baseline(s)

No further information

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

No further information

## **Appendix 5. Further background information on the monitoring plan**

No further information

## **Appendix 6. Summary of post registration changes**

Not applicable

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**Document information**

| <i>Version</i>                                                                                                                                     | <i>Date</i>     | <i>Description</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 05.0                                                                                                                                               | 9 March 2015    | Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to choice of start date of PoA;</li> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to local stakeholder consultation;</li> <li>• Add exception for generic CPA where technology is under positive lists;</li> <li>• Editorial improvement.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 04.1                                                                                                                                               | 5 August 2014   | Editorial revision to correct the document information table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 04.0                                                                                                                                               | 25 June 2014    | Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the project design document form for CDM programme of activities (these instructions supersede the <i>Guideline: Completing the programme design document form for CDM programme of activities</i> (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• 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;</li> <li>• Add general instructions on post-registration changes in paragraph 2 and 3 of general instructions and Appendix 6;</li> <li>• Change the reference number from <i>F-CDM-PoA-DD</i> to <i>CDM-PoA-DD-FORM</i>;</li> <li>• Editorial improvement.</li> </ul> |
| 03.0                                                                                                                                               | 3 December 2012 | EB 70<br>Revision to reflect changes to the <i>Guideline: Completing the programme design document form for CDM programmes of activities</i> (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.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Decision Class: Regulatory<br>Document Type: Form<br>Business Function: Registration<br>Keywords: programme of activities, project design document |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |