PROGRAMME DESIGN DOCUMENT FORM FOR SMALL-SCALE CDM PROGRAMMES OF ACTIVITIES (F-CDM-SSC-PoA-DD) Version 02.0

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA
A.1. Title of the PoA

Title: East Africa Renewable Energy Programme (EA-REP)
Version: Version 06
Date: 28/11/2012

A.2. Purpose and general description of the PoA

Policy/measure or stated goal of the PoA

The purpose of the East Africa Renewable Energy Programme (EA-REP) is to support the development and implementation of small-scale renewable energy projects in East Africa. The programme will target countries in East Africa, including, Kenya and Rwanda. The first CPA will take place in Kenya. Renewable energy technologies implemented under the programme will include small hydro, wind, solar photovoltaic and geothermal. Biomass projects are excluded from the programme.

Despite the energy sector reforms that have taken place since the late 1990s in countries in East Africa, small-scale, renewable energy projects with an installed capacity of smaller than or equal to 15 MW 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. Standard Bank Plc 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 small-scale renewable energy projects in East Africa. This will ensure that financial viability of projects will be enhanced and access to capital facilitated.

The stated goal of the PoA is to displace grid-connected, fossil fuel based electricity generation through the promotion of renewable energy based electricity generation in East Africa, thereby reducing greenhouse gas (GHG) emissions.

All CPAs under this PoA will therefore apply the small-scale baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17) as the installed capacity will be equal or below than 15 MW. The Type I-CPAs will be classified within sectoral scope 1: “Energy industries (renewable - / non-renewable sources)”.

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

- Provide clean and reliable electricity to the national grid systems incorporated in the programme;
- The programme is expected to provide local employment opportunities during the construction and operation phase of the CPAs;
- The CPAs are expected to contribute to the fiscal revenues through payment of taxes;

- The programme will improve the hydrocarbon trade balance through reduction of oil imports used for electricity generation;
- The programme will reduce the consumer price of electricity: In Kenya for example, according to the 2008 Schedule of Tariffs for Supply of Electricity by the Kenya Power and Lighting Company Limited, all electricity tariffs are liable to a Fuel Cost Charge, which is calculated monthly and published in the Kenya Gazette.[1] The Fuel Cost Charge is transferred directly to the consumer and depends directly on the specific fuel consumption of the thermal power plants. The higher the fuel consumption (and fuel price) by the thermal power plants, the higher the Fuel Cost Charge and, therefore, the higher the electricity bill for the consumer.

Framework for the implementation of the proposed PoA

Standard Bank Plc 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 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 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;
- Collect and compile monitoring records from all the CPA entities;
- Coordinate monitoring activities and data management during the lifetime of the PoA;
- 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:
- Operate 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;
- Make available staff for validation and verification where applicable.

The CME will enter into agreements with all CPA entities. The contractual agreements will summarize roles and responsibilities regarding the implementation of the individual project activities as a Component Project Activity (CPA). 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.

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

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

[1] Energy Regulatory Commission (2006) *Schedule of Tariffs for Supply of Electricity by the Kenya Power and Lighting Company Limited Set by the Energy Regulatory Commission under Powers Conferred under Section 45 of the Energy Act, 2006.*

A.3. CMEs and participants of PoA

Standard Bank Plc will act as the coordinating/managing entity. Standard Bank Plc is the sole project participant of the PoA.

A.4. Party(ies)

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Kenya (host)	Standard Bank Plc	No
Rwanda (host)	Standard Bank Plc	No

A.5. Physical/ Geographical boundary of the PoA

The geographical area within which small-scale Component Project Activities (SSC-CPAs) included in the PoA will be defined by the national boundaries of each of the Host Countries included in the PoA, Kenya and Rwanda. Figure 1 provides a map of the Host Countries. Table 1 gives an overview of the geographical coordinates of Kenya and Rwanda.

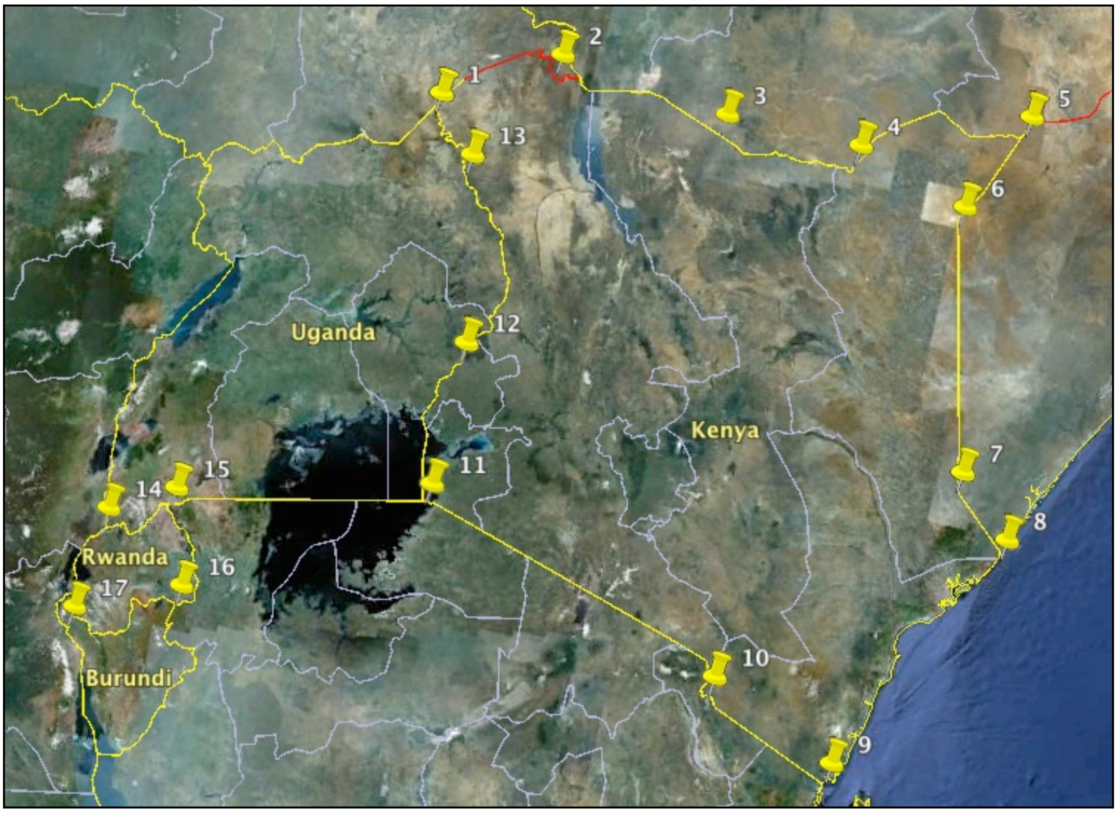

Figure 1: Kenya and Rwanda

Table 1: Geographical coordinates of Kenya and Rwanda.

	Latitude	Longitude
Kenya border point 1	4°10'28.34"N	34° 0'38.74"E
Kenya border point 2	4°41'36.79"N	35°37'38.14"E
Kenya border point 3	3°53'41.61"N	37°49'23.71"E
Kenya border point 4	3°30'28.79"N	39°36'33.51"E
Kenya border point 5	3°58'42.09"N	41°57'34.90"E
Kenya border point 6	2°42'42.36"N	41° 0'38.58"E
Kenya border point 7	0°49'31.95"S	40°58'30.66"E
Kenya border point 8	1°42'50.36"S	41°35'17.19"E
Kenya border point 9	4°41'23.11"S	39°16'40.83"E
Kenya border point 10	3°32'6.15"S	37°42'12.84"E
Kenya border point 11	1° 2'10.33"S	33°58'20.05"E
Kenya border point 12	0°49'16.24"N	34°24'19.64"E
Kenya border point 13	3°19'39.60"N	34°26'38.17"E
Rwanda border point 14	1°22'40.91"S	29°32'39.58"E
Rwanda border point 15	1° 6'15.24"S	30°30'26.00"E
Rwanda border point 16	2°24'27.98"S	30°34'34.47"E
Rwanda border point 17	2°42'48.58"S	29° 2'35.21"E

In line with EB 70, Annex 02 *Clean Development Mechanism Project Standard version 02.1,* paragraph 237, the coordinating/managing entity may request changes to the registered CDM PoA under the conditions specified by the Project Cycle Procedure. According to the *Clean Development Mechanism project cycle procedure version 03.1* (EB 70, Annex 04), paragraph 131 (a), "for CDM PoAs […] the following changes shall be allowed: Changes to programme boundary to expand geographical coverage or to include additional host Parties". Therefore, additional host Parties may be included in the future following the appropriate procedures.

A.6. Technologies/measures

SSC-CPAs under the PoA will use renewable energy technologies to generate electricity. Renewable energy technologies and measures to be employed by a SSC-CPA will include hydro, wind, solar photovoltaic (PV) and geothermal. Projects using renewable biomass are excluded from the programme. Installed capacities of individual SSC-CPAs will be below or equal to 15 MW.

Hydro-power:

A hydroelectric power plant harnesses the energy from a flow of water to generate electricity. There are two types of hydro schemes: accumulation reservoir and run-of-river hydro power. In a hydroelectric accumulation reservoir scheme, a watercourse is dammed and a reservoir forms behind the dam. The turbine is located at the base of the dam. When the turbine valve is opened, water flows across the turbine causing it to spin. This in turn drives the generator to generate electricity. In this process the gravitational potential energy of the stored water is converted into kinetic energy as the water flows down the pipe,

then into mechanical energy at the turbine, and finally into electrical energy at the generator. In a 'run-of-river' scheme, a proportion of the flow in the watercourse is diverted directly into a pipe, which runs down to the turbine. There is minimal, or no, storage of water.

Wind Power:

Wind energy originates from the sun. Solar radiation falls onto the earth and the temperature difference between the equator and the poles drives thermal currents - or winds - which circulate around the globe. The atmosphere is a big thermal machine continuously "producing" wind air mass flows between areas of low and high pressure. Up to now winds in up to about 200 m above ground level can be "harvested" by wind turbines. Wind turbines can generate electricity at wind speeds of 3 m/s to 35 m/s. Some specially designed wind turbines can work even at lower or higher wind speeds. Quite a wide range of different designs exist for special purposes. Wind turbines are designed with a vertical or horizontal axis with a one blade design or up to about 20 rotor blades, small capacity of some watt or up to some megawatt capacity, with or without gearbox and with direct current or alternating current generator. A general design does not exist, although the three bladed horizontal upwind turbines are the most successful ones. Generally, the turning rotor spins a generator, producing electricity.

Solar Power:

Solar PV
The solar photovoltaic cells, also known as the 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 excite 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 phosphor to the crystalline structure, p- or n- type semiconductors are formed respectively. By bringing them together, a p-n junction serves for creating an electric field within the semiconductor, which is able to separate electrons and holes and which creates a direct current (DC) coming out from the solar cells through the contacts. Solar modules are composed of solar cells in series and parallel in order to obtain a desired final power, current, and voltage. The amount of solar cells in crystalline modules varies typically between 36 and 72 cells. 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.

Geothermal Power:

Geothermal electricity is electricity generated from geothermal energy. Technologies in use include dry steam power plants, flash steam power plants and binary cycle power plants. Geothermal power stations are not dissimilar to other steam turbine thermal power stations - heat from a fuel source (in geothermal's case, the Earth's core) is used to heat water or another working fluid. The working fluid is then used to turn a turbine of a generator, thereby producing electricity. The fluid is then cooled and returned to the heat source.

The renewable energy generation units will either supply electricity to a national or regional grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.

The implementation of SSC-CPAs under the PoA will involve the installation of a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant). Capacity additions, retrofits and replacement of existing plants are not included in the PoA.

Project activities that include both renewable and non-renewable components (e.g. a wind/diesel unit) are not included in this PoA.

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65%. Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants. This was, for instance, very noticeable in Kenya during the 2009-2010 drought when a number of large hydro power plants had to be closed due to low water levels resulting in a power-rationing scheme which lasted for three months.

Detailed description of the baseline has been provided in section B.4 of part II of this document.

Detailed information about the exact technology and measure applied by the individual SSC-CPAs will be provided in the relevant section of the specific SSC-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 SSC-CPA *inter alia* technology transfer to the Host Party(ies) for application in the SSC-CPA.

A.7. Public funding of PoA

There is no public funding involved in this Programme of Activities.

SECTION B. Demonstration of additionality and development of eligibility criteria
B.1. Demonstration of additionality for PoA

Although progress has been made in certain areas, the low number of existing small-scale, renewable energy projects in East Africa shows that there are still many barriers hampering the development and implementation of this kind of projects. Even the introduction of Feed-in-Tariff policies for renewable energy technologies in a number of countries in East Africa has not yet created the desired effect and so far only one project has been successfully implemented, the Imenti Tea 0.3 MW small hydro project in Kenya.

One of the most cited barriers for the development and implementation renewable energy projects in Africa and East Africa is lack of access to capital.[2,3] 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 Africa has averaged only

[2] See for example: Eberhard *et al*. (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. Africa Infrastructure Country Diagnostic.
[3] Government of Uganda (2008) *Constraints to Investment in the Uganda's Electricity Generation Industry*. Study conducted by the Electricity Regulatory Commission and the Ministry of Financing, Planning and Economic Development.

about US$ 2 billion every year.[4] Therefore, the energy sector in general faces serious challenges with respect to mobilizing 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.

In addition to the access to capital barrier, tariffs in East Africa also tend to be insufficient to make small-scale renewable energy project commercially viable. For some countries in East Africa, there also exist concerns about the ability of the electricity off-taker to pay tariffs agreed with the projects[5] and sometimes tariffs are paid in the local currencies which exposes projects to considerable currency risk given that loans are mostly denominated in US Dollars or in Euros.

Another challenge facing small-scale renewable energy projects in the region is the high cost of investor due diligence and loan appraisals. This is one of the main reasons why many of the international financiers have a preference for large-scale power projects as opposed to small-scale power projects. Local banks, on the other hand, often do not have the net worth to engage in long term financing for renewable energy projects. In fact, short-term loans are often preferred with a maturity period not exceeding five years.

Taken together, the above barriers continue to hamper the implementation of small-scale renewable energy projects in the East African region. CDM has been identified as one of the ways in which some of the barriers to the development and implementation of renewable energy projects in Africa can be overcome.[6] The proposed Programme of Activities will use CDM revenues to overcome some of the barriers and, therefore, it can be concluded that this PoA would not be implemented in the absence of the CDM.

In this context, it will be demonstrated that for each CPA under the PoA that the CPA is additional following paragraph 9 of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* (version 02.1, EB 70, Annex 5) that states:

"*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*".

And paragraph 8 of the same standard that states:

"*PoAs that consist of one or more microscale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the "Guidelines for demonstrating additionality of microscale project activities".*

The additionality for the PoA will be demonstrated by establishing that each SSC-CPA is additional through the eligibility criteria on section B.2 using either the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) or *Guidelines for demonstrating additionality of microscale project activities* (version 04.0, EB 68, Annex 26).

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[4] African Union (2009) *Scaling up Renewable Energy in Africa.* 12th Ordinary Session of Heads of State and Governments of the African Union.

[5] *TANESCO not creditworthy* http://174.132.155.186/news/4-national-news/5447-shein-pledges-tough-action-on-tax-evasion.html (Accessed on 05 January 2012)

[6] African Union (2009) *Scaling up Renewable Energy in Africa.* 12th Ordinary Session of Heads of State and Governments of the African Union.

Following guidelines provided in paragraph 14 of *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* (version 02.1, EB 70, Annex 5), the PoA is applicable to paragraph 31(b) whereby a single methodology is consistently applied in each CPA of a PoA but using multiple technologies and measures. All CPA's under this PoA will apply the additionality related eligibility criteria derived from those in section B.2 below.

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

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

As per the *Clean Development Mechanism Project Standard* (version 02.1, EB 70, Annex 2) paragraph 151, the CME has developed eligibility criteria for inclusion of SSC-CPAs under the PoA. The eligibility criteria consists of two sets of criteria: (1) general eligibility criteria as provided in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* (version 02.1, EB 70, Annex 5) and (2) eligibility criteria for the demonstration of additionality.

The eligibility criteria for the demonstration of additionality for each CPA type were derived from the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) or *Guidelines for demonstrating additionality of microscale project activities* (version 04, EB 68, Annex 26).

	Topic based on EB 70 Annex 5 para 16	**Eligibility criteria**	**Means of verification**
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	CPA to provide detailed documentation regarding the exact geographical location of the project activity such as EIA report or feasibility study.
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	Signed confirmation from the entity implementing the CPA, confirming that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each CPA will have a unique name, which will at least refer to the location, technology and installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind,	Feasibility study or other project documentation proving that the CPA involves the implementation of a technology eligible for inclusion in the PoA.

		geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	Date of signing the contract with party providing equipment/construction/operation services. If this is not available, the expected date of signing the contract will be provided.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. discussions with the Utility company or draft PPA proving that the CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.* Explanation is provided in section D.2 of the specific CPA-DD.
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant project documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check in each CPA-DD carried out in line with additionality related eligibility criteria shown below.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	Environmental Impact Assessment report.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	Local stakeholder consultation report.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group and Distribution mechanisms (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	Monitoring section B.7 of the PoA-DD and D.7 of the specific CPA-DD *[Applicable for geothermal project types]*
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	Feasibility, engineering design or other relevant study reports.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities.*

		latest approved version of the *Guidelines on assessment of debundling for SSC project activities*	

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Means of verification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	Feasibility study or other relevant project documentation.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country. or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	Geographical coordinates of the project activity Public documentation from the host country delineating special underdeveloped zones (SUZs). or Documentation from the CDM Executive Board recognizing the specific renewable energy technology used by the CPA.
Rationale	
In case the SSC-CPA is a microscale project activity, i.e. project activities up to five megawatts that employ renewable energy technology, additionality will be demonstrated using the *Guidelines for demonstrating additionality of microscale project activities (version* 04, EB 68, Annex 26). SSC-CPAs under the PoA follow the methodology AMS-I.D, therefore eligible SSC-CPAs will have to follow paragraph 2 (a) or paragraph 2 (d) of the guidelines as they are grid-connected renewable energy technologies, in order to demonstrate microscale additionality.	

In case the SSC-CPA is not a microscale project activity, additionality will be demonstrated using the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) and the *Non binding best practice examples to demonstrate additionality for SSC project activities* (version 01, EB 35, Annex 34).

Option B.1 Investment Barrier	
Criteria	*Means of verification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	Investment analysis spreadsheet
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	Investment analysis spreadsheet
Rationale	
Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions. The investment barrier shall be demonstrated using benchmark analysis in accordance with the provisions of the *Tool for the demonstration and assessment of additionality* (versions 06.1.0, EB 69,	

Annex 20) and *Guidelines on the assessment of investment analysis* (version 05, EB 62, Annex 5).

Option B.2 Access-to-capital Barrier	
Criteria	*Means of verification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	Incorporation documents of the entity implementing the SSC-CPA.
Investment or debt financing is done by a company that also purchases the CERs. In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment agreement or any other relevant documentation in which it is shown that CDM was considered as requirement in order to finance the project Annual financial reports or any published documents showing the structure of the company and any subsidiaries
Rationale	
Access-to-capital barrier: the project activity could not access appropriate capital without consideration of the CDM revenues. The access-to-capital shall be demonstrated by referring to guidelines 1 and 6 of the *Guidelines for objective demonstration and assessment of barriers* (version 01.0*)*, as follows: 1. While demonstrating barriers related to the lack of access to capital, information should include nature of company, organization and its ownership and, financial information. A company that is a subsidiary of a multinational group may have different access to capital, technologies or skilled labour than a local SME company. 2. In case the project proponents make the claim for investment barriers, they should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account. For the cases where the investment is done by a company which also purchases the CERs and the loan agreement mentions that, there is an objective demonstration that the CDM facilitated the lending.	

Option C: Automatic additionality	
Criteria	*Means of verification*
The project activity uses a technology which is on the positive list of grid-connected renewable electricity generation technologies as specified in the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27)	Project feasibility study or other relevant project documentation.
Rationale	
In case the project activity involves a technology, which is on the positive list of grid-connected renewable electricity generation technologies defined in the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) the project will be automatically additional.	

B.3. Application of methodologies

This PoA will include grid-connected renewable power generation units of the following technologies types: wind, hydro (run-of-river reservoir and accumulation reservoir), geothermal and solar PV. 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 project activity (greenfield plants).

All SSC-CPAs implemented under this PoA will apply the approved small-scale baseline and monitoring methodology AMS-I.D *"Grid connected renewable electricity generation"* (version 17)

Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA, however in case of inclusion of a geothermal project activity, sampling will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. An electronic database will be established that contains general information regarding each SSC-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 SSC-CPA. The database will be accessible at any time for verification.

SECTION C. Management system

As per the *Clean Development Mechanism Project Standard* (version 02.1), paragraph 145, the CME shall establish and implement, and provide a description of the operational and management arrangements for the implementation of the proposed CDM PoA in accordance with requirements in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 02.1).

Individual CPAs will be developed and implemented by CPA entities. The CPA entities will be responsible for the operation and maintenance of the renewable energy power plant and will enter into a power purchase agreement, wheeling agreement or similar contractual arrangement with the electricity off-taker, and where relevant the end user, for the supply of electricity.

A CPA entity will also enter into a PoA Participation Agreement with the CME for participation in the proposed Programme of Activities.

The CME will establish the following operational and management arrangements for the implementation of the PoA:

a) Personnel involved in the inclusion of CPAs and their competencies

The CME's CPA Inclusion Management System (CPA-IMS) will involve the following parties:

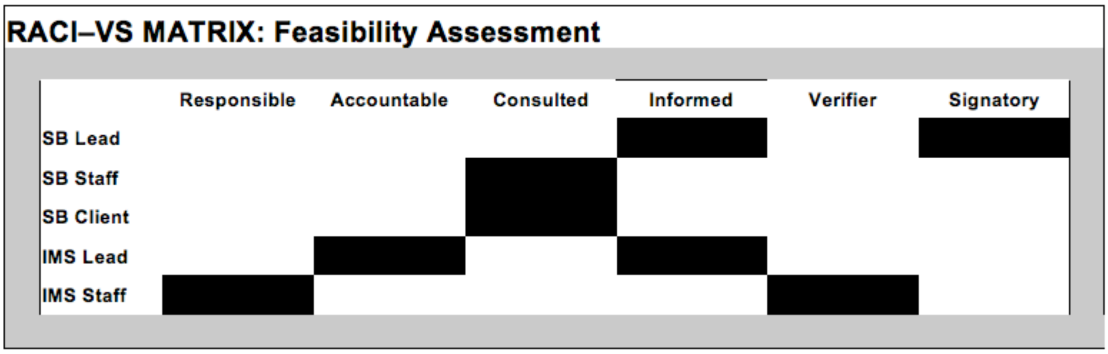
Personnel	Definition
SB Lead	The Standard Bank Lead (SB Lead) has authority to represent Standard Bank Plc in managing its responsibilities as a CME. The SB Lead is responsible for engaging the 'IMS operator' (IMS Lead and IMS Staff) and establishing the scope of its delegated tasks. Standard Bank Plc will nominate the SB Lead.
SB Staff	Standard Bank Staff (SB Staff) will be Standard Bank employees involved in related projects. Standard Bank will nominate the SB staff for each project involved in the management system.
SB Client/ CPA Implementer	The Standard Bank Client (SB Client) is Standard Bank's client who has an involvement/interest in a CPA. For example the SB client may be a company, a CDM project implementer, an NGO or a government, etc.

Personnel	Definition
IMS Lead	The IMS Lead has authority to represent the 'IMS operator' in its engagement with Standard Bank. This person has the accountability for executing the CPA-IMS processes.
IMS Staff	IMS Staff are 'employees' of the 'IMS operator', who execute CPA-IMS processes and tasks under the management of the IMS Lead.

The 'CPA-IMS Operator' is the in-house (Standard Bank) or outsourced resources that are operating the system incorporating the IMS Lead and IMS Staff. Standard Bank will ensure that these resources are suitably qualified and experienced to ensure the efficient and effective operation of the CPA-IMS.

The CPA-IMS will employ a RACI-VS (Responsible, Accountable, Consulted, Informed, Verifier, Signatory) responsibility assignment matrix as a framework for specifying key roles in discharging sub-processes. The addition of the Verifier, Signatory roles to the traditional RACI matrix recognises that while the 'CPA-IMS Operator' (in-house or outsourced resources that are operating the system) is engaged to implement the CPA-IMS, ultimate responsibility lies with the Standard Bank Plc as the CME.

Each sub-process in the CPA-IMS has a process map an associated description, which includes the respective RACI-VS Matrix. An example of the matrix is shown below.



Definitions of the roles described in the RACI-VS Matrix are presented below.

ROLE	DEFINITION
Responsible	Those who do the work to achieve the task
Accountable	The one ultimately answerable for the correct and thorough completion of the deliverable or task. The 'Accountable' person 'signs off 'on the work that the 'Responsible' people provide
Consulted	Those whose opinions are sought, and with whom there is two-way communication
Informed	Those who are kept up-to-date on progress, often only on completion of the task, and with whom there is often only one-way communication
Verifier	Those who check whether the service meets standards and required outputs
Signatory	Those who approve the decisions/project outcomes

The CPA-IMS operator will be responsible for the following tasks:

a) Development of CPA-DD in consultation with SB Staff and SB client

b) Carry out a technical review of a proposed CPA to ensure that the CPA meets all the eligibility criteria as formulated in the PoA-DD
c) Managing CPA inclusion process with contracted DOE
d) Collect and compile supporting evidence that are required for the inclusion of the CPA in the PoA, monitoring and verification
e) Verify that the CPA has not yet been developed as a single CDM project or been included in another PoA
f) Prepare the monitoring report and implement the monitoring database
g) Coordinate monitoring activities and data management during the lifetime of the PoA
h) Prepare and submit monitoring reports and facilitate the verification of the same;
i) Training the CPA implementing monitoring personnel
j) Obtaining a letter of approval of a host country in case of an inclusion of another country to the PoA
k) Obtaining letter of authorization of the coordination of the PoA of a host country in case of an inclusion of another country to the PoA
l) Liaise with the Designated National Authority (DNA) on matters related to the implementation of the PoA and inclusion of CPAs

Standard Bank staff will be responsible for:
a) Review of drafted CPA-DD
b) Contracting DOE to undertake CPA inclusion process
c) Communication with UNFCCC in regards to PoA

The Standard Bank lead will have the overall authority and responsibility for all entities involved in the CPA IMS. The Standard Bank lead will also be responsible for the training and capacity building of the parties involved in the CPA-IMS.

b) Training and capacity building for personnel involved in the inclusion of the CPAs

The CME shall further conduct training and capacity building exercises for any entity involved in the IMS based on any identified needs collected in a personnel training and development register in order to ensure that continuous improvements of the PoA management system is taking place. The training would include information on the latest EB guidelines on PoA development, CPA inclusion, monitoring, verification and issuance. An annual review of the CPA IMS staff will be undertaken and appropriate measures undertaken to ensure continuous development of their skills.

c) Procedures for technical review of inclusion of CPAs

As part of the responsibilities of the CPA-IMS operator, a technical review of a proposed CPA will be carried out prior to the petition of inclusion to the DOE. The CPA-IMS operator 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 CPA-IMS operator will also verify the authenticity of those documents by consulting with national or local authorities when necessary. Finally, the CPA-IMS operator 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 IMS operator, 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 IMS operator, its inclusion will be approved in line with the CME responsibilities as it waits for the final assessment from the DOE.

<u>**CPA DD Internal Review Checklist**</u>

POA TITLE:	*Insert PoA title here*

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 C of the CPA DD – has an environmental analysis been undertaken?			
If required under Section D 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 sited by the reviewer?			

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

Internal Reviewer:	
Date:	
Signature:	

d) Procedure to avoid double accounting

The following procedure will be established to avoid double counting and avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA:

1. Entities implementing a CPA will sign a confirmation, confirming that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity
2. Before inclusion of a CPA, the CME will check the UNFCCC CDM project database[7] for registered projects applying the same technology and methodology, and implemented in the same location. In case similar projects are found in the same location, the available project documentation will be further scrutinized to confirm that the registered project is different from the proposed CPA.

e) 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:

1. 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
2. Supporting evidence for each eligibility criterion to demonstrate that the CPA meets all the eligibility criteria for inclusion into the PoA.
3. 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.

The CPA-IMS Lead operator appointed by 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. Other CPA-IMS Lead staff will only have read access to the data and records. Standard Bank (and the ‘SB Lead’ as its representative), as the ultimate ‘owner’ of the system, has full ownership and access to all data and systems.

[7] http://cdm.unfccc.int/Projects/projsearch.html

The CPA-IMS 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.

f) 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 'CPA-IMS operator' 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. A Management System Improvement Plan will be developed every 6 months which will detail the actions to improve the management system based on analysis of the measurement and monitoring activities.
Additionally, training and capacity building for personnel involved in the inclusion of the CPAs will be carried out as outlined as above.

g) 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 07.0, EB 70, Annex 7), the start date of the PoA is the 21/01/2012, which is the date on which the PoA started global stakeholder consultation and therefore marks the start of the validation of the PoA. This marks the date in which the implementation or real action of the PoA began. The start date of any future SSC-CPA is not, or will not be, prior to the commencement of the PoA.

D.2. Length of the PoA

28 years

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

Environmental Analysis, including an Environmental Impact Assessment if required by the Host Country for that specific type of project activity, will be done at the CPA level because each individual renewable energy project (CPA) is expected to have different local impacts and environmental regulations will be different depending on the location and type of project to be implemented.

E.2. Analysis of the environmental impacts

Not applicable. Environmental analysis is carried out at the CPA level.

SECTION F. Local stakeholder comments
F.1. Solicitation of comments from local stakeholders

The stakeholder consultations will be conducted at CPA level, because of the different circumstances and conditions of every social environment in which each SSC-CPA is located.

F.2. Summary of comments received

Not applicable. Stakeholder consultation is done at the CPA level.

F.3. Report on consideration of comments received

Not applicable. Stakeholder consultation is done at the CPA level.

SECTION G. Approval and authorization

At the time of submission of this PoA-DD to the DOE, the letter of approval from the relevant DNAs was not available. The approval and authorization letters have been obtained from the Rwandan and Kenyan DNA's on the 09/07/2012 and 07/11/2012 respectively.

PART II. Generic component project activity (CPA)

CPA TYPE 1: Wind energy project in Kenya

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected wind energy project.

The generic SSC-CPA comprises the implementation and operation of a wind power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Kenyan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[8]:

Applicability criteria	Project activity
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind,	The generic SSC-CPA under the Programme will use wind energy that will

[8] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	supply electricity to the Kenyan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from wind energy and its supply to the Kenyan grid system.
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 Kenya. This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02), as it is a wind energy project
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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 Kenyan national grid system constitute the project boundary.

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

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for wind energy projects
		CH_4	No	Not applicable for wind energy projects
		N_2O	No	Not applicable for wind energy projects

	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for wind energy projects
		CH_4	No	Not applicable for wind energy projects
		N_2O	No	Not applicable for wind energy projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for wind energy projects
		CH_4	No	Not applicable for wind energy projects
		N_2O	No	Not applicable for wind energy projects

The figure below provides a flow chart 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 generic wind CPA..

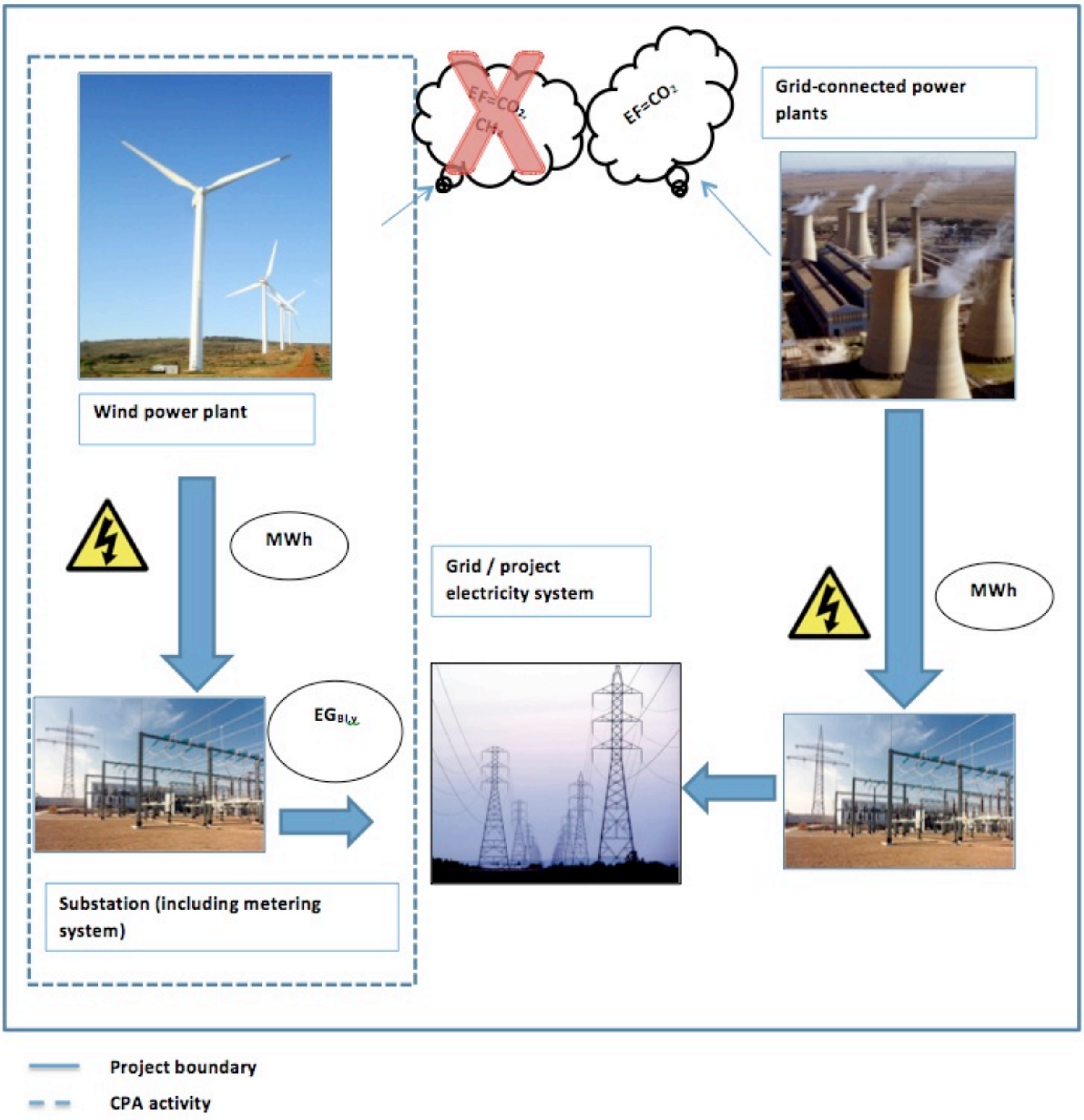


Figure 2: Wind CPA

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National grids in countries in East Africa such as Kenya typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[9] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in various countries in Kenya:

Table 2: Installed Capacity in MW

	Kenya[10]
Fossil fuel based	407.5
Large hydro	743.3
Small hydro[11]	14.7
Geothermal	198
Wind	5.1
Biomass/gas	26
Solar & other RE	0
Total	1394.6
% Renewable	71%
% Fossil Fuel Based	29%

Figure 3 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

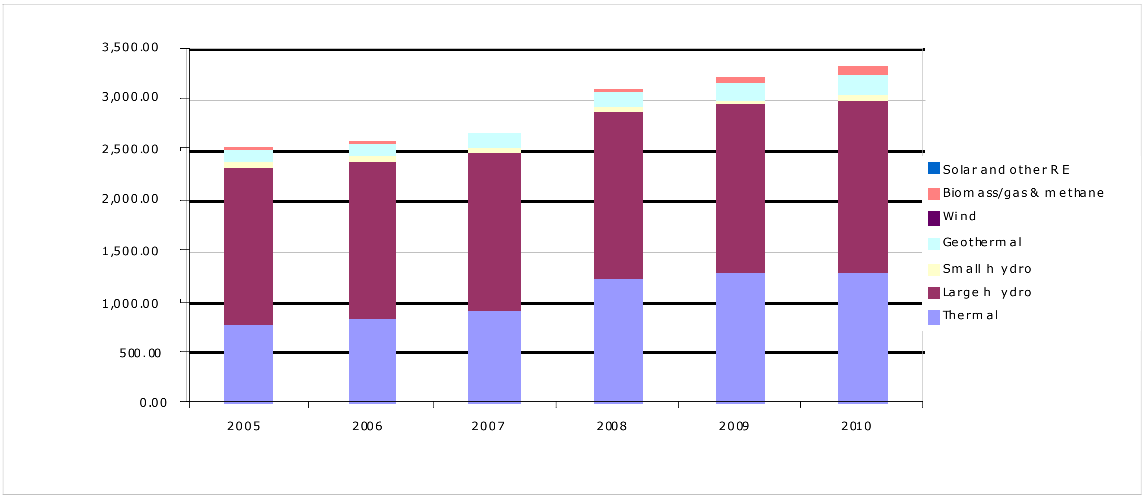


Figure 3: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[9] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.
[10] Kenya Power and Lighting Company (KPLC) Annual Report and Financial Statements for the Year Ended 30 June 2010
[11] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 4: Grid Connected Installed Capacity (MW), 2005-2010 (Kenya) shown below represents the installed capacity of grid-connected power plants in Kenya over the period 2005 to 2010.

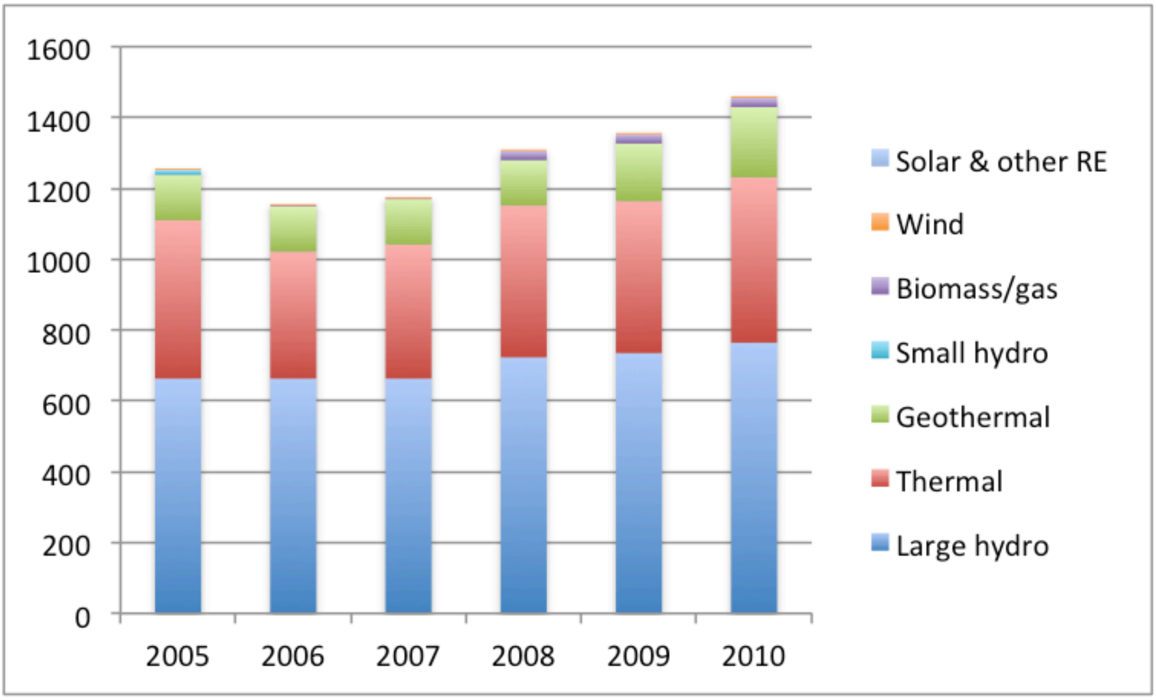


Figure 4: Grid Connected Installed Capacity (MW), 2005-2010 (Kenya)

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 5). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants. This was, for instance, very noticeable in Kenya during the 2009-2010 drought when a number of large hydro power plants had to be closed due to low water levels resulting in a power rationing scheme which lasted for three months. Figure 6 illustrates how during the 2009-2010 drought, electricity generation from hydro power plants in Kenya substantially dropped and was compensated for through an increase of fossil fuel based electricity generation.

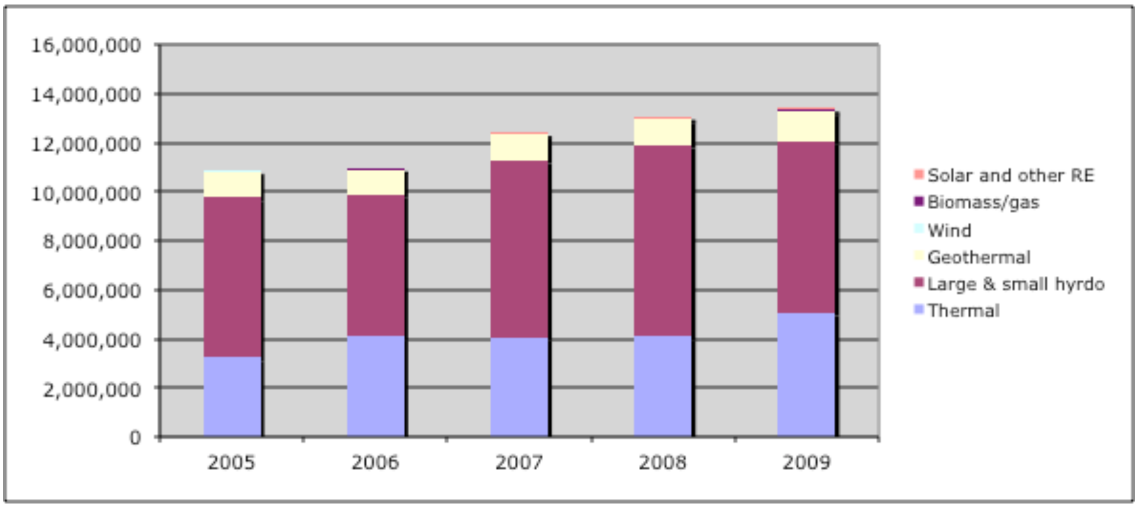


Figure 5: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

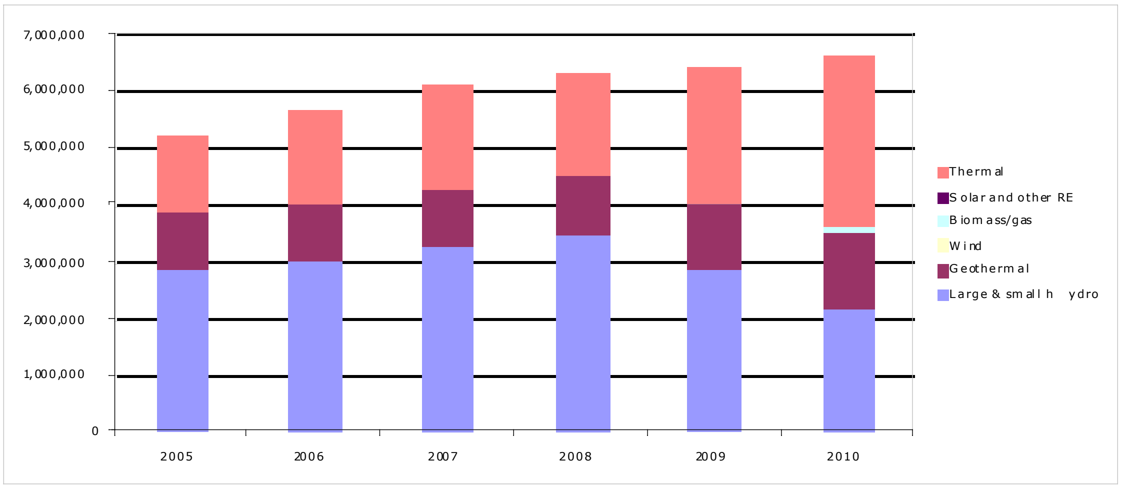


Figure 6: Electricity Generation from Grid-Connected Power Plants by Type in Kenya (MWh), 2005 - 2010

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. The electrification rates in Kenya and Ethiopia are the highest (around 15%) whereby for Kenya the rates are 51% in urban areas and 5% in rural areas. The national average is given as 15%.
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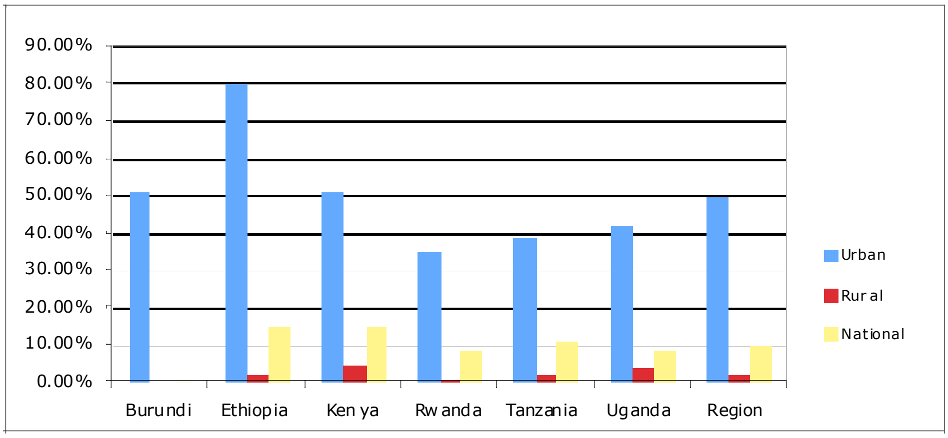

Figure 7: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Kenya has also introduced Feed-in-Tariff policies for renewable energy.

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that is, unbundling, privatization, and wholesale and retail competition.[12] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[13]

More information regarding the baseline situation in Kenya is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	**PoA eligibility criteria**	**Justification**
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Kenyan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a wind energy project, a technology eligible for inclusion in the PoA

[12] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[13] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

		excluded from this Programme of Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties <u>or</u> confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for wind energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in [district] that is a special underdeveloped zone in Kenya. or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for wind energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from wind energy. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Kenyan electricity system that is covered by the PoA and will be updated every seven years of the PoA. Wind energy CPAs in Kenya that are included in the PoA will be using the grid emission factor for the Kenyan electricity grid. Equations and fixed parameter values to calculate the grid emission factor for Kenya are provided in Appendix 4.

Project emissions

For most renewable energy project activities such as wind energy projects $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro

power plants with water reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves wind 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 wind 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 wind power plants, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

This CPA, which involves a wind power project, has no project emissions, $PE_y = 0$.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)

PE_y = Project emissions in year *y* (t CO2/y)

LE_y = Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (KENYA)

<table>
<tr><td>Data / Parameter</td><td>CAP_m</td></tr>
<tr><td>Unit</td><td>MW</td></tr>
<tr><td>Description</td><td>Total capacity of off-grid power plants included in off-grid power plant class m</td></tr>
<tr><td>Source of data</td><td>Survey on off grid power plants, as per Annex 2 of the Tool to calculate the emission factor for an electricity system</td></tr>
<tr><td>Value(s) applied</td><td><table>
<tr><td>Off-grid power plant class m</td><td>Total capacity (MW)</td></tr>
<tr><td>Households</td><td>141.39</td></tr>
<tr><td>ICG CAP<=10</td><td>56.62</td></tr>
<tr><td>ICG 10<CAP<=50</td><td>214.88</td></tr>
<tr><td>ICG 50<CAP<=100</td><td>19.01</td></tr>
<tr><td>ICG 100<CAP<=200</td><td>80.68</td></tr>
<tr><td>ICG 200<CAP<=400</td><td>33.56</td></tr>
<tr><td>ICG 400<CAP<=1,000</td><td>12.08</td></tr>
</table></td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>A survey was carried out among 1,174 off-grid power plants. The results of the survey were used to derive global estimates for the total population, for each class of off-grid power plants m, adjusting conservatively for the uncertainty at a 95% confidence level.

In the absence of data information regarding the global population of each stratum, a number of simplifications have been introduced to simplify the global estimates.
In the analysis, it is assumed that all off-grid power plants use a reciprocating engine system. This is considered conservative because reciprocating engine systems have the highest conversion efficiency (see table in Annex 1 of the Tool to calculate the emission factor for an electricity system)
In the analysis, it is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because diesel has a higher CO_2 emission factor (0.0726 tCO_2/GJ) than gasoline/ petrol (0.0675 tCO_2/GJ).
It is assumed that off-grid power plants owned by households fall in the following two capacity classes: <10kW and 10<CAP<=50kW. Therefore, the conversion efficiency for all household off-grid plants is assumed to be 33%.
Off-grid power plant classes for industrial, commercial and government off-grid plants have been reclassified to correspond with the consumer classes from KPLC.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	z
Unit	dimensionless
Description	Standard normal for a 95% confidence level
Source of data	H. Russell Bernard (1995) *Research Methods in Anthropology. Qualitative and Quantitative Approaches.* Altamira Press, London.
Value(s) applied	1.96
Choice of data or Measurement methods and procedures	This is the standard value for standard normal for a confidence level of 95% for a two-tailed test
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$PLF_{default,off\text{-}grid,y}$
Unit	dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year
Choice of data or Measurement methods and procedures	As per the provisions in step 4 of the *Tool to calculate the emission factor for an electricity system.* Option 3 is chosen to determine $EG_{m,y}$ for off-grid power plants in Step 4 of the *Tool to calculate the emission factor for an electricity system*.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$EG_{m,y}$**
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y* where *m* are non low-cost/must run power units
Source of data	Kenya Power and Lighting Company
Value(s) applied	see table below
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the national utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Generation July08-June09***	***Generation July09-June10***	***Generation July10-June11***
Fiat	9,101	-	-
Kipevu 1 Diesel	376,410	316,364	222,690
Kipevu 3 (GTI)	98,351	76,551	456
Kipevu 3 (GT2)	85,855	68,758	439
IberAfrica	343,664	298,726	352,038
Add.IberAfrica	-	322,458	369,606
Tsavo	565,775	494,925	368,489
Rabai Power	-	317,819	394,223
Aggreko Embakasi 1	740,476	409,602	-
Aggreko (Emb 2)	39,892	153,749	-
Aggreko (Emb 3)	-	130,084	-
Aggreko (Emb 4)	-	98,786	186,116
Aggreko (Emb 5)	-	13,190	80,425
Aggreko (Eldoret)	133,813	130,951	-
Aggreko Naivasha	-	159,935	-
Kipevu Diesel 3 (KPD3)	-	-	267,911

Data / Parameter	$EG_{k,y}$
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* where *k* are low-cost/must run power units.
Source of data	Kenya Power and Lighting Company
Value(s) applied	see table below
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Generation July08-June09*	*Generation July09-June10*	*Generation July10-June11*
Gitaru	655,401	457,237	801,654
Kamburu	347,898	244,139	407,527
Kiambere	614,358	546,152	898,770
Kindaruma	156,963	111,202	191,308
Masinga	128,074	60,977	201,075
Tana	43,613	28,674	49,701
Wanji	28,439	27,331	40,389
Sagana	5,810	8,348	8,020
Ndula	2,036	3,439	433
Mesco	2,560	223	-
Sosiani	1,581	1,411	1,538
Turkwel	523,541	335,068	455,102
Gogo	5,631	5,171	6,737
Sondu Miriu	333,149	340,460	364,305
Ngong (Wind)	287	15	-
Ngong 2	-	16,288	17,696
Olkaria 1	368,438	366,191	235,075
Olkaria 2	534,808	572,937	846,245
Orpower4	275,797	399,906	372,498
Mumias	4,230	98,704	87,407
Imenti Tea Factory (Feed in)	-	-	232

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	Energy Regulatory Commission *Schedule of Tariffs* (2008) Electricity generation data obtained from Kenya Power and Lighting Company.
Value(s) applied	

Power Plant	*Fuel Type*	*$FC_{i,m,y}$ (kg) 2008-2009*	*$FC_{i,m,y}$ (kg) 2009-2010*	*$FC_{i,m,y}$ (kg) 2010-2011*
Kipevu Diesel	HFO	81,680,970	68,650,988	48,324,598
Kipevu GT1	Kerosene	30,488,810	23,730,903	141,360
Kipevu GT2	Kerosene	26,615,050	21,314,980	136,090
Tsavo Diesel	HFO	123,904,769	108,388,509	80,699,025
Iberafrica	HFO	77,324,343	67,213,439	79,208,482
Iberafrica 2 (Additional 52.5 MW)	HFO	0	72,230,496	82,791,666
Aggreko Embakasi 1	AGO	170,309,459	94,208,483	0
Aggreko Embakasi 2	AGO	9,175,273	35,362,341	0
Aggreko Embakasi 3	AGO	0	29,268,824	0
Aggreko Embakasi 4	AGO	0	22,226,895	41,876,105
Aggreko Embakasi 5	AGO	0	2,967,716	18,095,607
Aggreko Naivasha	AGO	0	35,985,445	0
Aggreko Eldoret	AGO	31,312,169	30,642,490	0
Rabai	AGO	0	62,642,125	77,701,353
KPD3	HFO	0	0	56,127,396
Fiat	AGO	3,777,003	0	0

Choice of data or Measurement methods and procedures	The Energy Regulatory Commission *Schedule of Tariffs, 2008* provides approved specific fuel consumption data for thermal power plants. These data are provided in kg/kWh and are used by KPLC to calculate the fuel charges on the electricity bills of the consumers. The data can be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant. For simple adjusted OM, fuel consumption is calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option). For BM, fuel consumption is calculated once *ex ante* for the first crediting period, as explained in step 5 of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$NCV_{i,y}$
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	(see table below)
Choice of data or Measurement methods and procedures	No data on NCV is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Fuel Type*	*$NCV_{i,y}$ (GJ/kg)*
Kipevu Diesel	HFO	0.0398
Kipevu GT1	Kerosene	0.0420
Kipevu GT2	Kerosene	0.0420
Tsavo Diesel	HFO	0.0398
Iberafrica 1	HFO	0.0398
Iberafrica 2 (additional 52.5 MW)	HFO	0.0398
Aggreko Embakasi 1	AGO	0.0414
Aggreko Embakasi 2	AGO	0.0414
Aggreko Embakasi 3	AGO	0.0414
Aggreko Embakasi 4	AGO	0.0414
Aggreko Embakasi 5	AGO	0.0414
Aggreko Naivasha	AGO	0.0414
Aggreko Eldoret	AGO	0.0414
Rabai	AGO	0.0414
KPD3	HFO	0.0398
Fiat	AGO	0.0414

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* 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	(see table below)
Choice of data or Measurement methods and procedures	No data is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Fuel Type***	$EF_{CO2,i,y}$ ***(tCO_2/GJ)***
Kipevu Diesel	HFO	0.0755
Kipevu GT1	Kerosene	0.0697
Kipevu GT2	Kerosene	0.0697
Tsavo Diesel	HFO	0.0755
Iberafrica 1	HFO	0.0755
Iberafrica 2 (additional 52.5 MW)	HFO	0.0755
Aggreko Embakasi 1	AGO	0.0726
Aggreko Embakasi 2	AGO	0.0726
Aggreko Embakasi 3	AGO	0.0726
Aggreko Embakasi 4	AGO	0.0726
Aggreko Embakasi 5	AGO	0.0726
Aggreko Naivasha	AGO	0.0726
Aggreko Eldoret	AGO	0.0726
Rabai	AGO	0.0726
KPD3	HFO	0.0755
Fiat	AGO	0.0726

Data / Parameter	$EF_{CO2,m,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in off-grid power unit *m* 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	0.0675
Choice of data or Measurement methods and procedures	It is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because gasoline/petrol has a lower CO_2 emission factor than diesel. No data is available from power generation plants. Therefore, the IPCC value has been used.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net energy conversion efficiency of off-grid power unit *m.*
Source of data	The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	see table below
Choice of data or Measurement methods and procedures	Energy conversion efficiencies are based on the values in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system.* It is assumed that all off-grid power plants use reciprocating engine systems. This is considered conservative because the reciprocating engine systems have the highest net energy conversion efficiencies.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Off-grid power class *m*	Efficiency ($\eta_{m,y}$)
Households	33%
IC[14] CAP<=10	28%
IC 10<CAP<=50	33%
IC 50<CAP<=100	35%
IC 100<CAP<=200	37%
IC 200<CAP<=400	39%
IC 400<CAP<=1,000	42%

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

[14] Industrial and commercial

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$
The combined margin emission factor for the grid is calculated using the following equations:

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for wind SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	0.49000	tCO2/MWh	GEF calculations
W_{BM}	0.25		
$EF_{grid,OM,,y}$	0.65530	tCO2/MWh	GEF calculations
W_{OM}	0.75		
$EF_{grid,CM,y}$	0.61398	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = 0.61398 tCO2/MWh

BE_y = [Insert] * 0.61398 = [Insert] tCO2/year

Project emissions

For CPAs involving wind power, project emissions (PE_y) are considered 0.

$PE_y = 0$

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

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

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

CPA implementing entity

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

Metering will be conducted with calibrated measurement equipment according to the national standards

and reference points or IEC standards as agreed with the grid operator.

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

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 2: Solar photovoltaic energy project in Kenya

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected solar photovoltaic (PV) energy project.

The generic SSC-CPA comprises the implementation and operation of a solar PV power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Kenyan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation*" (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

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

Applicability criteria	**Project activity**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind,	The generic SSC-CPA under the Programme will use solar PV that will

[15] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	supply electricity to the Kenyan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from solar PV energy and its supply to the Kenyan grid system.
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 Kenya This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) as it is a solar PV energy project
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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 Kenyan national grid system constitute the project boundary.

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

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for solar PV projects
		CH_4	No	Not applicable for solar PV projects
		N_2O	No	Not applicable for solar PV projects

	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for solar PV projects
		CH_4	No	Not applicable for solar PV projects
		N_2O	No	Not applicable for solar PV projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for solar PV projects
		CH_4	No	Not applicable for solar PV projects
		N_2O	No	Not applicable for solar PV projects

The figure below provides a flow chart 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 generic solar PV CPA.

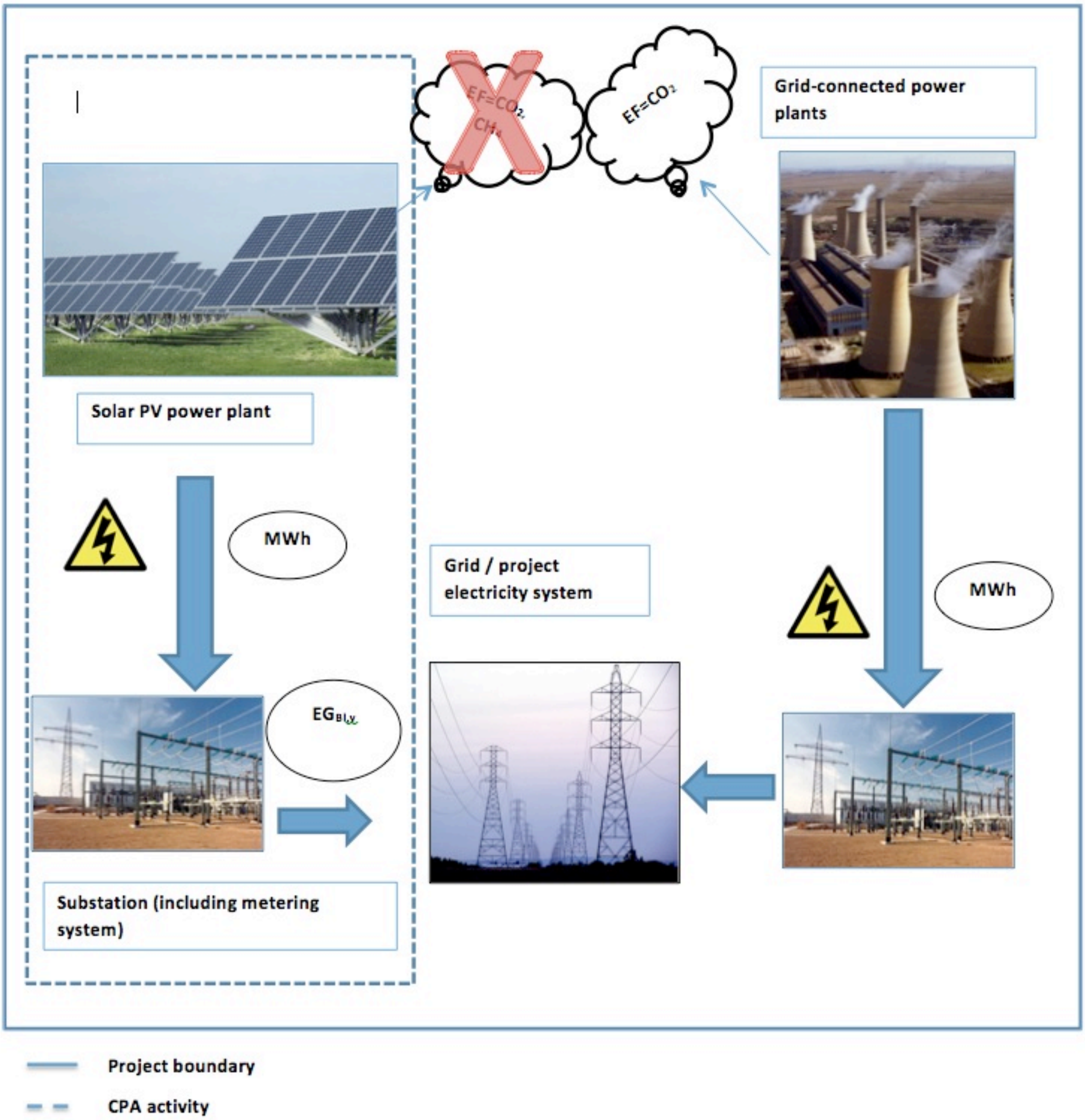

Figure 8: Solar PV CPA

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National grids in countries in East Africa such as Kenya typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[16] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in various countries in Kenya:

Table 3: Installed Capacity in MW

	Kenya[17]
Fossil fuel based	407.5
Large hydro	743.3
Small hydro[18]	14.7
Geothermal	198
Wind	5.1
Biomass/gas	26
Solar & other RE	0
Total	1394.6
% Renewable	71%
% Fossil Fuel Based	29%

Figure 3 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

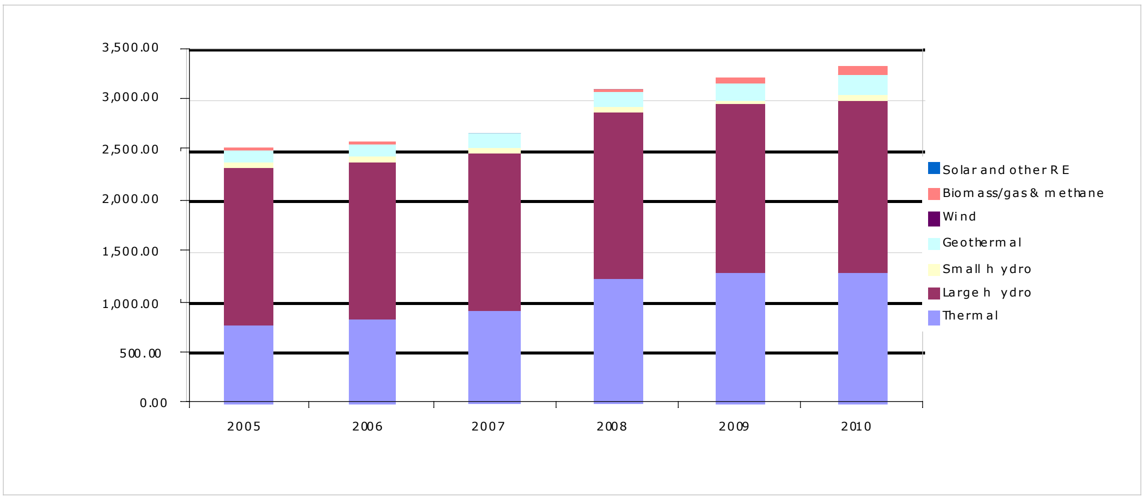

Figure 9: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[16] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.

[17] Kenya Power and Lighting Company (KPLC) Annual Report and Financial Statements for the Year Ended 30 June 2010

[18] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 10 shown below represents the installed capacity of grid-connected power plants in Kenya over the period 2005 to 2010.

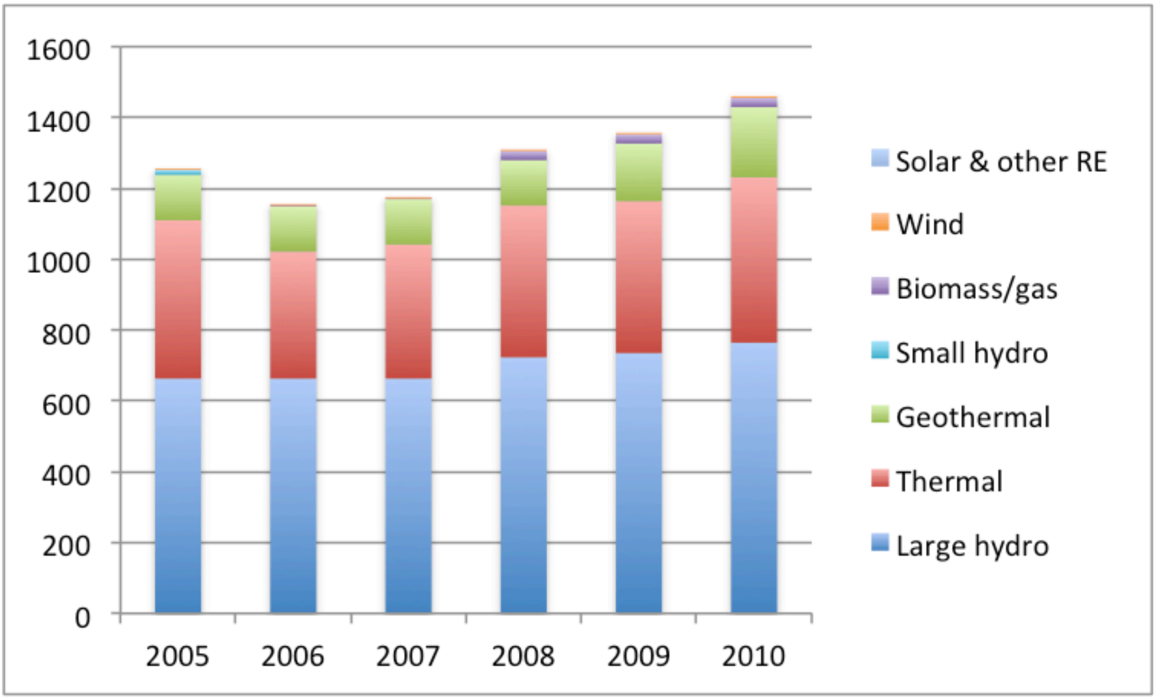

Figure 10: Grid Connected Installed Capacity (MW), 2005-2010 (Kenya)

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 5). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants. This was, for instance, very noticeable in Kenya during the 2009-2010 drought when a number of large hydro power plants had to be closed due to low water levels resulting in a power rationing scheme which lasted for three months. Figure 6 illustrates how during the 2009-2010 drought, electricity generation from hydro power plants in Kenya substantially dropped and was compensated for through an increase of fossil fuel based electricity generation.

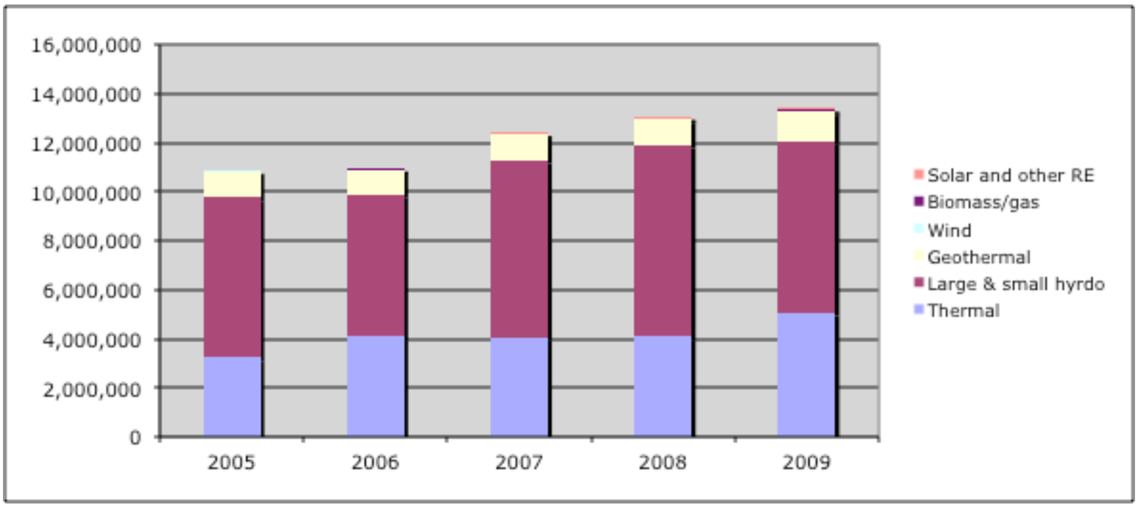

Figure 11: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

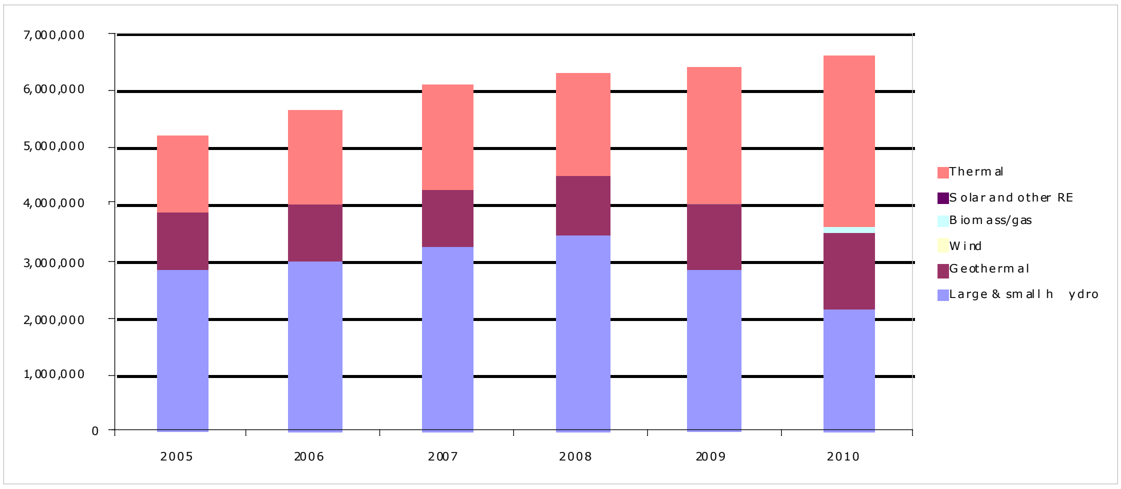

Figure 12: Electricity Generation from Grid-Connected Power Plants by Type in Kenya (MWh), 2005 - 2010

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. The electrification rates in Kenya and Ethiopia are the highest (around 15%) whereby for Kenya the rates are 51% in urban areas and 5% in rural areas. The national average is given as 15%.
.

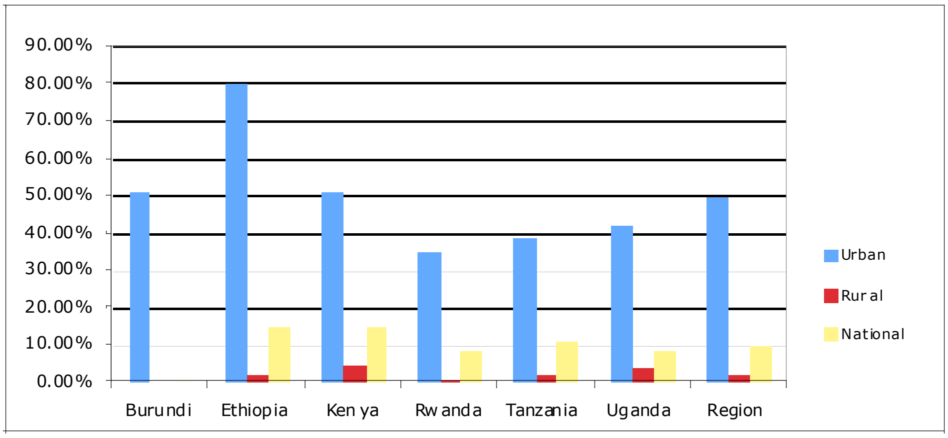

Figure 13: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Kenya has also introduced Feed-in-Tariff policies for renewable energy.

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that is, unbundling, privatization, and wholesale and retail competition.[19] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[20]

More information regarding the baseline situation in Kenya is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Kenyan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a solar PV energy project, a technology eligible for inclusion in the PoA

[19] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[20] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

		excluded from this Programme of Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties <u>or</u> confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for solar PV energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A, B.1, and B.2 are not necessary for solar PV CPAs as those are automatically additional through Option C.

Option C: Automatic additionality	
Criteria	*Justification*
The project activity uses a technology which is on the positive list of grid-connected renewable electricity generation technologies as specified in the latest version of the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27)	The project activity uses solar PV which is a technology on the positive list of grid-connected renewable electricity generation technologies.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from solar photovoltaic. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,grid,y}$ = CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Kenyan electricity system that is covered by the PoA and will be updated every seven years of the PoA. Solar PV CPAs in Kenya that are included in the PoA will be using the grid emission factor for the Kenyan electricity grid. Equations and fixed parameter values to calculate the grid emission factor for Kenya are provided in Appendix 4.

Project emissions

For most renewable energy project activities such as solar PV energy projects $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y = Project emissions in year *y* (tCO2e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO2/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

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 form hydro power plants.

This CPA, which involves a solar PV power project, has no project emissions, $PE_y = 0$.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (KENYA)

<table>
<tr><td>Data / Parameter</td><td>CAP_m</td></tr>
<tr><td>Unit</td><td>MW</td></tr>
<tr><td>Description</td><td>Total capacity of off-grid power plants included in off-grid power plant class m</td></tr>
<tr><td>Source of data</td><td>Survey on off grid power plants, as per Annex 2 of the Tool to calculate the emission factor for an electricity system</td></tr>
<tr><td>Value(s) applied</td><td><table>
<tr><td>Off-grid power plant class m</td><td>Total capacity (MW)</td></tr>
<tr><td>Households</td><td>141.39</td></tr>
<tr><td>ICG CAP<=10</td><td>56.62</td></tr>
<tr><td>ICG 10<CAP<=50</td><td>214.88</td></tr>
<tr><td>ICG 50<CAP<=100</td><td>19.01</td></tr>
<tr><td>ICG 100<CAP<=200</td><td>80.68</td></tr>
<tr><td>ICG 200<CAP<=400</td><td>33.56</td></tr>
<tr><td>ICG 400<CAP<=1,000</td><td>12.08</td></tr>
</table></td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>A survey was carried out among 1,174 off-grid power plants. The results of the survey were used to derive global estimates for the total population, for each class of off-grid power plants m, adjusting conservatively for the uncertainty at a 95% confidence level.

In the absence of data information regarding the global population of each stratum, a number of simplifications have been introduced to simplify the global estimates.

• In the analysis, it is assumed that all off-grid power plants use a reciprocating engine system. This is considered conservative because reciprocating engine systems have the highest conversion efficiency (see table in Annex 1 of the Tool to calculate the emission factor for an electricity system)
• In the analysis, it is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because diesel has a higher CO_2 emission factor (0.0726 tCO_2/GJ) than gasoline/ petrol (0.0675 tCO_2/GJ).
• It is assumed that off-grid power plants owned by households fall in the following two capacity classes: <10kW and 10<CAP<=50kW. Therefore, the conversion efficiency for all household off-grid plants is assumed to be 33%.
• Off-grid power plant classes for industrial, commercial and government off-grid plants have been reclassified to correspond with the consumer classes from KPLC.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	**z**
Unit	dimensionless
Description	Standard normal for a 95% confidence level
Source of data	H. Russell Bernard (1995) *Research Methods in Anthropology. Qualitative and Quantitative Approaches.* Altamira Press, London.
Value(s) applied	1.96
Choice of data or Measurement methods and procedures	This is the standard value for standard normal for a confidence level of 95% for a two-tailed test
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$PLF_{default,off\text{-}grid,y}$
Unit	dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year
Choice of data or Measurement methods and procedures	As per the provisions in step 4 of the *Tool to calculate the emission factor for an electricity system.* Option 3 is chosen to determine $EG_{m,y}$ for off-grid power plants in Step 4 of the *Tool to calculate the emission factor for an electricity system*.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$EG_{m,y}$**
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y* where *m* are non low-cost/must run power units
Source of data	Kenya Power and Lighting Company
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the national utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Generation July08-June09*	*Generation July09-June10*	*Generation July10-June11*
Fiat	9,101	-	-
Kipevu 1 Diesel	376,410	316,364	222,690
Kipevu 3 (GTI)	98,351	76,551	456
Kipevu 3 (GT2)	85,855	68,758	439
IberAfrica	343,664	298,726	352,038
Add.IberAfrica	-	322,458	369,606
Tsavo	565,775	494,925	368,489
Rabai Power	-	317,819	394,223
Aggreko Embakasi 1	740,476	409,602	-
Aggreko (Emb 2)	39,892	153,749	-
Aggreko (Emb 3)	-	130,084	-
Aggreko (Emb 4)	-	98,786	186,116
Aggreko (Emb 5)	-	13,190	80,425
Aggreko (Eldoret)	133,813	130,951	-
Aggreko Naivasha	-	159,935	-
Kipevu Diesel 3 (KPD3)	-	-	267,911

Data / Parameter	**$EG_{k,y}$**
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* where *k* are low-cost/must run power units.
Source of data	Kenya Power and Lighting Company
Value(s) applied	See table below
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Generation July08-June09***	***Generation July09-June10***	***Generation July10-June11***
Gitaru	655,401	457,237	801,654
Kamburu	347,898	244,139	407,527
Kiambere	614,358	546,152	898,770
Kindaruma	156,963	111,202	191,308
Masinga	128,074	60,977	201,075
Tana	43,613	28,674	49,701
Wanji	28,439	27,331	40,389
Sagana	5,810	8,348	8,020
Ndula	2,036	3,439	433
Mesco	2,560	223	-
Sosiani	1,581	1,411	1,538
Turkwel	523,541	335,068	455,102
Gogo	5,631	5,171	6,737
Sondu Miriu	333,149	340,460	364,305
Ngong (Wind)	287	15	-
Ngong 2	-	16,288	17,696
Olkaria 1	368,438	366,191	235,075
Olkaria 2	534,808	572,937	846,245
Orpower4	275,797	399,906	372,498
Mumias	4,230	98,704	87,407
Imenti Tea Factory (Feed in)	-	-	232

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	Energy Regulatory Commission *Schedule of Tariffs* (2008) Electricity generation data obtained from Kenya Power and Lighting Company.
Value(s) applied	

Power Plant	*Fuel Type*	*$FC_{i,m,y}$ (kg) 2008-2009*	*$FC_{i,m,y}$ (kg) 2009-2010*	*$FC_{i,m,y}$ (kg) 2010-2011*
Kipevu Diesel	HFO	81,680,970	68,650,988	48,324,598
Kipevu GT1	Kerosene	30,488,810	23,730,903	141,360
Kipevu GT2	Kerosene	26,615,050	21,314,980	136,090
Tsavo Diesel	HFO	123,904,769	108,388,509	80,699,025
Iberafrica	HFO	77,324,343	67,213,439	79,208,482
Iberafrica 2 (Additional 52.5 MW)	HFO	0	72,230,496	82,791,666
Aggreko Embakasi 1	AGO	170,309,459	94,208,483	0
Aggreko Embakasi 2	AGO	9,175,273	35,362,341	0
Aggreko Embakasi 3	AGO	0	29,268,824	0
Aggreko Embakasi 4	AGO	0	22,226,895	41,876,105
Aggreko Embakasi 5	AGO	0	2,967,716	18,095,607
Aggreko Naivasha	AGO	0	35,985,445	0
Aggreko Eldoret	AGO	31,312,169	30,642,490	0
Rabai	AGO	0	62,642,125	77,701,353
KPD3	HFO	0	0	56,127,396
Fiat	AGO	3,777,003	0	0

Choice of data or Measurement methods and procedures	The Energy Regulatory Commission *Schedule of Tariffs, 2008* provides approved specific fuel consumption data for thermal power plants. These data are provided in kg/kWh and are used by KPLC to calculate the fuel charges on the electricity bills of the consumers. The data can be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant. For simple adjusted OM, fuel consumption is calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option). For BM, fuel consumption is calculated once *ex ante* for the first crediting period, as explained in step 5 of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ/kg</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) of fossil fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>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</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Power Plant</th><th>Fuel Type</th><th>$NCV_{i,y}$ (GJ/kg)</th></tr>
<tr><td>Kipevu Diesel</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Kipevu GT1</td><td>Kerosene</td><td>0.0420</td></tr>
<tr><td>Kipevu GT2</td><td>Kerosene</td><td>0.0420</td></tr>
<tr><td>Tsavo Diesel</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Iberafrica 1</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Iberafrica 2 (additional 52.5 MW)</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Aggreko Embakasi 1</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 2</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 3</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 4</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 5</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Naivasha</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Eldoret</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Rabai</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>KPD3</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Fiat</td><td>AGO</td><td>0.0414</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>No data on NCV is available from power generation plants.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* 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	(see table below)
Choice of data or Measurement methods and procedures	No data is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Fuel Type***	$EF_{CO2,i,y}$ ***(tCO_2/GJ)***
Kipevu Diesel	HFO	0.0755
Kipevu GT1	Kerosene	0.0697
Kipevu GT2	Kerosene	0.0697
Tsavo Diesel	HFO	0.0755
Iberafrica 1	HFO	0.0755
Iberafrica 2 (additional 52.5 MW)	HFO	0.0755
Aggreko Embakasi 1	AGO	0.0726
Aggreko Embakasi 2	AGO	0.0726
Aggreko Embakasi 3	AGO	0.0726
Aggreko Embakasi 4	AGO	0.0726
Aggreko Embakasi 5	AGO	0.0726
Aggreko Naivasha	AGO	0.0726
Aggreko Eldoret	AGO	0.0726
Rabai	AGO	0.0726
KPD3	HFO	0.0755
Fiat	AGO	0.0726

Data / Parameter	$EF_{CO2,m,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in off-grid power unit *m* 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	0.0675
Choice of data or Measurement methods and procedures	It is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because gasoline/petrol has a lower CO_2 emission factor than diesel. No data is available from power generation plants. Therefore, the IPCC value has been used.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

<table>
<tr><td>Data / Parameter</td><td>$\eta_{m,y}$</td></tr>
<tr><td>Unit</td><td>-</td></tr>
<tr><td>Description</td><td>Average net energy conversion efficiency of off-grid power unit m.</td></tr>
<tr><td>Source of data</td><td>The default values provided in the table in Annex 1 of the Tool to calculate the emission factor for an electricity system</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><td>Off-grid power class m</td><td>Efficiency ($\eta_{m,y}$)</td></tr>
<tr><td>Households</td><td>33%</td></tr>
<tr><td>IC[21] CAP<=10</td><td>28%</td></tr>
<tr><td>IC 10<CAP<=50</td><td>33%</td></tr>
<tr><td>IC 50<CAP<=100</td><td>35%</td></tr>
<tr><td>IC 100<CAP<=200</td><td>37%</td></tr>
<tr><td>IC 200<CAP<=400</td><td>39%</td></tr>
<tr><td>IC 400<CAP<=1,000</td><td>42%</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Energy conversion efficiencies are based on the values in the table in Annex 1 of the Tool to calculate the emission factor for an electricity system. It is assumed that all off-grid power plants use reciprocating engine systems. This is considered conservative because the reciprocating engine systems have the highest net energy conversion efficiencies.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

[21] Industrial and commercial

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for solar SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	0.49000	tCO2/MWh	GEF calculations
W_{BM}	0.25		
$EF_{grid,OM,,y}$	0.65530	tCO2/MWh	GEF calculations
W_{OM}	0.75		
$EF_{grid,CM,y}$	0.61398	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = 0.61398 tCO2/MWh

BE_y = [Insert] * 0.61398 = [Insert] tCO2/year

Project emissions

For CPAs involving solar PV power, project emissions (PE_y) are considered 0.

$PE_y = 0$

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

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

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

CPA implementing entity

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

Metering will be conducted with calibrated measurement equipment according to the national standards

and reference points or IEC standards as agreed with the grid operator.

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

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 3: Geothermal (with fossil fuel combustion) energy project in Kenya

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected geothermal energy project with fossil fuel combustion.

The generic SSC-CPA comprises the implementation and operation of a geothermal power plant with fossil fuel combustion implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Kenyan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[22]:

Applicability criteria	Project activity
This methodology comprises renewable energy generation	The generic SSC-CPA under the

[22] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Programme will use geothermal energy that will supply electricity to the Kenyan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from geothermal energy and its supply to the Kenyan grid system.
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 Kenya This country is not an annex I country.

The project also meets the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) as follows:

The tool can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.	Project emissions from fossil fuel combustion from geothermal CPAs will be calculated based on the fuel combusted and its properties.

Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA, however in case of inclusion of a geothermal project activity, sampling will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), “ 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 Kenyan national grid system constitute the project boundary.

The sources and gases included in the SSC-CPA boundary for individual geothermal CPAs with fossil fuel combustion is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source

	power plants that are displaced due to project activity	N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	Yes	Main emission source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for geothermal projects
		CH_4	No	Not applicable for geothermal projects
		N_2O	No	Not applicable for geothermal projects

The figure below provides a flow chart 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 generic geothermal energy project with fossil fuel combustion CPA.

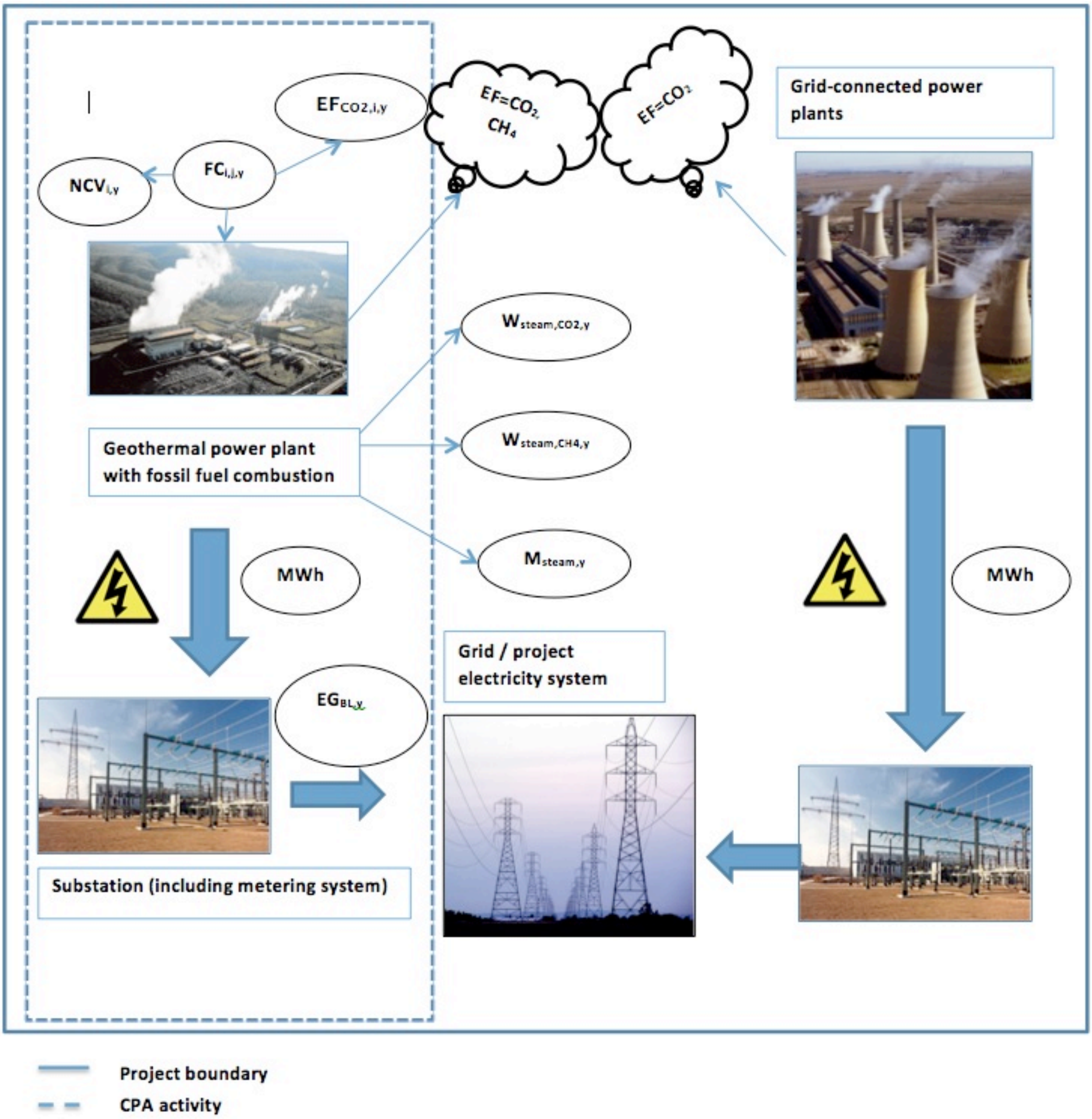

Figure 14: Geothermal CPA involving fossil fuel combustion

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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”.

National grids in countries in East Africa such as Kenya typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[23] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in various countries in Kenya:

Table 4: Installed Capacity in MW

	Kenya[24]
Fossil fuel based	407.5
Large hydro	743.3
Small hydro[25]	14.7
Geothermal	198
Wind	5.1
Biomass/gas	26
Solar & other RE	0
Total	1394.6
% Renewable	71%
% Fossil Fuel Based	29%

Figure 3 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

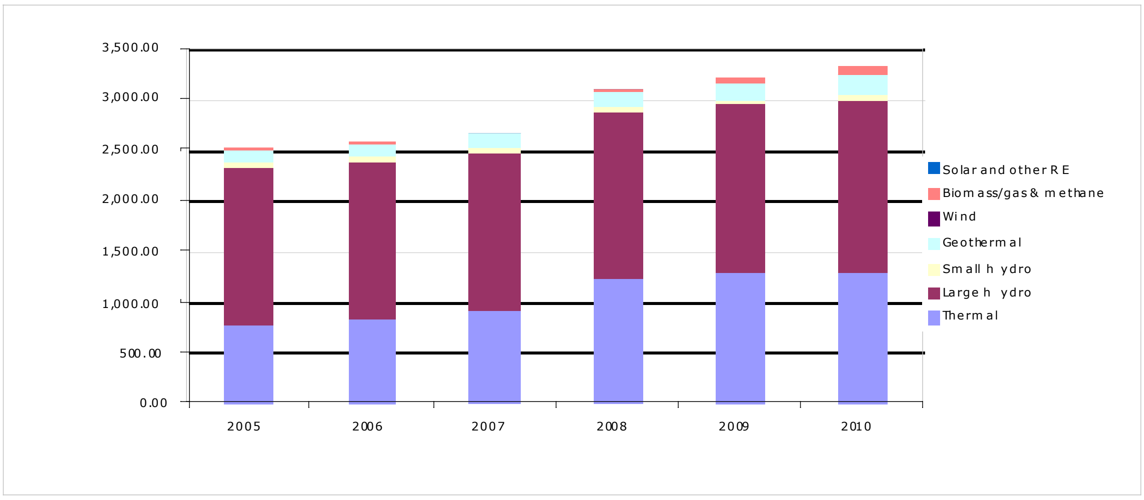

Figure 15: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[23] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.

[24] Kenya Power and Lighting Company (KPLC) Annual Report and Financial Statements for the Year Ended 30 June 2010

[25] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 16 shown below represents the installed capacity of grid-connected power plants in Kenya over the period 2005 to 2010.

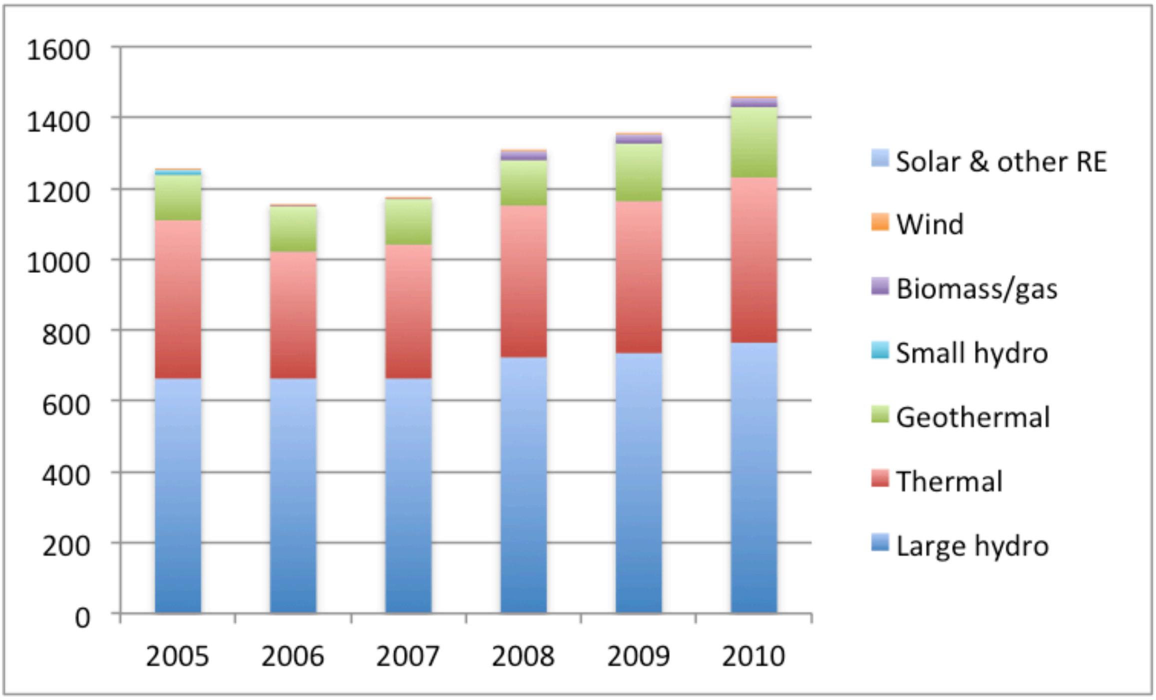

Figure 16: Grid Connected Installed Capacity (MW), 2005-2010 (Kenya)

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 5). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants. This was, for instance, very noticeable in Kenya during the 2009-2010 drought when a number of large hydro power plants had to be closed due to low water levels resulting in a power rationing scheme which lasted for three months. Figure 6 illustrates how during the 2009-2010 drought, electricity generation from hydro power plants in Kenya substantially dropped and was compensated for through an increase of fossil fuel based electricity generation.

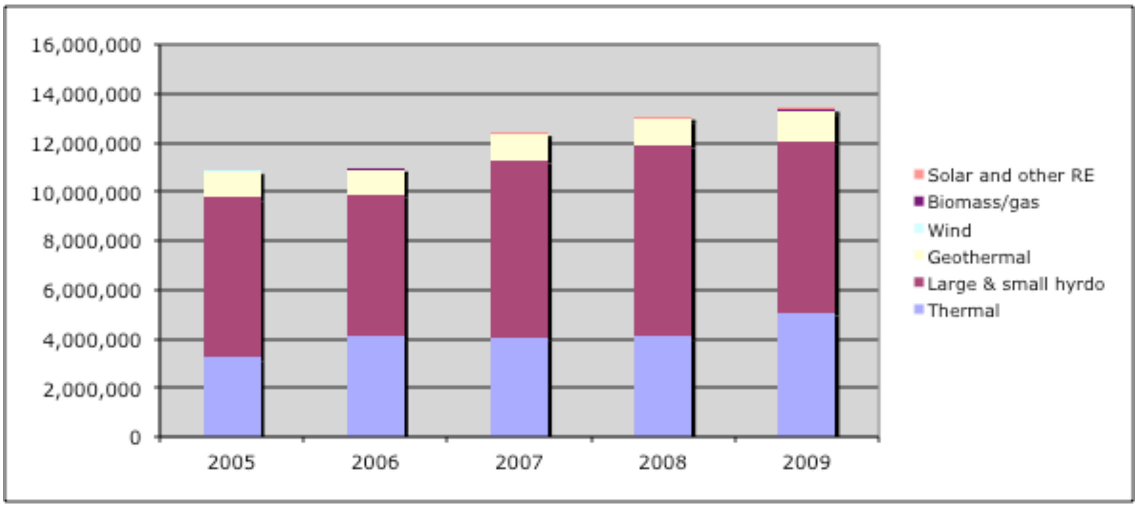

Figure 17: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

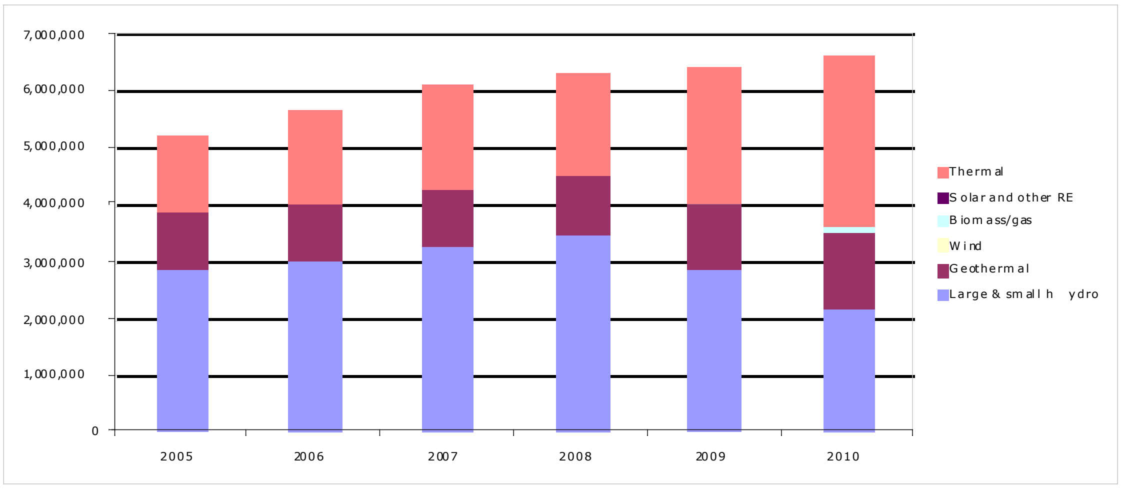

Figure 18: Electricity Generation from Grid-Connected Power Plants by Type in Kenya (MWh), 2005 - 2010

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. The electrification rates in Kenya and Ethiopia are the highest (around 15%) whereby for Kenya the rates are 51% in urban areas and 5% in rural areas. The national average is given as 15%.

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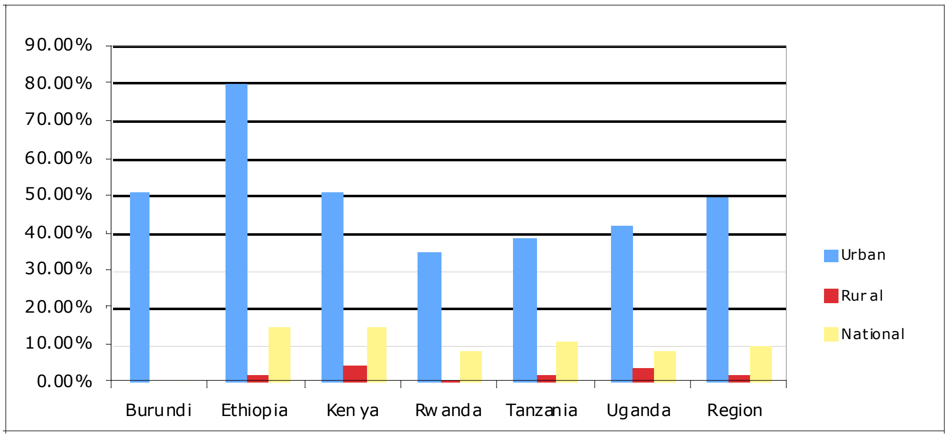

Figure 19: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Kenya has also introduced Feed-in-Tariff policies for renewable energy.

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that is, unbundling, privatization, and wholesale and retail competition.[26] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[27]

More information regarding the baseline situation in Kenya is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Kenyan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a geothermal energy project, a technology eligible for inclusion in the PoA

[26] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[27] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

		excluded from this Programme of Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	Monitoring section B.7 of the PoA-DD and D.7 of the specific CPA-DD *[Applicable for geothermal project types]*
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in [district] that is a special underdeveloped zone in Kenya. or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for geothermal energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from geothermal projects with fossil fuel combustion. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Kenyan electricity system that is covered by the PoA and will be updated every seven years of the PoA. Geothermal energy CPAs in Kenya that are included in the PoA will be using the grid emission factor for the Kenyan electricity grid. Equations and fixed parameter values to calculate the grid emission factor for Kenya are provided in Appendix 4.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

For geothermal projects that also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$).
($PE_{FF,y}$) shall be calculated as per the latest version of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*.

CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, using **equation (1)** of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*:

$$PE_{FC,y} = \Sigma\, FC_{i,j,y} * COEF_{i,y}$$

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr);
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr);
$COEF_{i,y}$	=	Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using Option B (**equation 4**) in the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*. Under Option B, the CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,i,y}$$

Where:

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

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

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

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

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO2e/yr)

$W_{steam,CO2,y}$ = Average mass fraction of carbon dioxide in the produced steam in year y (tCO2/t steam)

$W_{steam,CH4,y}$ = Average mass fraction of methane in the produced steam in year y (tCH4/t steam)

GWP_{CH4} = Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)

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

According to the methodology, the default value for GWP_{CH4} is used, 21tCO_2e/tCH4.

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

This CPA involves geothermal power plants with fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (KENYA)

<table>
<tr><td>Data / Parameter</td><td>CAP_m</td></tr>
<tr><td>Unit</td><td>MW</td></tr>
<tr><td>Description</td><td>Total capacity of off-grid power plants included in off-grid power plant class m</td></tr>
<tr><td>Source of data</td><td>Survey on off grid power plants, as per Annex 2 of the Tool to calculate the emission factor for an electricity system</td></tr>
<tr><td>Value(s) applied</td><td><table>
<tr><td>Off-grid power plant class m</td><td>Total capacity (MW)</td></tr>
<tr><td>Households</td><td>141.39</td></tr>
<tr><td>ICG CAP<=10</td><td>56.62</td></tr>
<tr><td>ICG 10<CAP<=50</td><td>214.88</td></tr>
<tr><td>ICG 50<CAP<=100</td><td>19.01</td></tr>
<tr><td>ICG 100<CAP<=200</td><td>80.68</td></tr>
<tr><td>ICG 200<CAP<=400</td><td>33.56</td></tr>
<tr><td>ICG 400<CAP<=1,000</td><td>12.08</td></tr>
</table></td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>A survey was carried out among 1,174 off-grid power plants. The results of the survey were used to derive global estimates for the total population, for each class of off-grid power plants m, adjusting conservatively for the uncertainty at a 95% confidence level.

In the absence of data information regarding the global population of each stratum, a number of simplifications have been introduced to simplify the global estimates.

• In the analysis, it is assumed that all off-grid power plants use a reciprocating engine system. This is considered conservative because reciprocating engine systems have the highest conversion efficiency (see table in Annex 1 of the Tool to calculate the emission factor for an electricity system)
• In the analysis, it is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because diesel has a higher CO_2 emission factor (0.0726 tCO_2/GJ) than gasoline/ petrol (0.0675 tCO_2/GJ).
• It is assumed that off-grid power plants owned by households fall in the following two capacity classes: <10kW and 10<CAP<=50kW. Therefore, the conversion efficiency for all household off-grid plants is assumed to be 33%.
• Off-grid power plant classes for industrial, commercial and government off-grid plants have been reclassified to correspond with the consumer classes from KPLC.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	**z**
Unit	dimensionless
Description	Standard normal for a 95% confidence level
Source of data	H. Russell Bernard (1995) *Research Methods in Anthropology. Qualitative and Quantitative Approaches.* Altamira Press, London.
Value(s) applied	1.96
Choice of data or Measurement methods and procedures	This is the standard value for standard normal for a confidence level of 95% for a two-tailed test
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$\mathbf{PLF_{default,off\text{-}grid,y}}$
Unit	dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year
Choice of data or Measurement methods and procedures	As per the provisions in step 4 of the *Tool to calculate the emission factor for an electricity system.* Option 3 is chosen to determine $EG_{m,y}$ for off-grid power plants in Step 4 of the *Tool to calculate the emission factor for an electricity system*.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y* where *m* are non low-cost/must run power units
Source of data	Kenya Power and Lighting Company
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the national utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Generation July08-June09*	*Generation July09-June10*	*Generation July10-June11*
Fiat	9,101	-	-
Kipevu 1 Diesel	376,410	316,364	222,690
Kipevu 3 (GTI)	98,351	76,551	456
Kipevu 3 (GT2)	85,855	68,758	439
IberAfrica	343,664	298,726	352,038
Add.IberAfrica	-	322,458	369,606
Tsavo	565,775	494,925	368,489
Rabai Power	-	317,819	394,223
Aggreko Embakasi 1	740,476	409,602	-
Aggreko (Emb 2)	39,892	153,749	-
Aggreko (Emb 3)	-	130,084	-
Aggreko (Emb 4)	-	98,786	186,116
Aggreko (Emb 5)	-	13,190	80,425
Aggreko (Eldoret)	133,813	130,951	-
Aggreko Naivasha	-	159,935	-
Kipevu Diesel 3 (KPD3)	-	-	267,911

<table>
<tr><td>Data / Parameter</td><td>$EG_{k,y}$</td></tr>
<tr><td>Unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Net quantity of electricity generated and delivered to the grid by power unit k in year y where k are low-cost/must run power units.</td></tr>
<tr><td>Source of data</td><td>Kenya Power and Lighting Company</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Power Plant</th><th>Generation July08-June09</th><th>Generation July09-June10</th><th>Generation July10-June11</th></tr>
<tr><td>Gitaru</td><td>655,401</td><td>457,237</td><td>801,654</td></tr>
<tr><td>Kamburu</td><td>347,898</td><td>244,139</td><td>407,527</td></tr>
<tr><td>Kiambere</td><td>614,358</td><td>546,152</td><td>898,770</td></tr>
<tr><td>Kindaruma</td><td>156,963</td><td>111,202</td><td>191,308</td></tr>
<tr><td>Masinga</td><td>128,074</td><td>60,977</td><td>201,075</td></tr>
<tr><td>Tana</td><td>43,613</td><td>28,674</td><td>49,701</td></tr>
<tr><td>Wanji</td><td>28,439</td><td>27,331</td><td>40,389</td></tr>
<tr><td>Sagana</td><td>5,810</td><td>8,348</td><td>8,020</td></tr>
<tr><td>Ndula</td><td>2,036</td><td>3,439</td><td>433</td></tr>
<tr><td>Mesco</td><td>2,560</td><td>223</td><td>-</td></tr>
<tr><td>Sosiani</td><td>1,581</td><td>1,411</td><td>1,538</td></tr>
<tr><td>Turkwel</td><td>523,541</td><td>335,068</td><td>455,102</td></tr>
<tr><td>Gogo</td><td>5,631</td><td>5,171</td><td>6,737</td></tr>
<tr><td>Sondu Miriu</td><td>333,149</td><td>340,460</td><td>364,305</td></tr>
<tr><td>Ngong (Wind)</td><td>287</td><td>15</td><td>-</td></tr>
<tr><td>Ngong 2</td><td>-</td><td>16,288</td><td>17,696</td></tr>
<tr><td>Olkaria 1</td><td>368,438</td><td>366,191</td><td>235,075</td></tr>
<tr><td>Olkaria 2</td><td>534,808</td><td>572,937</td><td>846,245</td></tr>
<tr><td>Orpower4</td><td>275,797</td><td>399,906</td><td>372,498</td></tr>
<tr><td>Mumias</td><td>4,230</td><td>98,704</td><td>87,407</td></tr>
<tr><td>Imenti Tea Factory (Feed in)</td><td>-</td><td>-</td><td>232</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Data are obtained directly from Kenya Power and Lighting Company, which is the utility in charge of electricity distribution in the country.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	Energy Regulatory Commission *Schedule of Tariffs* (2008) Electricity generation data obtained from Kenya Power and Lighting Company.
Value(s) applied	

Power Plant	*Fuel Type*	*$FC_{i,m,y}$ (kg) 2008-2009*	*$FC_{i,m,y}$ (kg) 2009-2010*	*$FC_{i,m,y}$ (kg) 2010-2011*
Kipevu Diesel	HFO	81,680,970	68,650,988	48,324,598
Kipevu GT1	Kerosene	30,488,810	23,730,903	141,360
Kipevu GT2	Kerosene	26,615,050	21,314,980	136,090
Tsavo Diesel	HFO	123,904,769	108,388,509	80,699,025
Iberafrica	HFO	77,324,343	67,213,439	79,208,482
Iberafrica 2 (Additional 52.5 MW)	HFO	0	72,230,496	82,791,666
Aggreko Embakasi 1	AGO	170,309,459	94,208,483	0
Aggreko Embakasi 2	AGO	9,175,273	35,362,341	0
Aggreko Embakasi 3	AGO	0	29,268,824	0
Aggreko Embakasi 4	AGO	0	22,226,895	41,876,105
Aggreko Embakasi 5	AGO	0	2,967,716	18,095,607
Aggreko Naivasha	AGO	0	35,985,445	0
Aggreko Eldoret	AGO	31,312,169	30,642,490	0
Rabai	AGO	0	62,642,125	77,701,353
KPD3	HFO	0	0	56,127,396
Fiat	AGO	3,777,003	0	0

Choice of data or Measurement methods and procedures	The Energy Regulatory Commission *Schedule of Tariffs, 2008* provides approved specific fuel consumption data for thermal power plants. These data are provided in kg/kWh and are used by KPLC to calculate the fuel charges on the electricity bills of the consumers. The data can be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant. For simple adjusted OM, fuel consumption is calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option). For BM, fuel consumption is calculated once *ex ante* for the first crediting period, as explained in step 5 of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$NCV_{i,y}$**
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	(see table below)
Choice of data or Measurement methods and procedures	No data on NCV is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Fuel Type***	***$NCV_{i,y}$ (GJ/kg)***
Kipevu Diesel	HFO	0.0398
Kipevu GT1	Kerosene	0.0420
Kipevu GT2	Kerosene	0.0420
Tsavo Diesel	HFO	0.0398
Iberafrica 1	HFO	0.0398
Iberafrica 2 (additional 52.5 MW)	HFO	0.0398
Aggreko Embakasi 1	AGO	0.0414
Aggreko Embakasi 2	AGO	0.0414
Aggreko Embakasi 3	AGO	0.0414
Aggreko Embakasi 4	AGO	0.0414
Aggreko Embakasi 5	AGO	0.0414
Aggreko Naivasha	AGO	0.0414
Aggreko Eldoret	AGO	0.0414
Rabai	AGO	0.0414
KPD3	HFO	0.0398
Fiat	AGO	0.0414

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* 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	See table below
Choice of data or Measurement methods and procedures	No data is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Fuel Type***	$EF_{CO2,i,y}$ (tCO_2/GJ)
Kipevu Diesel	HFO	0.0755
Kipevu GT1	Kerosene	0.0697
Kipevu GT2	Kerosene	0.0697
Tsavo Diesel	HFO	0.0755
Iberafrica 1	HFO	0.0755
Iberafrica 2 (additional 52.5 MW)	HFO	0.0755
Aggreko Embakasi 1	AGO	0.0726
Aggreko Embakasi 2	AGO	0.0726
Aggreko Embakasi 3	AGO	0.0726
Aggreko Embakasi 4	AGO	0.0726
Aggreko Embakasi 5	AGO	0.0726
Aggreko Naivasha	AGO	0.0726
Aggreko Eldoret	AGO	0.0726
Rabai	AGO	0.0726
KPD3	HFO	0.0755
Fiat	AGO	0.0726

Data / Parameter	$EF_{CO2,m,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in off-grid power unit *m* 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	0.0675
Choice of data or Measurement methods and procedures	It is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because gasoline/petrol has a lower CO_2 emission factor than diesel. No data is available from power generation plants. Therefore, the IPCC value has been used.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net energy conversion efficiency of off-grid power unit *m.*
Source of data	The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	**Off-grid power class *m*** / **Efficiency ($\eta_{m,y}$)**: Households 33%; IC[28] CAP<=10 28%; IC 10<CAP<=50 33%; IC 50<CAP<=100 35%; IC 100<CAP<=200 37%; IC 200<CAP<=400 39%; IC 400<CAP<=1,000 42%
Choice of data or Measurement methods and procedures	Energy conversion efficiencies are based on the values in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system.* It is assumed that all off-grid power plants use reciprocating engine systems. This is considered conservative because the reciprocating engine systems have the highest net energy conversion efficiencies.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Values applied for $\eta_{m,y}$:

Off-grid power class *m*	Efficiency ($\eta_{m,y}$)
Households	33%
IC[28] CAP<=10	28%
IC 10<CAP<=50	33%
IC 50<CAP<=100	35%
IC 100<CAP<=200	37%
IC 200<CAP<=400	39%
IC 400<CAP<=1,000	42%

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

[28] Industrial and commercial

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	Value	Unit	Source
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$
The combined margin emission factor for the grid is calculated using the following equations:

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for geothermal SSC-CPAs:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.49000	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	0.65530	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	0.57265	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = 0.57265 tCO2/MWh

BE_y = [Insert] * 0.57265 = [Insert] tCO2/year

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

For geothermal projects, which also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$).
$PE_{FF,y}$ shall be calculated as per the version 2 of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion* (version 02).

CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, using **equation (1)** of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*:

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

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr);
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr);
$COEF_{i,y}$	=	Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using Option B **(equation 4)** in the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*. Under Option B, the CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

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

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

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

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

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

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from fossil fuel combustion:

Parameter	**Value**	**Unit**	**Source**
$NCV_{i,y}$	[insert value]	[insert unit]	[insert source]
$EF_{CO2,i,y}$	[insert value]	[insert value]	[insert source]
$FC_{i,j,y}$	[insert value]	[insert value]	[insert source]
$COEF_{i,y}$	[insert value]	[insert value]	Calculated
$PE_{FC,j,y}$	[insert value]	tCO2/y	Calculated

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)

$W_{steam,CO2,y}$ = Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO2/t steam)

$W_{steam,CH4,y}$ = Average mass fraction of methane in the produced steam in year *y* (tCH4/t steam)

GWP_{CH4} = Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)

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

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the operation of the geothermal power plant:

Parameter	**Value**	**Unit**	**Source**
$W_{steam,CO2,y}$	[insert value]	[insert unit]	[insert source]
$W_{steam,CH4,y}$	[insert value]	[insert unit]	[insert source]
GWP_{CH4}	21	tCO2e/tCH4	Default value
$M_{Steam,y}$	[insert value]	[insert unit]	[insert source]
$PE_{GP,y}$	[insert value]	tCO2e/y	Calculated

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

This CPA involves geothermal power plants with fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Total Project Emission for the project activity equal:

PE_y = [insert value] + [insert value] + 0

PE_y = [insert value]

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year y (t CO2/y)
BE_y	=	Baseline Emissions in year y (t CO2/y)
PE_y	=	Project emissions in year y (t CO2/y)
LE_y	=	Leakage emissions in year y (t CO2/y)

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

PROJECTS THAT ALSO USE FOSSIL FUELS FOR ELECTRICITY GENERATION

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

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,i,y}$</td></tr>
<tr><td>Unit</td><td>tCO2/GJ</td></tr>
<tr><td>Description</td><td>Weighted average CO_2 emission factor of fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>If a) is not available
These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>d) IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards

Monitoring Frequency:
• For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated.
• For c): Review appropriateness of the values annually.
• For d): Any future revision of the IPCC Guidelines should be taken into account.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of project emissions</td></tr>
</table>

Additional comment	For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, Options b), c) or d) should be used. This parameter is applicable to geothermal CPAs that involve fossil fuel combustion

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ per mass or volume unit (e.g. GJ/m³, GJ/ton)</td></tr>
<tr><td>Description</td><td>Weighted average net calorific value of fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>b) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>c) Regional or national default values</td><td>If a) is not available
These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>d) IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards

Monitoring Frequency:
For a) and b): Measurements should be undertaken in line with national or international fuel standards
For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated
For c): Review appropriateness of the values annually
For d): Any future revision of the IPCC Guidelines should be taken into account
If a), b) of c) are used, the project will verify if the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.</td></tr>
</table>

Purpose of data	Calculation of project emissions
Additional comment	Applicable to geothermal CPAs that involve fossil fuel combustion

SPECIFIC PARAMETERS FOR GEOTHERMAL PROJECTS

Data / Parameter	$W_{steam,CO2,y}$
Unit	tCO2/t steam
Description	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in specific CPA-DD.
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal project activities

Data / Parameter	$W_{steam,CH4,y}$
Unit	tCH_4/t steam
Description	Average mass fraction of methane in the produced steam in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported in each specific CPA-DD
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane.
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

Data / Parameter	$M_{steam,y}$
Unit	t steam/yr
Description	Quantity of steam produced in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported by specific CPA-DD
Measurement methods and procedures	The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports.
Monitoring frequency	Daily
QA/QC procedures	Data will be read continuously and logged daily. Data will be entered into CDM monitoring workbook every day and will be checked for consistency when entered. Meters will be maintained and periodically verified according to manufacturer specifications to ensure accurate readings; they will be recalibrated within the schedule recommended by the manufacturer.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

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

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

CPA implementing entity

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

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

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes. Project activities using geothermal technologies and involving fossil fuel consumption for electricity generation, will also monitor and keep records of additional parameters as specified in section B. 7.1. Additional parameter values will be reported on a quarterly basis with supporting evidence (if applicable). These parameters are listed in the table below:

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All
$W_{steam,CO2,y}$	Average mass fraction of carbon dioxide in the produced steam in year *y*	Geothermal CPAs
$W_{steam,CH4,y}$	Average mass fraction of methane in the produced steam in year *y*	Geothermal CPAs
$M_{steam,y}$	Quantity of steam produced in year *y*	Geothermal CPAs
$FC_{i,j,y}$	Quantity of fuel type *i* combusted in process *j* during the year *y*	Geothermal CPAs using fossil fuels
$EF_{CO2,i,y}$	Weighted average CO_2 emission factor of fuel type *i* in year *y*	Geothermal CPAs using fossil fuels
$NCV_{i,y}$	Weighted average net calorific value of fuel type *i* in year *y*	Geothermal CPAs using fossil fuels

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 4: Geothermal (without fossil fuel combustion) energy project in Kenya

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected geothermal energy project without fossil fuel combustion.

The generic SSC-CPA comprises the implementation and operation of a geothermal power plant without fossil fuel combustion implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Kenyan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:
- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[29]:

Applicability criteria	Project activity
This methodology comprises renewable energy generation	The generic SSC-CPA under the

[29] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Programme will use geothermal energy that will supply electricity to the Kenyan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from geothermal energy and its supply to the Kenyan grid system.
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 Kenya This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) as it is a geothermal energy project without fossil fuel combustion.
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA, however in case of inclusion of a geothermal project activity, sampling will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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 Kenyan national grid system constitute the project boundary.

The sources and gases included in the SSC-CPA boundary for individual geothermal CPAs without fossil fuel combustion is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive	CO_2	Yes	Main emission source
		CH_4	Yes	Main emission source

	emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for geothermal projects without fossil fuel combustion
		CH_4	No	Not applicable for geothermal projects without fossil fuel combustion
		N_2O	No	Not applicable for geothermal projects without fossil fuel combustion
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for geothermal projects
		CH_4	No	Not applicable for geothermal projects
		N_2O	No	Not applicable for geothermal projects

The figure below provides a flow chart 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 generic geothermal CPA without fossil fuels combustion.

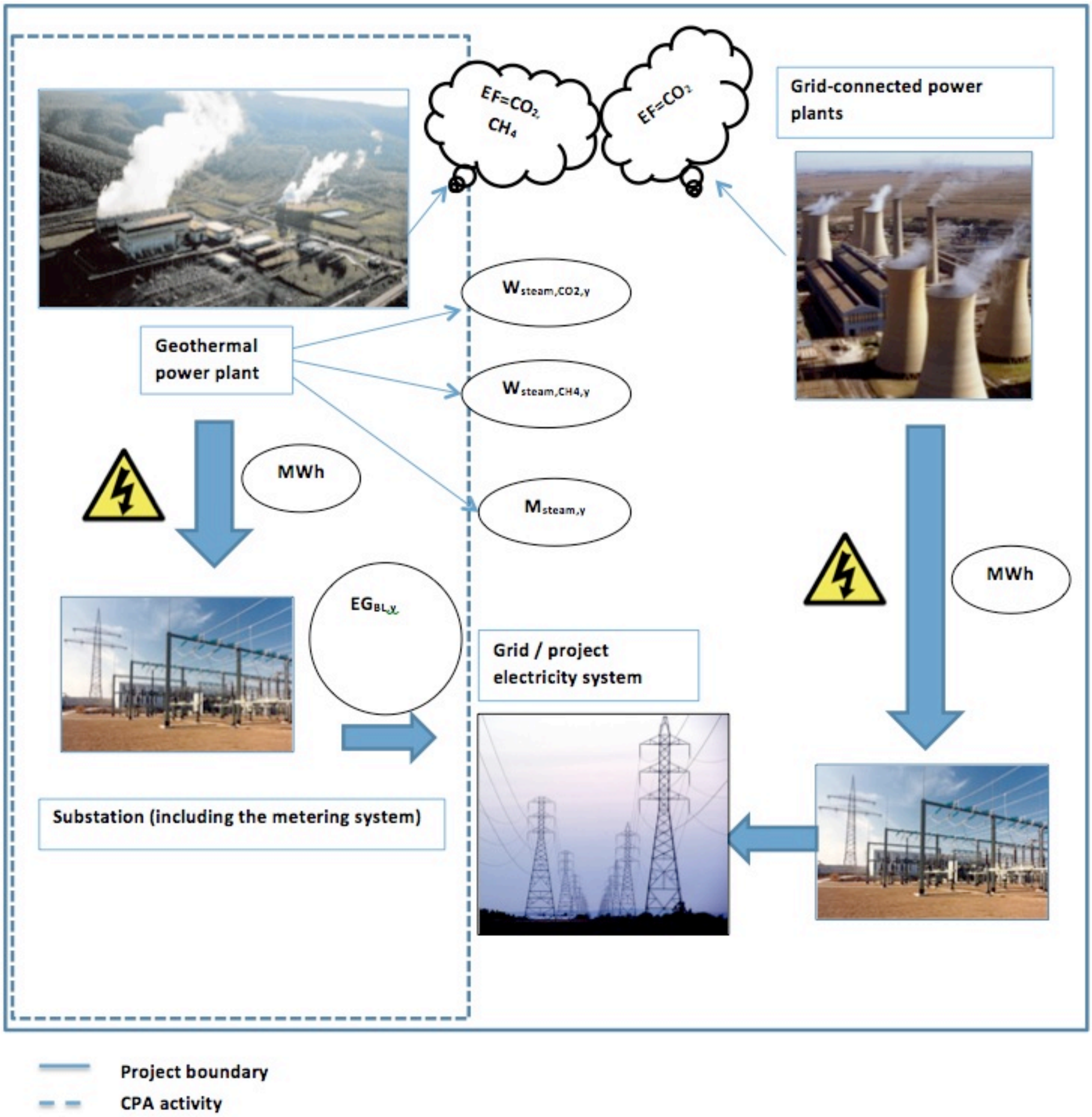

Figure 20: Geothermal CPA without fossil fuels combustion

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National grids in countries in East Africa such as Kenya typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[30] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in various countries in Kenya:

Table 5: Installed Capacity in MW

	Kenya[31]
Fossil fuel based	407.5
Large hydro	743.3
Small hydro[32]	14.7
Geothermal	198
Wind	5.1
Biomass/gas	26
Solar & other RE	0
Total	1394.6
% Renewable	71%
% Fossil Fuel Based	29%

Figure 3 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

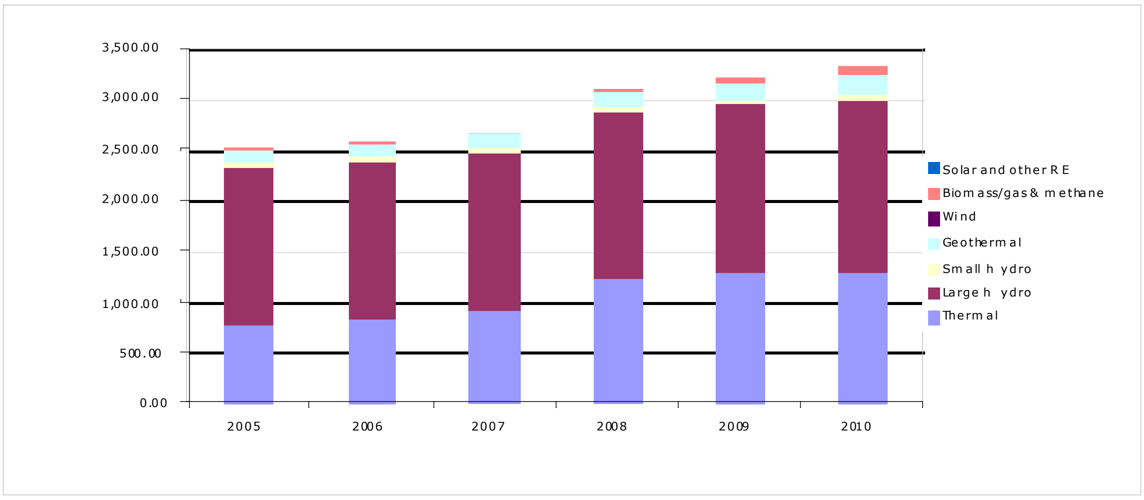

Figure 21: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[30] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.
[31] Kenya Power and Lighting Company (KPLC) Annual Report and Financial Statements for the Year Ended 30 June 2010
[32] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 22 shown below represents the installed capacity of grid-connected power plants in Kenya over the period 2005 to 2010.

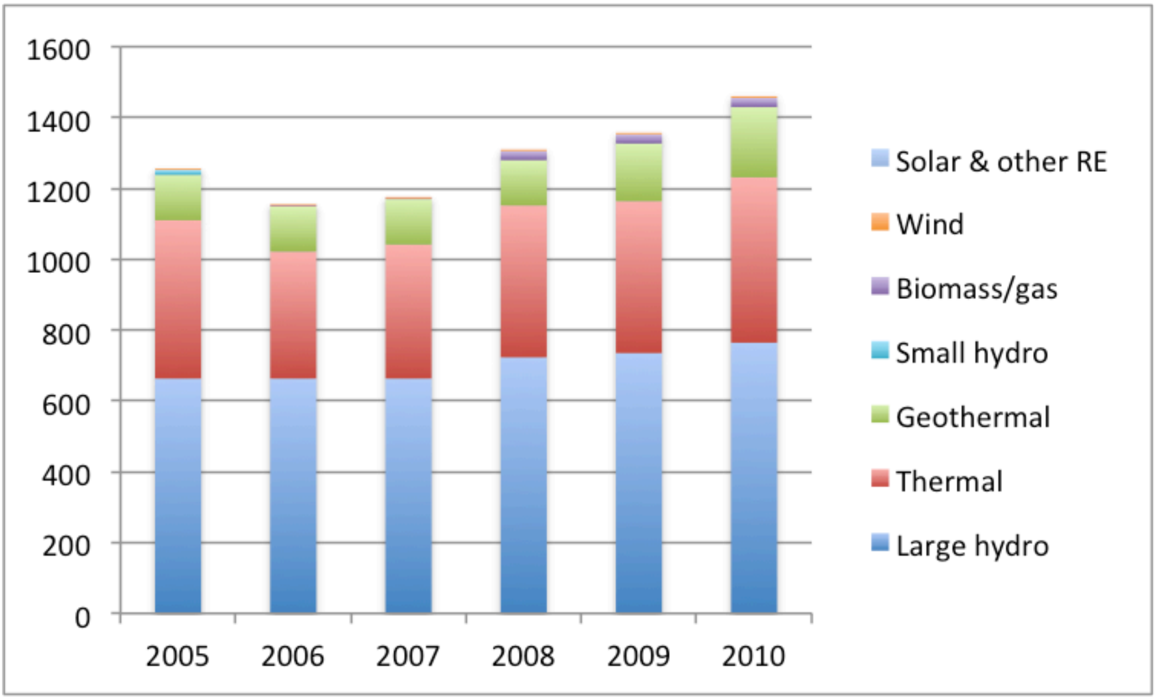

Figure 22: Grid Connected Installed Capacity (MW), 2005-2010 (Kenya)

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 5). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants. This was, for instance, very noticeable in Kenya during the 2009-2010 drought when a number of large hydro power plants had to be closed due to low water levels resulting in a power rationing scheme which lasted for three months. Figure 6 illustrates how during the 2009-2010 drought, electricity generation from hydro power plants in Kenya substantially dropped and was compensated for through an increase of fossil fuel based electricity generation.

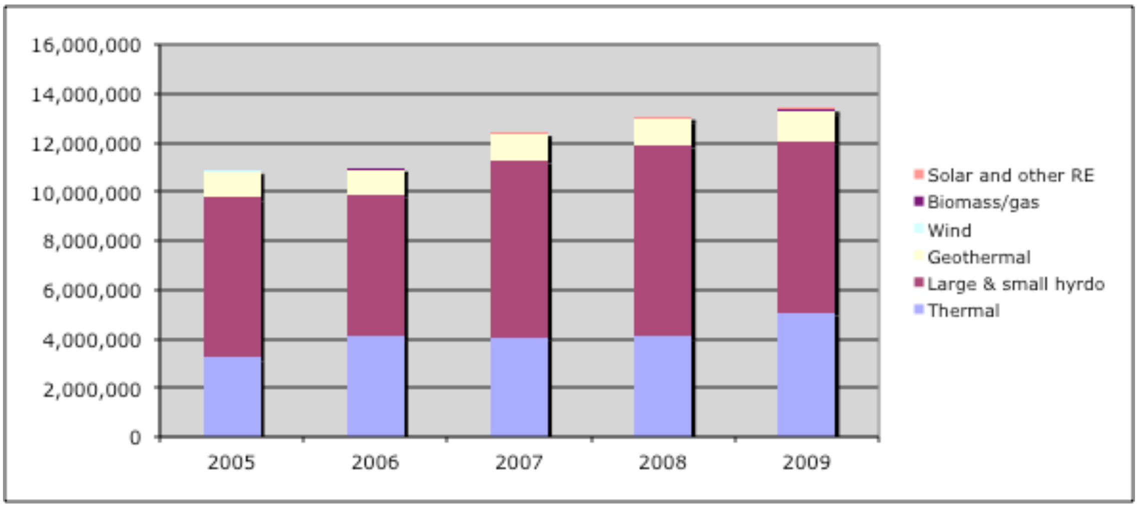

Figure 23: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

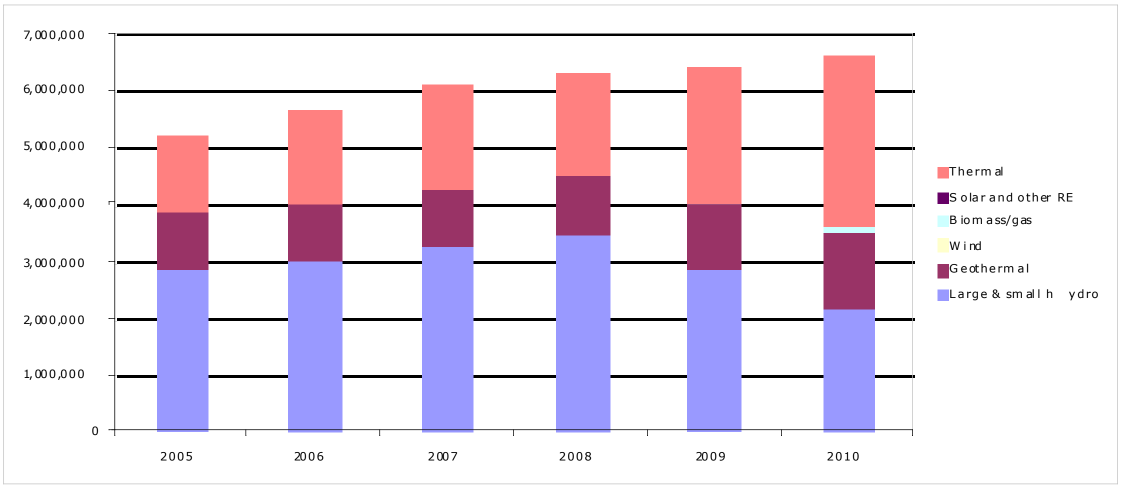

Figure 24: Electricity Generation from Grid-Connected Power Plants by Type in Kenya (MWh), 2005 - 2010

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. The electrification rates in Kenya and Ethiopia are the highest (around 15%) whereby for Kenya the rates are 51% in urban areas and 5% in rural areas. The national average is given as 15%.
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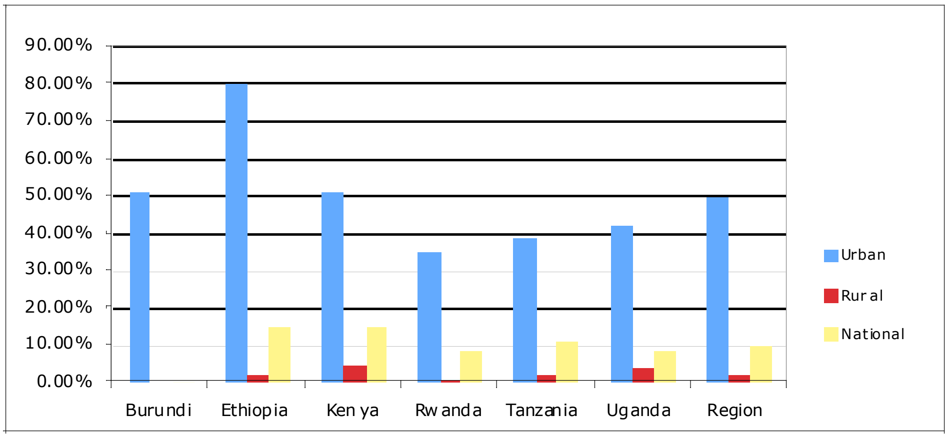

Figure 25: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Kenya has also introduced Feed-in-Tariff policies for renewable energy.

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that is, unbundling, privatization, and wholesale and retail competition.[33] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[34]

More information regarding the baseline situation in Kenya is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Kenyan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a geothermal energy project, a technology eligible for inclusion in the PoA

[33] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[34] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

		excluded from this Programme of Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties <u>or</u> confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	Monitoring section B.7 of the PoA-DD and D.7 of the specific CPA-DD *[Applicable for geothermal project types]*
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in [district] that is a special underdeveloped zone in Kenya. or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for geothermal energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from geothermal project without fossil fuel combustion Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Kenyan electricity system that is covered by the PoA and will be updated every seven years of the PoA. Geothermal energy CPAs in Kenya that are included in the PoA will be using the grid emission factor for the Kenyan electricity grid. Equations and fixed parameter values to calculate the grid emission factor for Kenya are provided in Appendix 4.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

For geothermal projects that also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). However this generic CPA includes geothermal projects without fossil fuels combustion, therefore $PE_{FF,y} = 0$

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$W_{steam,CO2,y}$	=	Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO2/t steam)
$W_{steam,CH4,y}$	=	Average mass fraction of methane in the produced steam in year *y* (tCH4/t steam)
GWP_{CH4}	=	Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)
$M_{steam,y}$	=	Quantity of steam produced in year *y* (t steam/y)

According to the methodology, the default value for GWP_{CH4} is used, 21tCO_2e/tCH4.

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

This CPA involves geothermal power plants without fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (KENYA)

<table>
<tr><td>Data / Parameter</td><td>CAP_m</td></tr>
<tr><td>Unit</td><td>MW</td></tr>
<tr><td>Description</td><td>Total capacity of off-grid power plants included in off-grid power plant class m</td></tr>
<tr><td>Source of data</td><td>Survey on off grid power plants, as per Annex 2 of the Tool to calculate the emission factor for an electricity system</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><td>Off-grid power plant class m</td><td>Total capacity (MW)</td></tr>
<tr><td>Households</td><td>141.39</td></tr>
<tr><td>ICG CAP<=10</td><td>56.62</td></tr>
<tr><td>ICG 10<CAP<=50</td><td>214.88</td></tr>
<tr><td>ICG 50<CAP<=100</td><td>19.01</td></tr>
<tr><td>ICG 100<CAP<=200</td><td>80.68</td></tr>
<tr><td>ICG 200<CAP<=400</td><td>33.56</td></tr>
<tr><td>ICG 400<CAP<=1,000</td><td>12.08</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>A survey was carried out among 1,174 off-grid power plants. The results of the survey were used to derive global estimates for the total population, for each class of off-grid power plants m, adjusting conservatively for the uncertainty at a 95% confidence level.

In the absence of data information regarding the global population of each stratum, a number of simplifications have been introduced to simplify the global estimates.

In the analysis, it is assumed that all off-grid power plants use a reciprocating engine system. This is considered conservative because reciprocating engine systems have the highest conversion efficiency (see table in Annex 1 of the Tool to calculate the emission factor for an electricity system)
In the analysis, it is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because diesel has a higher CO_2 emission factor (0.0726 tCO_2/GJ) than gasoline/ petrol (0.0675 tCO_2/GJ).
It is assumed that off-grid power plants owned by households fall in the following two capacity classes: <10kW and 10<CAP<=50kW. Therefore, the conversion efficiency for all household off-grid plants is assumed to be 33%.
Off-grid power plant classes for industrial, commercial and government off-grid plants have been reclassified to correspond with the consumer classes from KPLC.

</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	**z**
Unit	dimensionless
Description	Standard normal for a 95% confidence level
Source of data	H. Russell Bernard (1995) *Research Methods in Anthropology. Qualitative and Quantitative Approaches.* Altamira Press, London.
Value(s) applied	1.96
Choice of data or Measurement methods and procedures	This is the standard value for standard normal for a confidence level of 95% for a two-tailed test
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$PLF_{default,off\text{-}grid,y}$
Unit	dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year
Choice of data or Measurement methods and procedures	As per the provisions in step 4 of the *Tool to calculate the emission factor for an electricity system.* Option 3 is chosen to determine $EG_{m,y}$ for off-grid power plants in Step 4 of the *Tool to calculate the emission factor for an electricity system*.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y* where *m* are non low-cost/must run power units
Source of data	Kenya Power and Lighting Company
Value(s) applied	

Power Plant	*Generation July08-June09*	*Generation July09-June10*	*Generation July10-June11*
Fiat	9,101	-	-
Kipevu 1 Diesel	376,410	316,364	222,690
Kipevu 3 (GTI)	98,351	76,551	456
Kipevu 3 (GT2)	85,855	68,758	439
IberAfrica	343,664	298,726	352,038
Add.IberAfrica	-	322,458	369,606
Tsavo	565,775	494,925	368,489
Rabai Power	-	317,819	394,223
Aggreko Embakasi 1	740,476	409,602	-
Aggreko (Emb 2)	39,892	153,749	-
Aggreko (Emb 3)	-	130,084	-
Aggreko (Emb 4)	-	98,786	186,116
Aggreko (Emb 5)	-	13,190	80,425
Aggreko (Eldoret)	133,813	130,951	-
Aggreko Naivasha	-	159,935	-
Kipevu Diesel 3 (KPD3)	-	-	267,911

Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the national utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$EG_{k,y}$**
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* where *k* are low-cost/must run power units.
Source of data	Kenya Power and Lighting Company
Value(s) applied	see table below
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Generation July08-June09***	***Generation July09-June10***	***Generation July10-June11***
Gitaru	655,401	457,237	801,654
Kamburu	347,898	244,139	407,527
Kiambere	614,358	546,152	898,770
Kindaruma	156,963	111,202	191,308
Masinga	128,074	60,977	201,075
Tana	43,613	28,674	49,701
Wanji	28,439	27,331	40,389
Sagana	5,810	8,348	8,020
Ndula	2,036	3,439	433
Mesco	2,560	223	-
Sosiani	1,581	1,411	1,538
Turkwel	523,541	335,068	455,102
Gogo	5,631	5,171	6,737
Sondu Miriu	333,149	340,460	364,305
Ngong (Wind)	287	15	-
Ngong 2	-	16,288	17,696
Olkaria 1	368,438	366,191	235,075
Olkaria 2	534,808	572,937	846,245
Orpower4	275,797	399,906	372,498
Mumias	4,230	98,704	87,407
Imenti Tea Factory (Feed in)	-	-	232

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	Energy Regulatory Commission *Schedule of Tariffs* (2008) Electricity generation data obtained from Kenya Power and Lighting Company.
Value(s) applied	

Power Plant	*Fuel Type*	*$FC_{i,m,y}$ (kg) 2008-2009*	*$FC_{i,m,y}$ (kg) 2009-2010*	*$FC_{i,m,y}$ (kg) 2010-2011*
Kipevu Diesel	HFO	81,680,970	68,650,988	48,324,598
Kipevu GT1	Kerosene	30,488,810	23,730,903	141,360
Kipevu GT2	Kerosene	26,615,050	21,314,980	136,090
Tsavo Diesel	HFO	123,904,769	108,388,509	80,699,025
Iberafrica	HFO	77,324,343	67,213,439	79,208,482
Iberafrica 2 (Additional 52.5 MW)	HFO	0	72,230,496	82,791,666
Aggreko Embakasi 1	AGO	170,309,459	94,208,483	0
Aggreko Embakasi 2	AGO	9,175,273	35,362,341	0
Aggreko Embakasi 3	AGO	0	29,268,824	0
Aggreko Embakasi 4	AGO	0	22,226,895	41,876,105
Aggreko Embakasi 5	AGO	0	2,967,716	18,095,607
Aggreko Naivasha	AGO	0	35,985,445	0
Aggreko Eldoret	AGO	31,312,169	30,642,490	0
Rabai	AGO	0	62,642,125	77,701,353
KPD3	HFO	0	0	56,127,396
Fiat	AGO	3,777,003	0	0

Choice of data or Measurement methods and procedures	The Energy Regulatory Commission *Schedule of Tariffs, 2008* provides approved specific fuel consumption data for thermal power plants. These data are provided in kg/kWh and are used by KPLC to calculate the fuel charges on the electricity bills of the consumers. The data can be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant. For simple adjusted OM, fuel consumption is calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option). For BM, fuel consumption is calculated once *ex ante* for the first crediting period, as explained in step 5 of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ/kg</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) of fossil fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>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</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Power Plant</th><th>Fuel Type</th><th>$NCV_{i,y}$ (GJ/kg)</th></tr>
<tr><td>Kipevu Diesel</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Kipevu GT1</td><td>Kerosene</td><td>0.0420</td></tr>
<tr><td>Kipevu GT2</td><td>Kerosene</td><td>0.0420</td></tr>
<tr><td>Tsavo Diesel</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Iberafrica 1</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Iberafrica 2 (additional 52.5 MW)</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Aggreko Embakasi 1</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 2</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 3</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 4</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Embakasi 5</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Naivasha</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Aggreko Eldoret</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>Rabai</td><td>AGO</td><td>0.0414</td></tr>
<tr><td>KPD3</td><td>HFO</td><td>0.0398</td></tr>
<tr><td>Fiat</td><td>AGO</td><td>0.0414</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>No data on NCV is available from power generation plants.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	**$EF_{CO2,i,y}$**
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* 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	(see table below)
Choice of data or Measurement methods and procedures	No data is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Fuel Type*	*$EF_{CO2,i,y}$ (tCO_2/GJ)*
Kipevu Diesel	HFO	0.0755
Kipevu GT1	Kerosene	0.0697
Kipevu GT2	Kerosene	0.0697
Tsavo Diesel	HFO	0.0755
Iberafrica 1	HFO	0.0755
Iberafrica 2 (additional 52.5 MW)	HFO	0.0755
Aggreko Embakasi 1	AGO	0.0726
Aggreko Embakasi 2	AGO	0.0726
Aggreko Embakasi 3	AGO	0.0726
Aggreko Embakasi 4	AGO	0.0726
Aggreko Embakasi 5	AGO	0.0726
Aggreko Naivasha	AGO	0.0726
Aggreko Eldoret	AGO	0.0726
Rabai	AGO	0.0726
KPD3	HFO	0.0755
Fiat	AGO	0.0726

Data / Parameter	$EF_{CO2,m,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in off-grid power unit *m* 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	0.0675
Choice of data or Measurement methods and procedures	It is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because gasoline/petrol has a lower CO_2 emission factor than diesel. No data is available from power generation plants. Therefore, the IPCC value has been used.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net energy conversion efficiency of off-grid power unit *m.*
Source of data	The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	see table below
Choice of data or Measurement methods and procedures	Energy conversion efficiencies are based on the values in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system.* It is assumed that all off-grid power plants use reciprocating engine systems. This is considered conservative because the reciprocating engine systems have the highest net energy conversion efficiencies.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Value(s) applied:

Off-grid power class *m*	Efficiency ($\eta_{m,y}$)
Households	33%
IC[35] CAP<=10	28%
IC 10<CAP<=50	33%
IC 50<CAP<=100	35%
IC 100<CAP<=200	37%
IC 200<CAP<=400	39%
IC 400<CAP<=1,000	42%

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

[35] Industrial and commercial

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for geothermal SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	0.49000	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	0.65530	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	0.57265	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = 0.57265 tCO2/MWh

BE_y = [Insert] * 0.57265 = [Insert] tCO2/year

Project emissions

For most renewable energy project activities $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

For geothermal projects that also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). However this generic CPA includes geothermal projects without fossil fuels combustion, therefore $PE_{FF,y} = 0$

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$W_{steam,CO2,y}$	=	Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO2/t steam)
$W_{steam,CH4,y}$	=	Average mass fraction of methane in the produced steam in year *y* (tCH4/t steam)
GWP_{CH4}	=	Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)
$M_{steam,y}$	=	Quantity of steam produced in year *y* (t steam/y)

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the operation of the geothermal power plant:

Parameter	**Value**	**Unit**	**Source**
$W_{steam,CO2,y}$	[insert value]	[insert unit]	[insert source]

$W_{steam,CH4,y}$	[insert value]	[insert unit]	[insert source]
GWP_{CH4}	21	tCO2e/tCH4	Default value
$M_{Steam,y}$	[insert value]	[insert unit]	[insert source]
$PE_{GP,y}$	[insert value]	tCO2e/y	Calculated

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

This CPA involves geothermal power plants without fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Total Project Emission for the project activity equal:

PE_y = 0 + [insert value] + 0

PE_y = [insert value]

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR GEOTHERMAL PROJECTS

Data / Parameter	$W_{steam,CO2,y}$
Unit	tCO2/t steam
Description	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in specific CPA-DD.
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal project activities

Data / Parameter	$W_{steam,CH4,y}$
Unit	tCH_4/t steam
Description	Average mass fraction of methane in the produced steam in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported in each specific CPA-DD
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane.
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

Data / Parameter	$M_{steam,y}$
Unit	t steam/yr
Description	Quantity of steam produced in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported by specific CPA-DD
Measurement methods and procedures	The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports.
Monitoring frequency	Daily
QA/QC procedures	Data will be read continuously and logged daily. Data will be entered into CDM monitoring workbook every day and will be checked for consistency when entered. Meters will be maintained and periodically verified according to manufacturer specifications to ensure accurate readings; they will be recalibrated within the schedule recommended by the manufacturer.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

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

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

CPA implementing entity

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

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

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

Project activities using geothermal technologies (but not involving fossil fuel consumption for electricity generation) will also monitor and keep records of additional parameters as specified in section B. 7.1. Additional parameter values will be reported on a quarterly basis with supporting evidence (if applicable). These parameters are listed in the table below:

Parameter	**Description**	**Type of CPA**
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of	All

	the implementation of the CDM project activity in year *y*	
$W_{steam,CO2,y}$	Average mass fraction of carbon dioxide in the produced steam in year *y*	Geothermal CPAs
$W_{steam,CH4,y}$	Average mass fraction of methane in the produced steam in year *y*	Geothermal CPAs
$M_{steam,y}$	Quantity of steam produced in year *y*	Geothermal CPAs

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and

information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 5: Hydro (run-of-river) project in Kenya

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected hydro (run-of-river) project.

The generic SSC-CPA comprises the implementation and operation of a hydro (run-of-river) power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Kenyan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology

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

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation*" (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[36]:

Applicability criteria	**Project activity**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind,	The generic SSC-CPA under the Programme will use hydro (run-of-river)

[36] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	energy that will supply electricity to the Kenyan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA. Hydro run-of-river do not have reservoirs
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from hydro (run-of-river) energy and its supply to the Kenyan grid system.
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 Kenya This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) since it is a hydro (run-of-river) energy project
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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 Kenyan national grid system constitute the project boundary.

The sources and gases included in the SSC-CPA boundary for individual hydro (run-of-river) CPAs is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for hydro (run-of-river) projects
		CH_4	No	Not applicable for hydro (run-of-river) projects

		N_2O	No	Not applicable for hydro (run-of-river) projects
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for hydro (run-of-river) projects
		CH_4	No	Not applicable for hydro (run-of-river) projects
		N_2O	No	Not applicable for hydro (run-of-river) projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for hydro (run-of-river) projects
		CH_4	No	Not applicable for hydro (run-of-river) projects
		N_2O	No	Not applicable for hydro (run-of-river) projects

The figure below provides a flow chart 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 generic hydro (run-of-river) CPA.

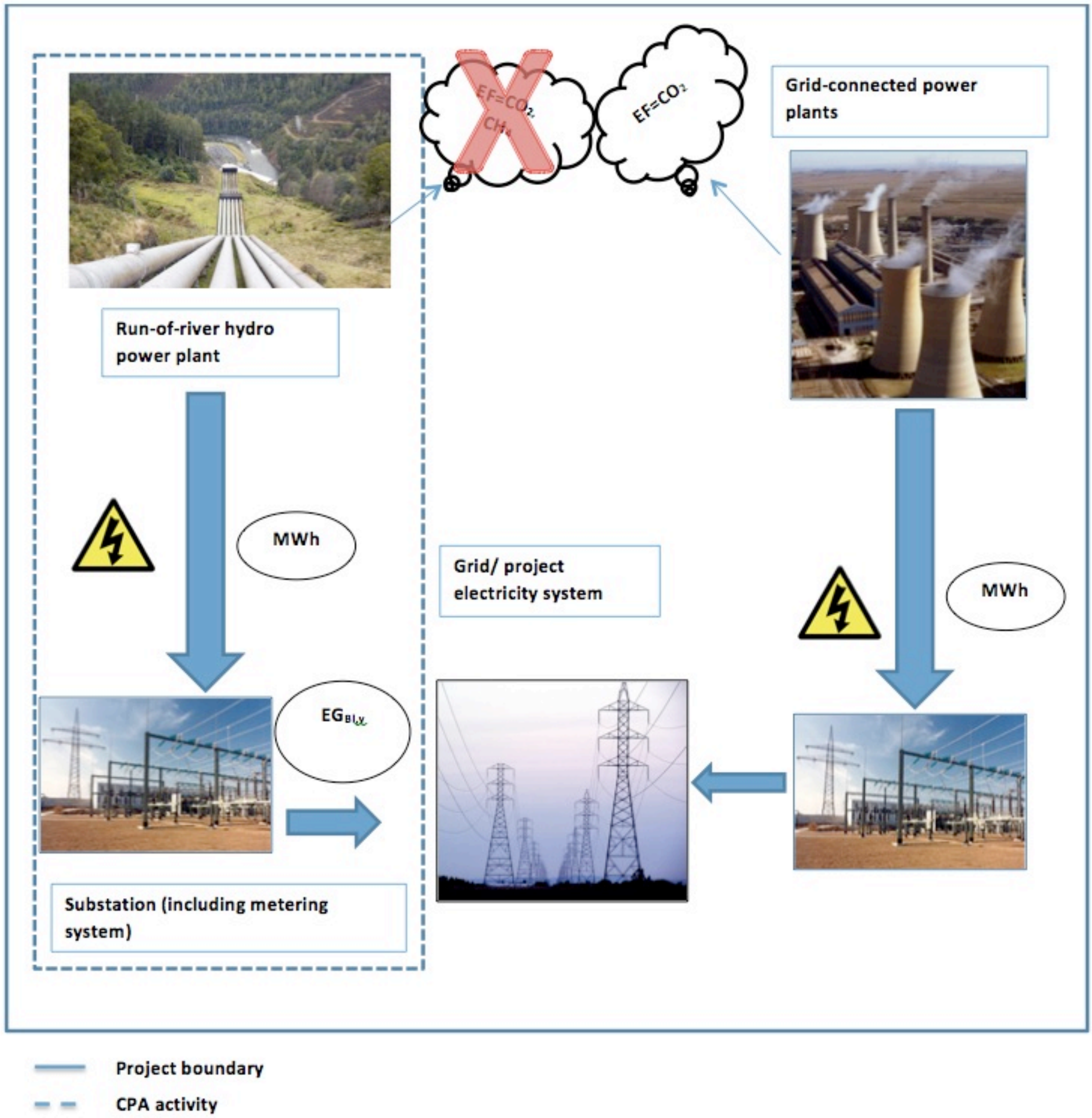

Figure 26: Run-of-river hydro CPA

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National grids in countries in East Africa such as Kenya typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is

currently estimated at 5.3 GW.[37] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in various countries in Kenya:

Table 6: Installed Capacity in MW

	Kenya[38]
Fossil fuel based	407.5
Large hydro	743.3
Small hydro[39]	14.7
Geothermal	198
Wind	5.1
Biomass/gas	26
Solar & other RE	0
Total	1394.6
% Renewable	71%
% Fossil Fuel Based	29%

Figure 3 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

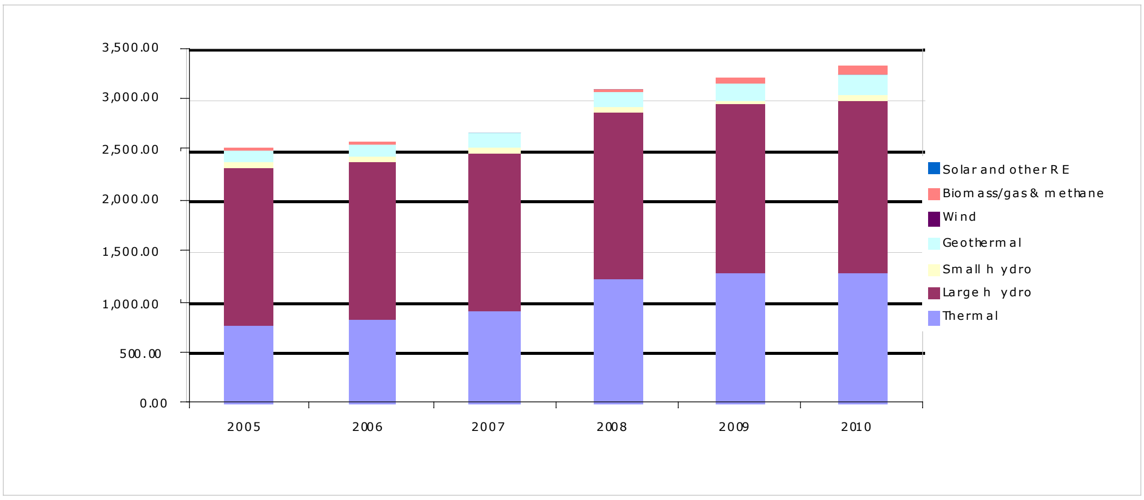

Figure 27: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

Figure 28 shown below represents the installed capacity of grid-connected power plants in Kenya over the period 2005 to 2010.

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[37] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.

[38] Kenya Power and Lighting Company (KPLC) Annual Report and Financial Statements for the Year Ended 30 June 2010

[39] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

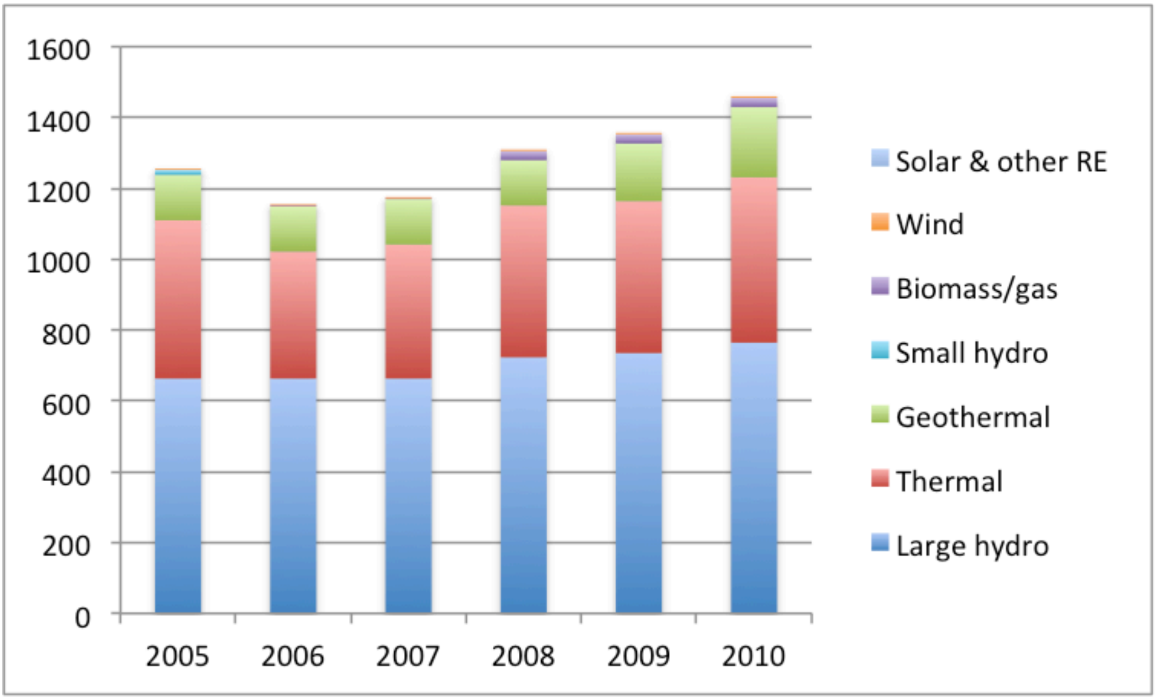


Figure 28: Grid Connected Installed Capacity (MW), 2005-2010 (Kenya)

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 5). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants. This was, for instance, very noticeable in Kenya during the 2009-2010 drought when a number of large hydro power plants had to be closed due to low water levels resulting in a power rationing scheme which lasted for three months. Figure 6 illustrates how during the 2009-2010 drought, electricity generation from hydro power plants in Kenya substantially dropped and was compensated for through an increase of fossil fuel based electricity generation.

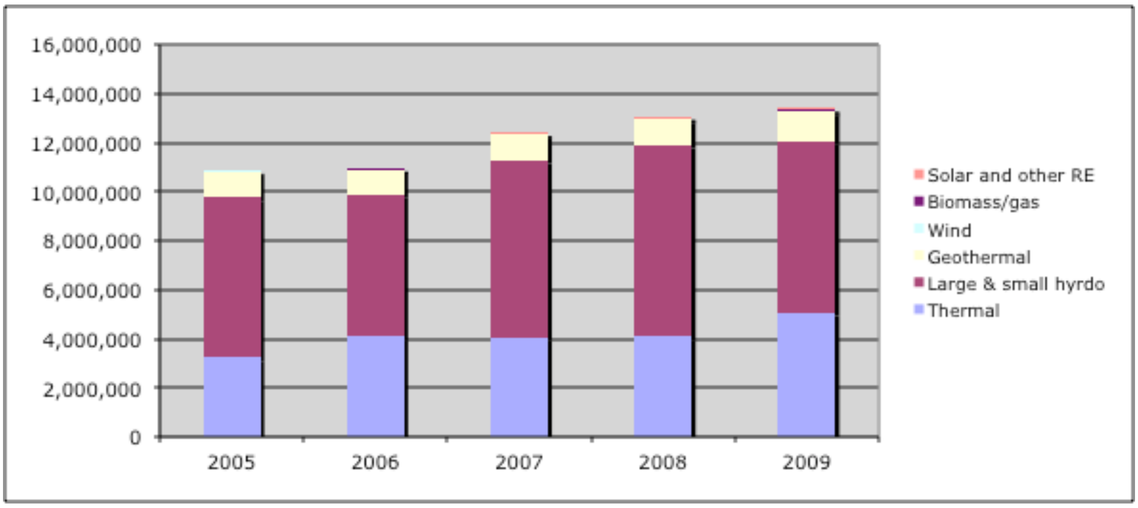


Figure 29: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

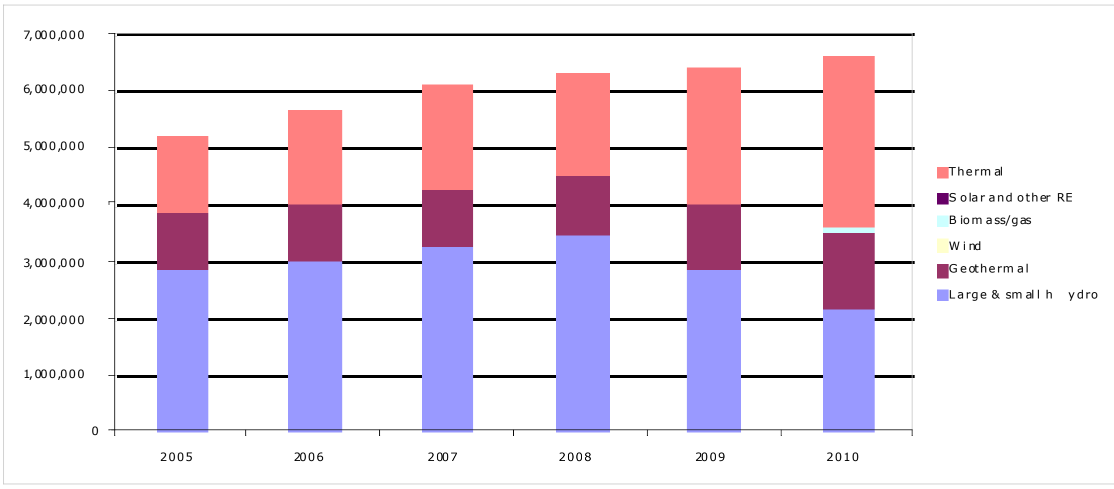


Figure 30: Electricity Generation from Grid-Connected Power Plants by Type in Kenya (MWh), 2005 - 2010

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. The electrification rates in Kenya and Ethiopia are the highest (around 15%) whereby for Kenya the rates are 51% in urban areas and 5% in rural areas. The national average is given as 15%.
.

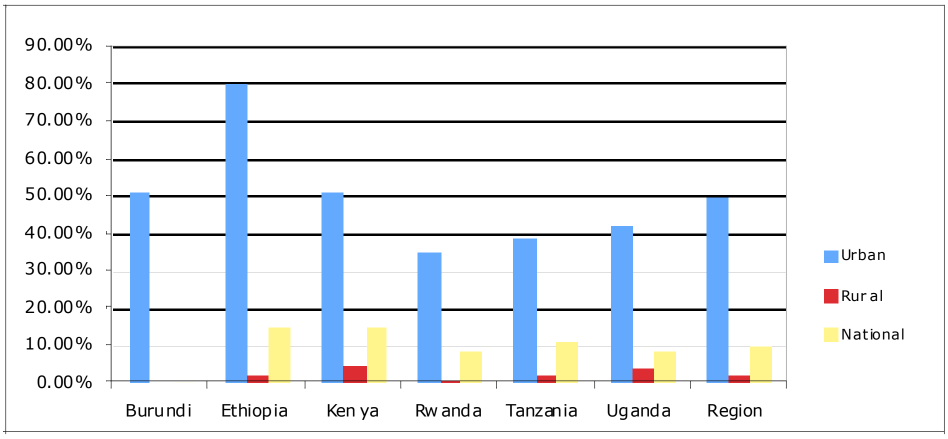


Figure 31: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Kenya has also introduced Feed-in-Tariff policies for renewable energy.

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the “standard” reform model, that

is, unbundling, privatization, and wholesale and retail competition.[40] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[41]

More information regarding the baseline situation in Kenya is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Kenyan boundaries.
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of Activities.	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a hydro energy project, a technology eligible for inclusion in the PoA

[40] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[41] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties <u>or</u> confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for hydro (run-of-river) energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in [district] that is a special underdeveloped zone in Kenya.. or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for hydro energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from hydro (run-of-river) projects. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Kenyan electricity system that is covered by the PoA and will be updated every seven years of the PoA. Hydro energy CPAs in Kenya that are included in the PoA will be using the grid emission factor for the Kenyan electricity grid. Equations and fixed parameter values to calculate the grid emission factor for Kenya are provided in Appendix 4.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (run-of-river) 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 hydro (run-of-river) 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 hydro (run-of-river) power plants, which does not comprise water reservoirs. Therefore there are no emissions from water reservoirs.

This CPA, which involves a hydro (run-of-river) power project, has no project emissions, $PE_y = 0$.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)

PE_y = Project emissions in year *y* (t CO2/y)

LE_y = Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (KENYA)

<table>
<tr><td>Data / Parameter</td><td>CAP_m</td></tr>
<tr><td>Unit</td><td>MW</td></tr>
<tr><td>Description</td><td>Total capacity of off-grid power plants included in off-grid power plant class m</td></tr>
<tr><td>Source of data</td><td>Survey on off grid power plants, as per Annex 2 of the Tool to calculate the emission factor for an electricity system</td></tr>
<tr><td>Value(s) applied</td><td><table>
<tr><td>Off-grid power plant class m</td><td>Total capacity (MW)</td></tr>
<tr><td>Households</td><td>141.39</td></tr>
<tr><td>ICG CAP<=10</td><td>56.62</td></tr>
<tr><td>ICG 10<CAP<=50</td><td>214.88</td></tr>
<tr><td>ICG 50<CAP<=100</td><td>19.01</td></tr>
<tr><td>ICG 100<CAP<=200</td><td>80.68</td></tr>
<tr><td>ICG 200<CAP<=400</td><td>33.56</td></tr>
<tr><td>ICG 400<CAP<=1,000</td><td>12.08</td></tr>
</table></td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>A survey was carried out among 1,174 off-grid power plants. The results of the survey were used to derive global estimates for the total population, for each class of off-grid power plants m, adjusting conservatively for the uncertainty at a 95% confidence level.

In the absence of data information regarding the global population of each stratum, a number of simplifications have been introduced to simplify the global estimates.

• In the analysis, it is assumed that all off-grid power plants use a reciprocating engine system. This is considered conservative because reciprocating engine systems have the highest conversion efficiency (see table in Annex 1 of the Tool to calculate the emission factor for an electricity system)
• In the analysis, it is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because diesel has a higher CO_2 emission factor (0.0726 tCO_2/GJ) than gasoline/ petrol (0.0675 tCO_2/GJ).
• It is assumed that off-grid power plants owned by households fall in the following two capacity classes: <10kW and 10<CAP<=50kW. Therefore, the conversion efficiency for all household off-grid plants is assumed to be 33%.
• Off-grid power plant classes for industrial, commercial and government off-grid plants have been reclassified to correspond with the consumer classes from KPLC.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	**z**
Unit	dimensionless
Description	Standard normal for a 95% confidence level
Source of data	H. Russell Bernard (1995) *Research Methods in Anthropology. Qualitative and Quantitative Approaches.* Altamira Press, London.
Value(s) applied	1.96
Choice of data or Measurement methods and procedures	This is the standard value for standard normal for a confidence level of 95% for a two-tailed test
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$\mathbf{PLF_{default,off\text{-}grid,y}}$
Unit	dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year
Choice of data or Measurement methods and procedures	As per the provisions in step 4 of the *Tool to calculate the emission factor for an electricity system.* Option 3 is chosen to determine $EG_{m,y}$ for off-grid power plants in Step 4 of the *Tool to calculate the emission factor for an electricity system*.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

<table>
<tr><td>Data / Parameter</td><td>$EG_{m,y}$</td></tr>
<tr><td>Unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Net electricity generated by power plant/unit m in year y where m are non low-cost/must run power units</td></tr>
<tr><td>Source of data</td><td>Kenya Power and Lighting Company</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Power Plant</th><th>Generation July08-June09</th><th>Generation July09-June10</th><th>Generation July10-June11</th></tr>
<tr><td>Fiat</td><td>9,101</td><td>-</td><td>-</td></tr>
<tr><td>Kipevu 1 Diesel</td><td>376,410</td><td>316,364</td><td>222,690</td></tr>
<tr><td>Kipevu 3 (GTI)</td><td>98,351</td><td>76,551</td><td>456</td></tr>
<tr><td>Kipevu 3 (GT2)</td><td>85,855</td><td>68,758</td><td>439</td></tr>
<tr><td>IberAfrica</td><td>343,664</td><td>298,726</td><td>352,038</td></tr>
<tr><td>Add.IberAfrica</td><td>-</td><td>322,458</td><td>369,606</td></tr>
<tr><td>Tsavo</td><td>565,775</td><td>494,925</td><td>368,489</td></tr>
<tr><td>Rabai Power</td><td>-</td><td>317,819</td><td>394,223</td></tr>
<tr><td>Aggreko Embakasi 1</td><td>740,476</td><td>409,602</td><td>-</td></tr>
<tr><td>Aggreko (Emb 2)</td><td>39,892</td><td>153,749</td><td>-</td></tr>
<tr><td>Aggreko (Emb 3)</td><td>-</td><td>130,084</td><td>-</td></tr>
<tr><td>Aggreko (Emb 4)</td><td>-</td><td>98,786</td><td>186,116</td></tr>
<tr><td>Aggreko (Emb 5)</td><td>-</td><td>13,190</td><td>80,425</td></tr>
<tr><td>Aggreko (Eldoret)</td><td>133,813</td><td>130,951</td><td>-</td></tr>
<tr><td>Aggreko Naivasha</td><td>-</td><td>159,935</td><td>-</td></tr>
<tr><td>Kipevu Diesel 3 (KPD3)</td><td>-</td><td>-</td><td>267,911</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Data are obtained directly from Kenya Power and Lighting Company, which is the national utility in charge of electricity distribution in the country.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	$EG_{k,y}$
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* where *k* are low-cost/must run power units.
Source of data	Kenya Power and Lighting Company
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Generation July08-June09*	*Generation July09-June10*	*Generation July10-June11*
Gitaru	655,401	457,237	801,654
Kamburu	347,898	244,139	407,527
Kiambere	614,358	546,152	898,770
Kindaruma	156,963	111,202	191,308
Masinga	128,074	60,977	201,075
Tana	43,613	28,674	49,701
Wanji	28,439	27,331	40,389
Sagana	5,810	8,348	8,020
Ndula	2,036	3,439	433
Mesco	2,560	223	-
Sosiani	1,581	1,411	1,538
Turkwel	523,541	335,068	455,102
Gogo	5,631	5,171	6,737
Sondu Miriu	333,149	340,460	364,305
Ngong (Wind)	287	15	-
Ngong 2	-	16,288	17,696
Olkaria 1	368,438	366,191	235,075
Olkaria 2	534,808	572,937	846,245
Orpower4	275,797	399,906	372,498
Mumias	4,230	98,704	87,407
Imenti Tea Factory (Feed in)	-	-	232

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	Energy Regulatory Commission *Schedule of Tariffs* (2008) Electricity generation data obtained from Kenya Power and Lighting Company.
Value(s) applied	

Power Plant	*Fuel Type*	*$FC_{i,m,y}$ (kg) 2008-2009*	*$FC_{i,m,y}$ (kg) 2009-2010*	*$FC_{i,m,y}$ (kg) 2010-2011*
Kipevu Diesel	HFO	81,680,970	68,650,988	48,324,598
Kipevu GT1	Kerosene	30,488,810	23,730,903	141,360
Kipevu GT2	Kerosene	26,615,050	21,314,980	136,090
Tsavo Diesel	HFO	123,904,769	108,388,509	80,699,025
Iberafrica	HFO	77,324,343	67,213,439	79,208,482
Iberafrica 2 (Additional 52.5 MW)	HFO	0	72,230,496	82,791,666
Aggreko Embakasi 1	AGO	170,309,459	94,208,483	0
Aggreko Embakasi 2	AGO	9,175,273	35,362,341	0
Aggreko Embakasi 3	AGO	0	29,268,824	0
Aggreko Embakasi 4	AGO	0	22,226,895	41,876,105
Aggreko Embakasi 5	AGO	0	2,967,716	18,095,607
Aggreko Naivasha	AGO	0	35,985,445	0
Aggreko Eldoret	AGO	31,312,169	30,642,490	0
Rabai	AGO	0	62,642,125	77,701,353
KPD3	HFO	0	0	56,127,396
Fiat	AGO	3,777,003	0	0

Choice of data or Measurement methods and procedures	The Energy Regulatory Commission *Schedule of Tariffs, 2008* provides approved specific fuel consumption data for thermal power plants. These data are provided in kg/kWh and are used by KPLC to calculate the fuel charges on the electricity bills of the consumers. The data can be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant. For simple adjusted OM, fuel consumption is calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option). For BM, fuel consumption is calculated once *ex ante* for the first crediting period, as explained in step 5 of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$NCV_{i,y}$**
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	See table below
Choice of data or Measurement methods and procedures	No data on NCV is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Fuel Type***	***$NCV_{i,y}$ (GJ/kg)***
Kipevu Diesel	HFO	0.0398
Kipevu GT1	Kerosene	0.0420
Kipevu GT2	Kerosene	0.0420
Tsavo Diesel	HFO	0.0398
Iberafrica 1	HFO	0.0398
Iberafrica 2 (additional 52.5 MW)	HFO	0.0398
Aggreko Embakasi 1	AGO	0.0414
Aggreko Embakasi 2	AGO	0.0414
Aggreko Embakasi 3	AGO	0.0414
Aggreko Embakasi 4	AGO	0.0414
Aggreko Embakasi 5	AGO	0.0414
Aggreko Naivasha	AGO	0.0414
Aggreko Eldoret	AGO	0.0414
Rabai	AGO	0.0414
KPD3	HFO	0.0398
Fiat	AGO	0.0414

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* 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	(see table below)
Choice of data or Measurement methods and procedures	No data is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Value(s) applied:

Power Plant	*Fuel Type*	*$EF_{CO2,i,y}$ (tCO_2/GJ)*
Kipevu Diesel	HFO	0.0755
Kipevu GT1	Kerosene	0.0697
Kipevu GT2	Kerosene	0.0697
Tsavo Diesel	HFO	0.0755
Iberafrica 1	HFO	0.0755
Iberafrica 2 (additional 52.5 MW)	HFO	0.0755
Aggreko Embakasi 1	AGO	0.0726
Aggreko Embakasi 2	AGO	0.0726
Aggreko Embakasi 3	AGO	0.0726
Aggreko Embakasi 4	AGO	0.0726
Aggreko Embakasi 5	AGO	0.0726
Aggreko Naivasha	AGO	0.0726
Aggreko Eldoret	AGO	0.0726
Rabai	AGO	0.0726
KPD3	HFO	0.0755
Fiat	AGO	0.0726

Data / Parameter	$EF_{CO2,m,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in off-grid power unit *m* 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	0.0675
Choice of data or Measurement methods and procedures	It is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because gasoline/petrol has a lower CO_2 emission factor than diesel. No data is available from power generation plants. Therefore, the IPCC value has been used.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net energy conversion efficiency of off-grid power unit *m.*
Source of data	The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Energy conversion efficiencies are based on the values in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system.* It is assumed that all off-grid power plants use reciprocating engine systems. This is considered conservative because the reciprocating engine systems have the highest net energy conversion efficiencies.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Value(s) applied:

Off-grid power class *m*	Efficiency ($\eta_{m,y}$)
Households	33%
IC[42] CAP<=10	28%
IC 10<CAP<=50	33%
IC 50<CAP<=100	35%
IC 100<CAP<=200	37%
IC 200<CAP<=400	39%
IC 400<CAP<=1,000	42%

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

[42] Industrial and commercial

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$
The combined margin emission factor for the grid is calculated using the following equations:

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for hydro SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	0.49000	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	0.65530	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	0.57265	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = 0.57265 tCO2/MWh

BE_y = [Insert] * 0.57265 = [Insert] tCO2/year

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (run-of-river) 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 hydro (run-of-river) 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 hydro (run-of-river) power plants, which does not comprise water reservoirs. Therefore there are no emissions from water reservoirs.

This CPA, which involves a hydro (run-of-river) power project, has no project emissions, $PE_y = 0$.

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)

PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

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

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

CPA implementing entity

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

Metering will be conducted with calibrated measurement equipment according to the national standards

and reference points or IEC standards as agreed with the grid operator.

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

Parameter	**Description**	**Type of CPA**
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 6: Hydro (with accumulation reservoir) project in Kenya

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected hydro (with accumulation reservoir) project.

The generic SSC-CPA comprises the implementation and operation of a hydro (with accumulation reservoir) power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Kenyan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology

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

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation*" (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[43]:

Applicability criteria	Project activity
This methodology comprises renewable energy generation	The generic SSC-CPA under the

[43] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Programme will use hydropower energy that will supply electricity to the Kenyan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	For SSC-CPAs under the PoA that implement a hydro power plant with a reservoir at least one of the following conditions will be satisfied: • The SSC-CPA is implemented in an existing reservoir with no change in the volume of reservoir; • The SSC-CPA is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the SSC-CPA, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The SSC-CPA results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.

In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from hydro (with accumulation reservoir) energy and its supply to the Kenyan grid system.
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 Kenya This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) since it is a hydro (with accumulated reservoir) energy project
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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 Kenyan national grid system constitute the project boundary.

The sources and gases included in the SSC-CPA boundary for individual hydro (with accumulation reservoir) CPAs is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source

Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for hydro (with accumulation reservoir) projects
		CH_4	No	Not applicable for hydro (with accumulation reservoir) projects
		N_2O	No	Not applicable for hydro (with accumulation reservoir) projects
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for hydro (with accumulation reservoir) projects
		CH_4	No	Not applicable for hydro (with accumulation reservoir) projects
		N_2O	No	Not applicable for hydro (with accumulation reservoir) projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source

The figure below provides a flow chart 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 generic hydro (with accumulation reservoir) CPA.

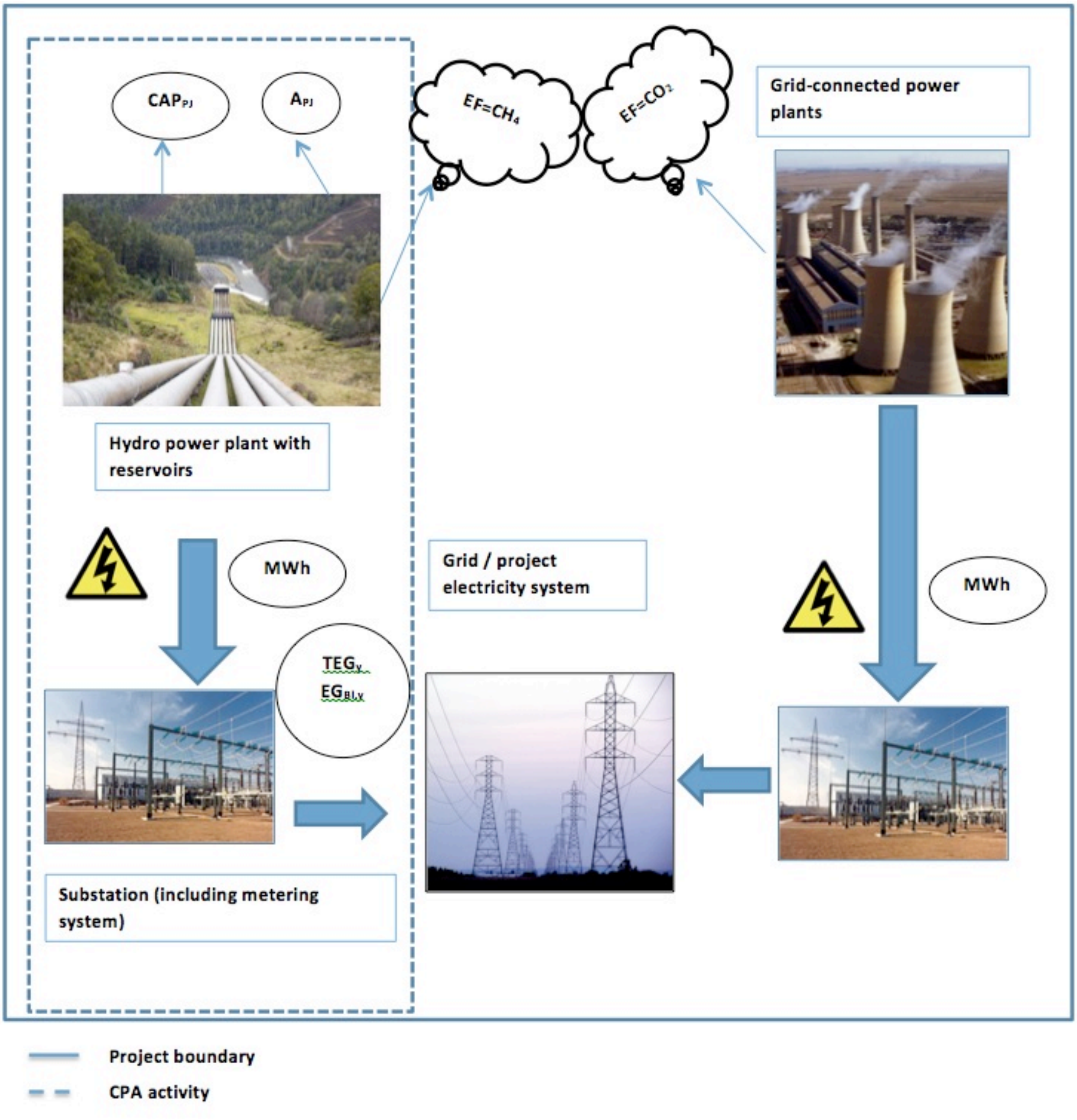


Figure 32: Hydro CPA with accumulation reservoir

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National grids in countries in East Africa such as Kenya typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[44] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in various countries in Kenya:

Table 7: Installed Capacity in MW

	Kenya[45]
Fossil fuel based	407.5
Large hydro	743.3
Small hydro[46]	14.7
Geothermal	198
Wind	5.1
Biomass/gas	26
Solar & other RE	0
Total	1394.6
% Renewable	71%
% Fossil Fuel Based	29%

Figure 3 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

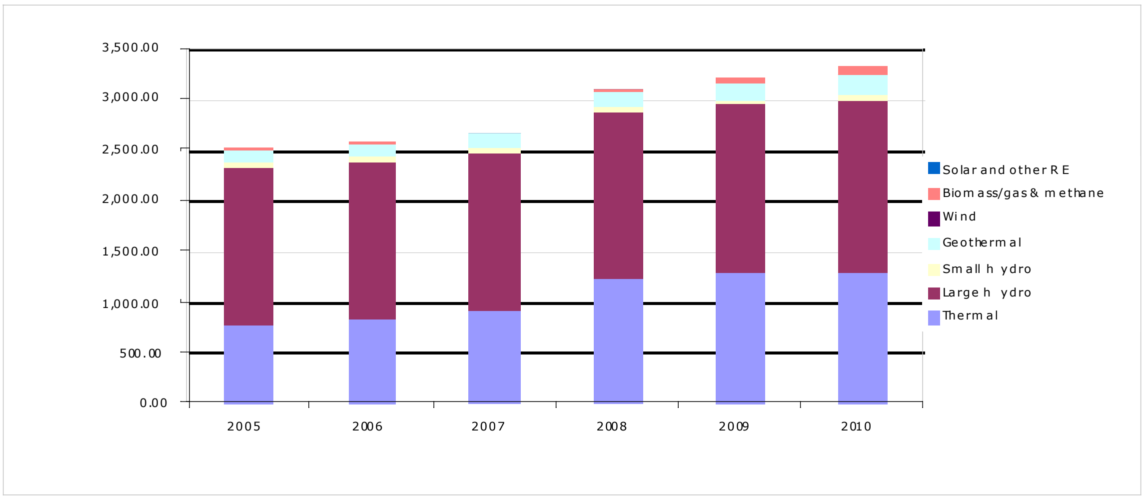


Figure 33: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[44] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.

[45] Kenya Power and Lighting Company (KPLC) Annual Report and Financial Statements for the Year Ended 30 June 2010

[46] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 34 shown below represents the installed capacity of grid-connected power plants in Kenya over the period 2005 to 2010.

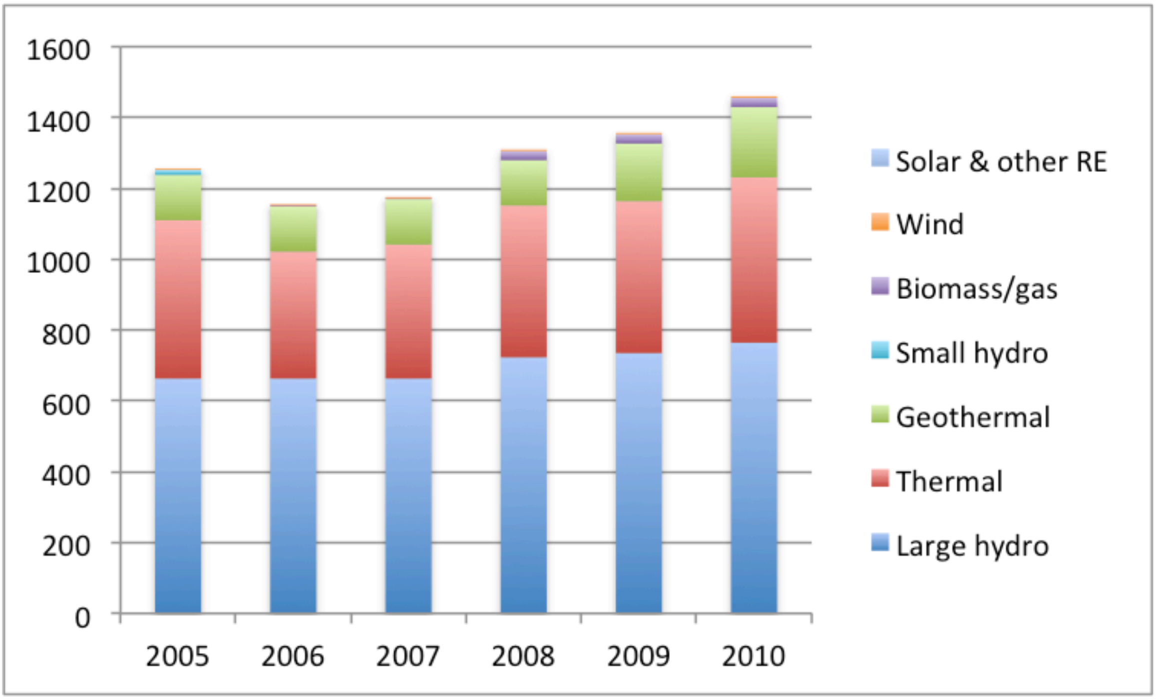


Figure 34: Grid Connected Installed Capacity (MW), 2005-2010 (Kenya)

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 5). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants. This was, for instance, very noticeable in Kenya during the 2009-2010 drought when a number of large hydro power plants had to be closed due to low water levels resulting in a power rationing scheme which lasted for three months. Figure 6 illustrates how during the 2009-2010 drought, electricity generation from hydro power plants in Kenya substantially dropped and was compensated for through an increase of fossil fuel based electricity generation.

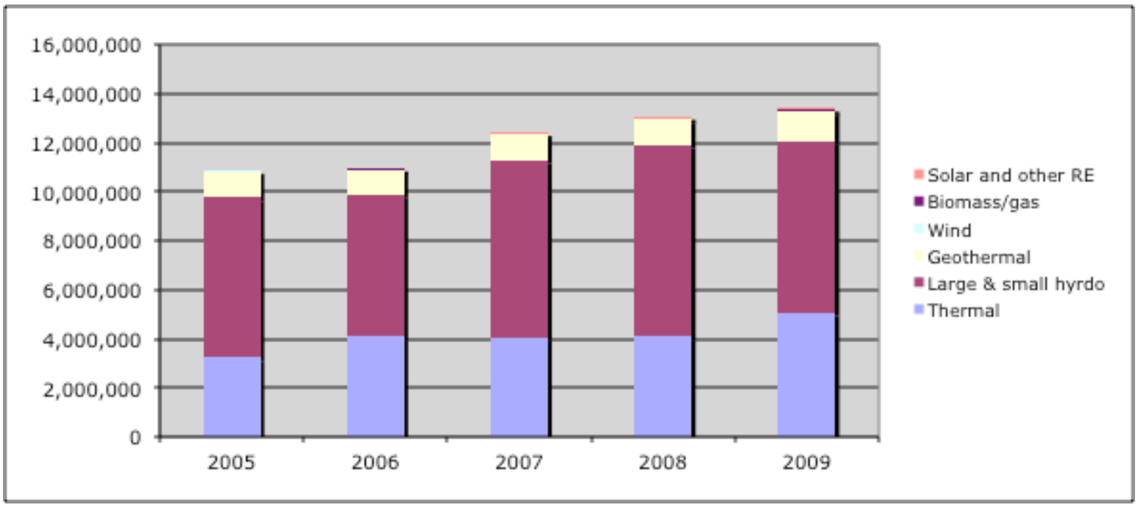


Figure 35: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

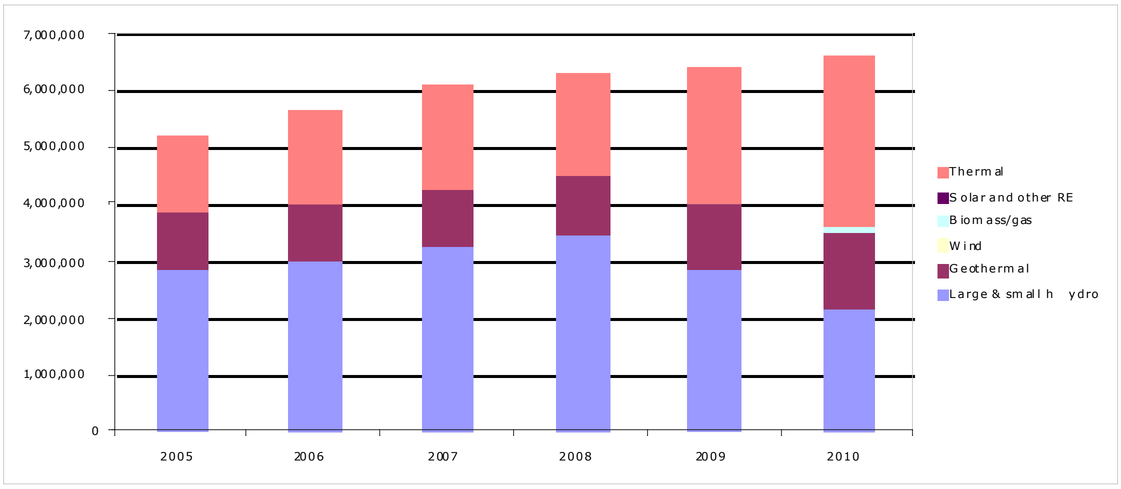


Figure 36: Electricity Generation from Grid-Connected Power Plants by Type in Kenya (MWh), 2005 - 2010

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. The electrification rates in Kenya and Ethiopia are the highest (around 15%) whereby for Kenya the rates are 51% in urban areas and 5% in rural areas. The national average is given as 15%.
.

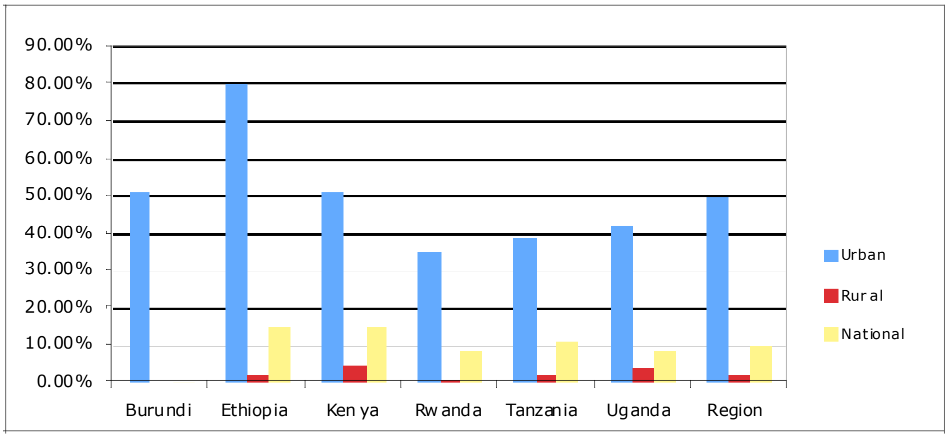


Figure 37: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Kenya has also introduced Feed-in-Tariff policies for renewable energy.

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that is, unbundling, privatization, and wholesale and retail competition.[47] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[48]

More information regarding the baseline situation in Kenya is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Kenyan boundaries.
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a hydro energy project, a technology eligible for inclusion in the PoA

47 Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

48 Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

		excluded from this Programme of Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Kenyan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for hydro (with accumulation reservoir) energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in [district] that is a special underdeveloped zone in Kenya. or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for hydro energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from hydro (with accumulation reservoir) Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Kenyan electricity system that is covered by the PoA and will be updated every seven years of the PoA. Hydro energy CPAs in Kenya that are included in the PoA will be using the grid emission factor for the Kenyan electricity grid. Equations and fixed parameter values to calculate the grid emission factor for Kenya are provided in Appendix 4.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (with accumulation reservoir) 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 hydro (with accumulation reservoir) 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 ($PE_{HP,y}$)

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

(a) If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2, **equation 3** in ACM0002 (version 13.0.0) will be used to calculate $PE_{HP,y}$:

$$PE_{HP,y} = (EF_{Res} – TEG_y) / 1000$$

Where:

$PE_{HP,y}$	=	Project emissions from water reservoirs (tCO2e/yr)
EF_{Res}	=	Default emission factor for emissions from reservoirs of hydro power plants in year *y* (kgCO2e/MWh)
TEG_y	=	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

According to the methodology, the default value for EF_{Res} is used, 90 kgCO_2e/MWh.

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

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

The power density of the project activity (*PD*) will be calculated using **equation (5)** in ACM0002 version 13.0.0, as follows:

$$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL})$$

Where:

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

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR HYDRO PROJECT ACTIVITIES (WITH ACCUMULATION RESERVOIR)

Data / Parameter	Cap_{BL}
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
Source of data	Project site
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	Determine the installed capacity based on recognized standards
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

Data / Parameter	A_{BL}
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (KENYA)

<table>
<tr><td>Data / Parameter</td><td>CAP_m</td></tr>
<tr><td>Unit</td><td>MW</td></tr>
<tr><td>Description</td><td>Total capacity of off-grid power plants included in off-grid power plant class m</td></tr>
<tr><td>Source of data</td><td>Survey on off grid power plants, as per Annex 2 of the Tool to calculate the emission factor for an electricity system</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><td>Off-grid power plant class m</td><td>Total capacity (MW)</td></tr>
<tr><td>Households</td><td>141.39</td></tr>
<tr><td>ICG CAP<=10</td><td>56.62</td></tr>
<tr><td>ICG 10<CAP<=50</td><td>214.88</td></tr>
<tr><td>ICG 50<CAP<=100</td><td>19.01</td></tr>
<tr><td>ICG 100<CAP<=200</td><td>80.68</td></tr>
<tr><td>ICG 200<CAP<=400</td><td>33.56</td></tr>
<tr><td>ICG 400<CAP<=1,000</td><td>12.08</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>A survey was carried out among 1,174 off-grid power plants. The results of the survey were used to derive global estimates for the total population, for each class of off-grid power plants m, adjusting conservatively for the uncertainty at a 95% confidence level.

In the absence of data information regarding the global population of each stratum, a number of simplifications have been introduced to simplify the global estimates.

In the analysis, it is assumed that all off-grid power plants use a reciprocating engine system. This is considered conservative because reciprocating engine systems have the highest conversion efficiency (see table in Annex 1 of the Tool to calculate the emission factor for an electricity system)
In the analysis, it is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because diesel has a higher CO_2 emission factor (0.0726 tCO_2/GJ) than gasoline/ petrol (0.0675 tCO_2/GJ).
It is assumed that off-grid power plants owned by households fall in the following two capacity classes: <10kW and 10<CAP<=50kW. Therefore, the conversion efficiency for all household off-grid plants is assumed to be 33%.
Off-grid power plant classes for industrial, commercial and government off-grid plants have been reclassified to correspond with the consumer classes from KPLC.
</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	**z**
Unit	dimensionless
Description	Standard normal for a 95% confidence level
Source of data	H. Russell Bernard (1995) *Research Methods in Anthropology. Qualitative and Quantitative Approaches.* Altamira Press, London.
Value(s) applied	1.96
Choice of data or Measurement methods and procedures	This is the standard value for standard normal for a confidence level of 95% for a two-tailed test
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	$\mathbf{PLF_{default,off\text{-}grid,y}}$
Unit	dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year
Choice of data or Measurement methods and procedures	As per the provisions in step 4 of the *Tool to calculate the emission factor for an electricity system.* Option 3 is chosen to determine $EG_{m,y}$ for off-grid power plants in Step 4 of the *Tool to calculate the emission factor for an electricity system*.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$EG_{m,y}$**
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y* where *m* are non low-cost/must run power units
Source of data	Kenya Power and Lighting Company
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the national utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	***Generation July08-June09***	***Generation July09-June10***	***Generation July10-June11***
Fiat	9,101	-	-
Kipevu 1 Diesel	376,410	316,364	222,690
Kipevu 3 (GTI)	98,351	76,551	456
Kipevu 3 (GT2)	85,855	68,758	439
IberAfrica	343,664	298,726	352,038
Add.IberAfrica	-	322,458	369,606
Tsavo	565,775	494,925	368,489
Rabai Power	-	317,819	394,223
Aggreko Embakasi 1	740,476	409,602	-
Aggreko (Emb 2)	39,892	153,749	-
Aggreko (Emb 3)	-	130,084	-
Aggreko (Emb 4)	-	98,786	186,116
Aggreko (Emb 5)	-	13,190	80,425
Aggreko (Eldoret)	133,813	130,951	-
Aggreko Naivasha	-	159,935	-
Kipevu Diesel 3 (KPD3)	-	-	267,911

Data / Parameter	$EG_{k,y}$
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* where *k* are low-cost/must run power units.
Source of data	Kenya Power and Lighting Company
Value(s) applied	(see table below)
Choice of data or Measurement methods and procedures	Data are obtained directly from Kenya Power and Lighting Company, which is the utility in charge of electricity distribution in the country.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Generation July08-June09*	*Generation July09-June10*	*Generation July10-June11*
Gitaru	655,401	457,237	801,654
Kamburu	347,898	244,139	407,527
Kiambere	614,358	546,152	898,770
Kindaruma	156,963	111,202	191,308
Masinga	128,074	60,977	201,075
Tana	43,613	28,674	49,701
Wanji	28,439	27,331	40,389
Sagana	5,810	8,348	8,020
Ndula	2,036	3,439	433
Mesco	2,560	223	-
Sosiani	1,581	1,411	1,538
Turkwel	523,541	335,068	455,102
Gogo	5,631	5,171	6,737
Sondu Miriu	333,149	340,460	364,305
Ngong (Wind)	287	15	-
Ngong 2	-	16,288	17,696
Olkaria 1	368,438	366,191	235,075
Olkaria 2	534,808	572,937	846,245
Orpower4	275,797	399,906	372,498
Mumias	4,230	98,704	87,407
Imenti Tea Factory (Feed in)	-	-	232

Data / Parameter	$FC_{i,m,y}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data	Energy Regulatory Commission *Schedule of Tariffs* (2008) Electricity generation data obtained from Kenya Power and Lighting Company.
Value(s) applied	

Power Plant	***Fuel Type***	***$FC_{i,m,y}$ (kg) 2008-2009***	***$FC_{i,m,y}$ (kg) 2009-2010***	***$FC_{i,m,y}$ (kg) 2010-2011***
Kipevu Diesel	HFO	81,680,970	68,650,988	48,324,598
Kipevu GT1	Kerosene	30,488,810	23,730,903	141,360
Kipevu GT2	Kerosene	26,615,050	21,314,980	136,090
Tsavo Diesel	HFO	123,904,769	108,388,509	80,699,025
Iberafrica	HFO	77,324,343	67,213,439	79,208,482
Iberafrica 2 (Additional 52.5 MW)	HFO	0	72,230,496	82,791,666
Aggreko Embakasi 1	AGO	170,309,459	94,208,483	0
Aggreko Embakasi 2	AGO	9,175,273	35,362,341	0
Aggreko Embakasi 3	AGO	0	29,268,824	0
Aggreko Embakasi 4	AGO	0	22,226,895	41,876,105
Aggreko Embakasi 5	AGO	0	2,967,716	18,095,607
Aggreko Naivasha	AGO	0	35,985,445	0
Aggreko Eldoret	AGO	31,312,169	30,642,490	0
Rabai	AGO	0	62,642,125	77,701,353
KPD3	HFO	0	0	56,127,396
Fiat	AGO	3,777,003	0	0

Choice of data or Measurement methods and procedures	The Energy Regulatory Commission *Schedule of Tariffs, 2008* provides approved specific fuel consumption data for thermal power plants. These data are provided in kg/kWh and are used by KPLC to calculate the fuel charges on the electricity bills of the consumers. The data can be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant. For simple adjusted OM, fuel consumption is calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option). For BM, fuel consumption is calculated once *ex ante* for the first crediting period, as explained in step 5 of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$NCV_{i,y}$**
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	(see table below)
Choice of data or Measurement methods and procedures	No data on NCV is available from power generation plants.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Power Plant	*Fuel Type*	*$NCV_{i,y}$ (GJ/kg)*
Kipevu Diesel	HFO	0.0398
Kipevu GT1	Kerosene	0.0420
Kipevu GT2	Kerosene	0.0420
Tsavo Diesel	HFO	0.0398
Iberafrica 1	HFO	0.0398
Iberafrica 2 (additional 52.5 MW)	HFO	0.0398
Aggreko Embakasi 1	AGO	0.0414
Aggreko Embakasi 2	AGO	0.0414
Aggreko Embakasi 3	AGO	0.0414
Aggreko Embakasi 4	AGO	0.0414
Aggreko Embakasi 5	AGO	0.0414
Aggreko Naivasha	AGO	0.0414
Aggreko Eldoret	AGO	0.0414
Rabai	AGO	0.0414
KPD3	HFO	0.0398
Fiat	AGO	0.0414

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,i,y}$</td></tr>
<tr><td>Unit</td><td>tCO_2/GJ</td></tr>
<tr><td>Description</td><td>CO_2 emission factor of fossil fuel type i used in power unit m in year y</td></tr>
<tr><td>Source of data</td><td>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.</td></tr>
<tr><td>Value(s) applied</td><td>
<table>
<tr><th>Power Plant</th><th>Fuel Type</th><th>$EF_{CO2,i,y}$ (tCO_2/GJ)</th></tr>
<tr><td>Kipevu Diesel</td><td>HFO</td><td>0.0755</td></tr>
<tr><td>Kipevu GT1</td><td>Kerosene</td><td>0.0697</td></tr>
<tr><td>Kipevu GT2</td><td>Kerosene</td><td>0.0697</td></tr>
<tr><td>Tsavo Diesel</td><td>HFO</td><td>0.0755</td></tr>
<tr><td>Iberafrica 1</td><td>HFO</td><td>0.0755</td></tr>
<tr><td>Iberafrica 2 (additional 52.5 MW)</td><td>HFO</td><td>0.0755</td></tr>
<tr><td>Aggreko Embakasi 1</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>Aggreko Embakasi 2</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>Aggreko Embakasi 3</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>Aggreko Embakasi 4</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>Aggreko Embakasi 5</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>Aggreko Naivasha</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>Aggreko Eldoret</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>Rabai</td><td>AGO</td><td>0.0726</td></tr>
<tr><td>KPD3</td><td>HFO</td><td>0.0755</td></tr>
<tr><td>Fiat</td><td>AGO</td><td>0.0726</td></tr>
</table>
</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>No data is available from power generation plants.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>See appendix 4 on the Kenyan grid emission factor</td></tr>
</table>

Data / Parameter	**$EF_{CO2,m,i,y}$**
Unit	tCO_2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in off-grid power unit *m* 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	0.0675
Choice of data or Measurement methods and procedures	It is assumed that all off-grid power plants use gasoline/petrol. This is considered conservative because gasoline/petrol has a lower CO_2 emission factor than diesel. No data is available from power generation plants. Therefore, the IPCC value has been used.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Data / Parameter	**$\eta_{m,y}$**
Unit	-
Description	Average net energy conversion efficiency of off-grid power unit *m.*
Source of data	The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	see table below
Choice of data or Measurement methods and procedures	Energy conversion efficiencies are based on the values in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system.* It is assumed that all off-grid power plants use reciprocating engine systems. This is considered conservative because the reciprocating engine systems have the highest net energy conversion efficiencies.
Purpose of data	Calculation of baseline emissions
Additional comment	See appendix 4 on the Kenyan grid emission factor

Value(s) applied:

Off-grid power class *m*	Efficiency ($\eta_{m,y}$)
Households	33%
IC[49] CAP<=10	28%
IC 10<CAP<=50	33%
IC 50<CAP<=100	35%
IC 100<CAP<=200	37%
IC 200<CAP<=400	39%
IC 400<CAP<=1,000	42%

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

[49] Industrial and commercial

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for hydro SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	0.49000	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	0.65530	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	0.57265	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = 0.57265 tCO2/MWh

BE_y = [Insert] * 0.57265 = [Insert] tCO2/year

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (with accumulation reservoir) 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 hydro (with accumulation reservoir) 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 ($PE_{HP,y}$)

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir. The project emissions will depend on the power density of the single or multiple reservoirs.

The power density of the single or multiple reservoirs (*PD*) will be calculated using **equation (5)** in ACM0002 version 13.0.0, as follows:

$$PD = (Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL})$$

Where:

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

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

The table(s) provide(s) an overview of the parameter values used to calculate the power density of the single or multiple reservoirs:

Parameter	Value	Unit	Source
Cap_{PJ}	[insert value]	[insert unit]	[insert source]
Cap_{BL}	[insert value]	[insert unit]	[insert source]
A_{PJ}	[insert value]	[insert unit]	[insert source]
A_{BL}	[insert value]	[insert unit]	[insert source]

The power density of the single or multiple reservoirs equals [insert value] W/m^2. Therefore, the following formula is used to calculate the project emissions:

(a) If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2 **equation 3** in ACM0002 (version 13.0.0) will be used to calculate $PE_{HP,y}$:

$$PE_{HP,y} = (EF_{Res} - TEG_y) / 1000$$

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs (tCO2e/yr)

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants in year *y* (kgCO2e/MWh)

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

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the water reservoir:

Parameter	Value	Unit	Source
EF_{Res}	90	kgCO2e/MWh	ACM0002 version 13.0.0
TEG_y	[insert value]	[insert unit]	[insert source]
$PE_{HP,y}$	[insert value]	[insert unit]	Calculated

b) If the power density of the single or multiple reservoirs (*PD*) is greater than 10 W/m^2:

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

Total Project Emission for the project activity equal:

PE_y = 0 + 0 + [insert value]

PE_y = [insert value]

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR HYDRO PROJECTS (WITH ACCUMULATION RESERVOIR)

Data / Parameter	TEG_Y
Unit	MWh/yr
Description	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Electricity meters
Monitoring frequency	Continuous measurement and at least monthly recording.
QA/QC procedures	Calculation of project emissions
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2

Data / Parameter	CAP_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data	Project site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Determine the installed capacity based on recognized standards
Monitoring frequency	Monitoring must be done on an annual basis
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

Data / Parameter	A_{PJ}
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc
Monitoring frequency	Monitoring must be done on an annual basis
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

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

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

CPA implementing entity

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

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

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

Project activities using hydro technologies (with accumulated reservoir) will also monitor and keep records of additional parameters as specified in section B. 7.1. Additional parameter values will be reported on a quarterly basis with supporting evidence (if applicable). These parameters are listed in the table below:

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All
TEG_Y	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*	Hydro CPAs with reservoirs
CAP_{PJ}	Installed capacity of the hydro power plant after the implementation of the project activity.	Hydro CPAs with reservoirs
A_{PJ}	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project	Hydro CPAs with reservoirs

	activity, when the reservoir is full.	

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures.

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 7: Wind energy project in Rwanda

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected wind energy project.

The generic SSC-CPA comprises the implementation and operation of a wind power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Rwandan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation*" (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[50]:

Applicability criteria	**Project activity**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind,	The generic SSC-CPA under the Programme will use wind energy that will

[50] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	supply electricity to the Rwandan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from wind energy and its supply to the Rwandan grid system.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is located in Rwanda. This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02), as it is a wind energy project.
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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.

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

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for wind energy projects
		CH_4	No	Not applicable for wind energy projects
		N_2O	No	Not applicable for wind energy projects

	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for wind energy projects
		CH_4	No	Not applicable for wind energy projects
		N_2O	No	Not applicable for wind energy projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for wind energy projects
		CH_4	No	Not applicable for wind energy projects
		N_2O	No	Not applicable for wind energy projects

The figure below provides a flow chart 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 generic wind CPA.

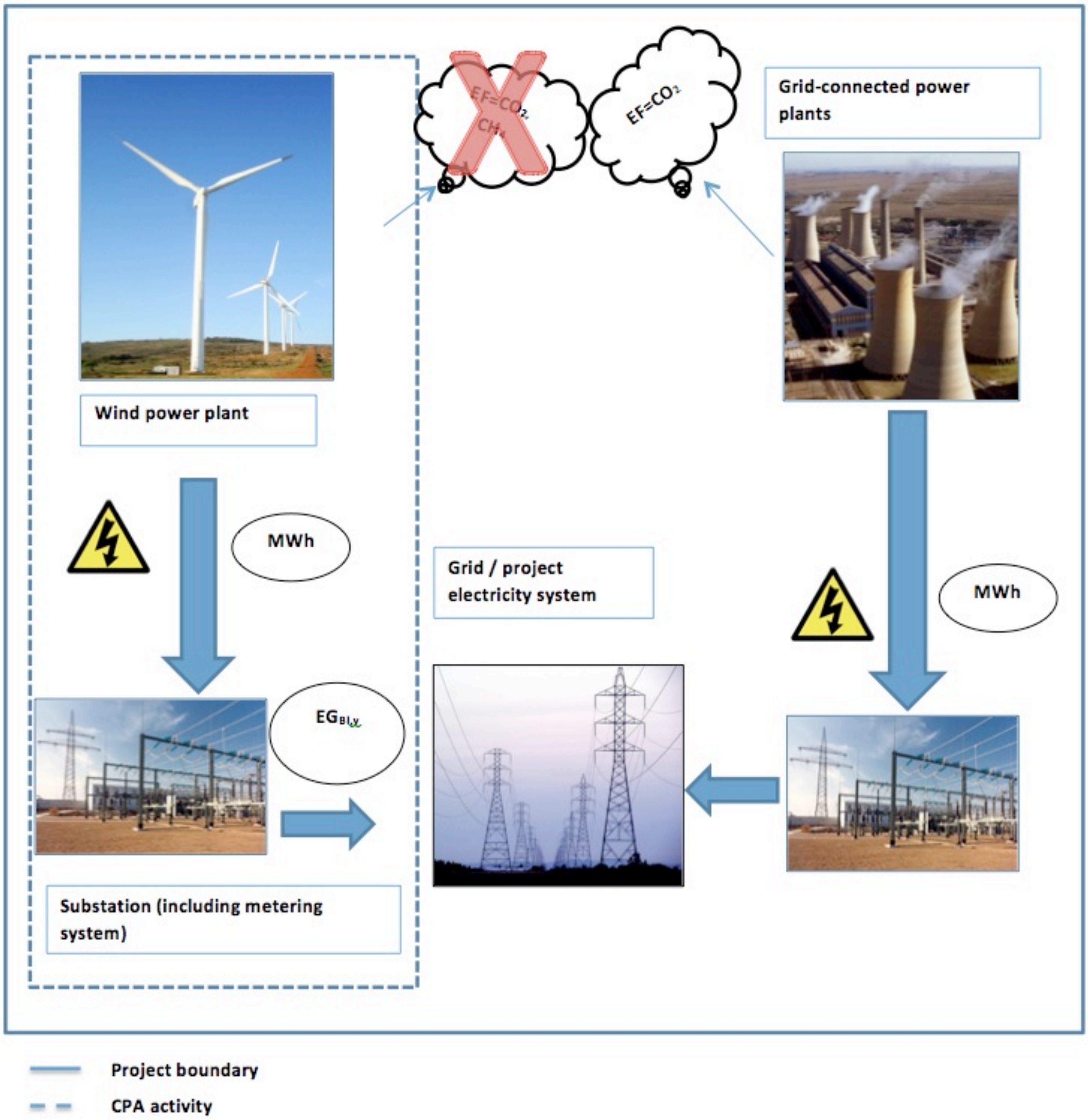


Figure 38: Wind CPA

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National electricity grids in countries in East Africa such as Rwanda typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[51] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in Rwanda.

Table 8: Installed Capacity in MW

	Rwanda[52]
Fossil fuel based	29.37
Large hydro	24.26
Small hydro[53]	3
Geothermal	0
Wind	0
Biomass/gas	0
Solar & other RE	0.25
Total	56.88
% Renewable	48%
% Fossil Fuel Based	52%

Figure 39 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

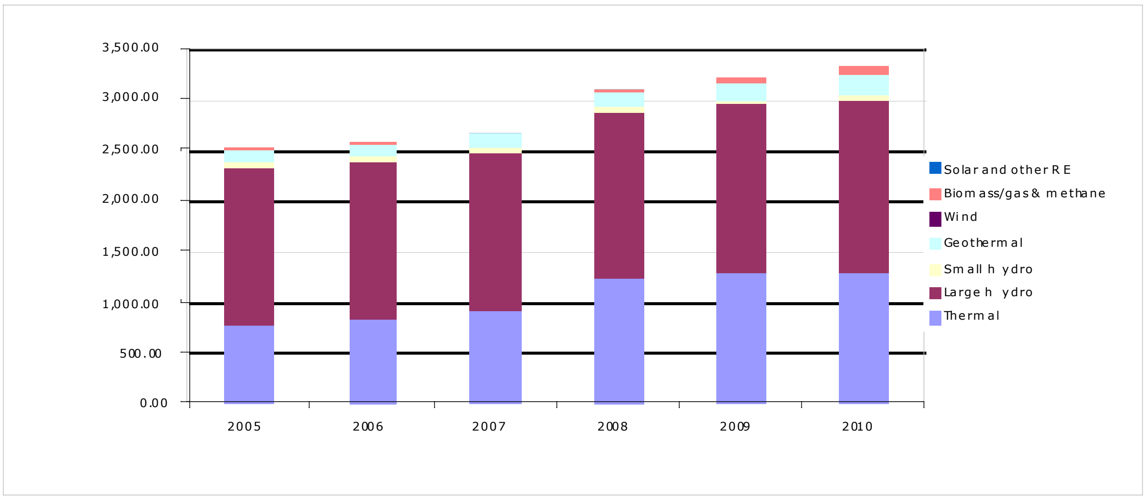


Figure 39: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[51] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.
[52] Rwanda Environment Management Authority (REMA) Energy Resources http://www.rema.gov.rw/soe/chap8.php (accessed on 7 September 2011)
[53] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 40 below represents the installed capacity of grid-connected power plants in Rwanda over the period 2005 to 2010.

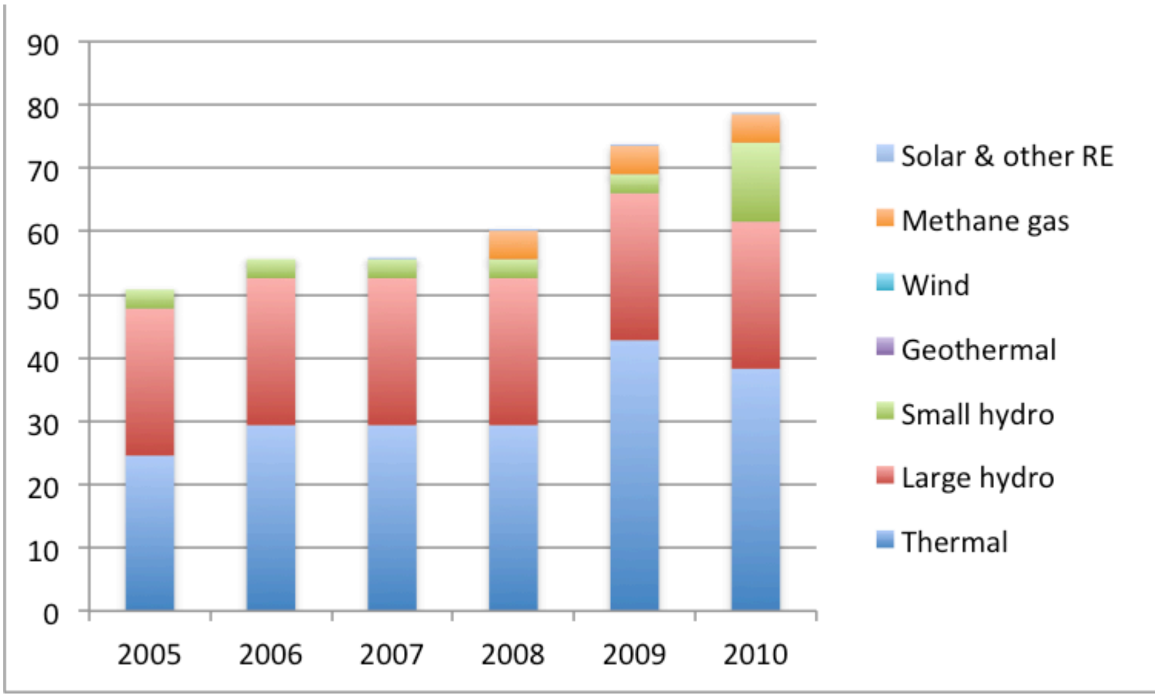


Figure 40: Grid - Connected Installed Capacity (MW) -Rwanda

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 41). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants.

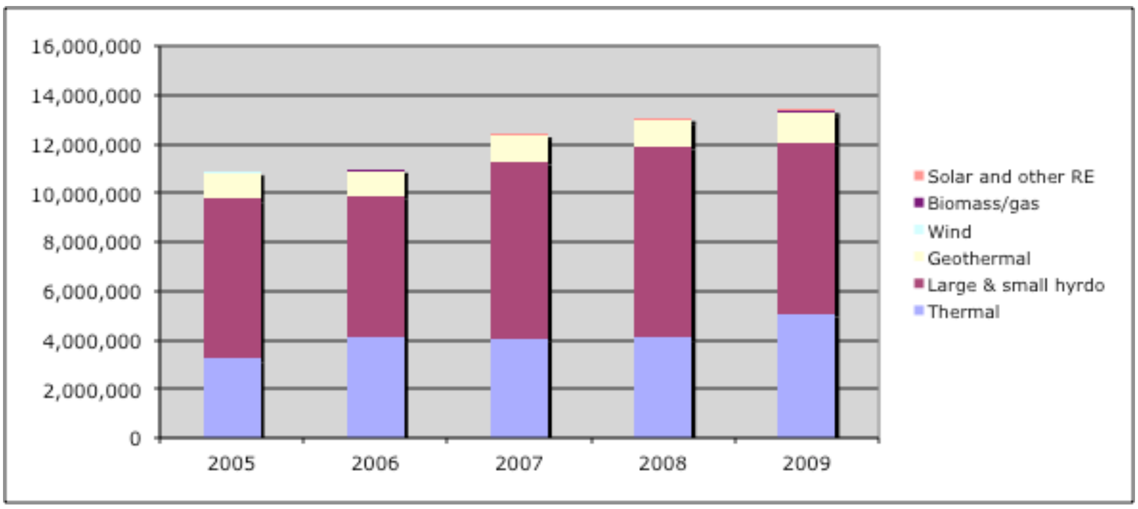


Figure 41: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

Figure 42 below shows the generation from grid-connected power plants by type in Rwanda.

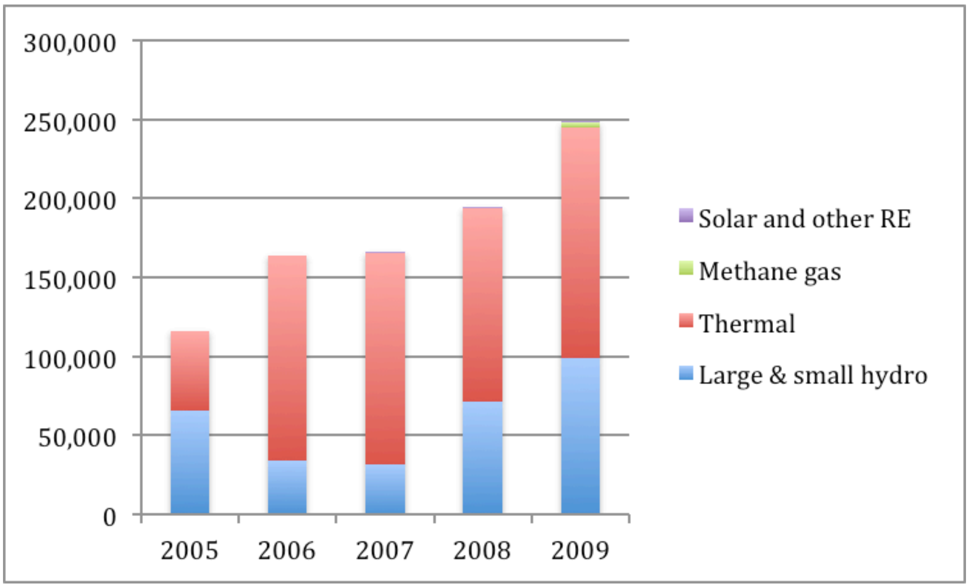


Figure 42: Generation from Grid- Connected Power Plants by Type (MWh), 2005-2009 -Rwanda

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. In Rwanda, the electrification rates are 35% in urban areas and 1% in the rural areas. The national electrification rate is 9%.

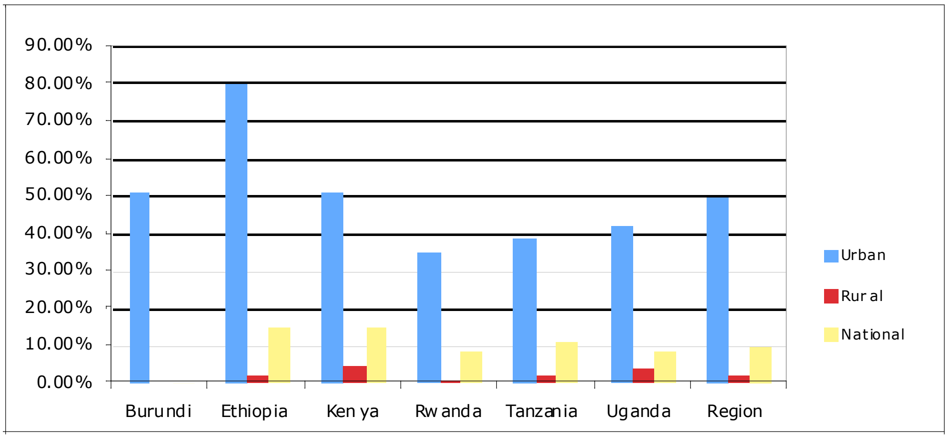


Figure 43: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Some countries have also introduced Feed-in-Tariff policies for renewable energy (e.g. Kenya and Uganda).

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the “standard” reform model, that

is, unbundling, privatization, and wholesale and retail competition.[54] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[55]

More information regarding the baseline situation in Rwanda is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Rwandan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of Activities.	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a wind energy project, a technology eligible for inclusion in the PoA

[54] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

[55] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for wind energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in Rwanda which is a Least Developed Country (LDC). or The CPA employs [technology] which is a recommended technology by the Rwandan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for wind energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from wind energy. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Rwandan electricity system that is covered by the PoA for each specific CPA and will be updated after the end of each crediting period of the CPA or annually depending on the data vintage applied following guidelines in the latest version of the *tool to calculate the emission factor for an electricity system*.

Project emissions

For most renewable energy project activities such as wind energy projects $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro

power plants with water reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves wind 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 wind 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 wind power plants, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

This CPA, which involves a wind power project, has no project emissions, $PE_y = 0$.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)

PE_y = Project emissions in year *y* (t CO2/y)

LE_y = Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (RWANDA)

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ/mass or volume unit</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) of fossil fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>Values provided by the fuel supplier of the power plants in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default
values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data
or
Measurement methods and procedures</td><td>Monitoring frequency

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation
(ex ante option) or annually during the crediting period for the relevant year. Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly. • BM: For the first crediting period, either once ex ante or annually ex post. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>The gross calorific value (GCV) of the fuel can be used, if gross calorific values are provided by the data sources used. Make sure that in such cases also a gross calorific value basis is used for CO2 emission factor</td></tr>
</table>

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO2/GJ
Description	CO2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data	The following data sources may be used if the relevant conditions apply: **Data source** — **Conditions for using the data source** Values provided by the fuel supplier of the power plant in invoices — If data is collected from power plant operators (e.g. utilities) Regional or national average default values — If values are reliable and documented in regional or national energy statistics / energy balances IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories —
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	*Monitoring frequency:* Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year; Dispatch data OM: Annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*,. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Nested table within "Source of data":

Data source	Conditions for using the data source
Values provided by the fuel supplier of the power plant in invoices	If data is collected from power plant operators (e.g. utilities)
Regional or national average default values	If values are reliable and documented in regional or national energy statistics / energy balances
IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories	

Data / Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* or *k* in year *y*
Source of data	Use either: • Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or • For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system* (if available for the type of power plant).
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be recorded in the specific CPA-DD *Monitoring frequency:* Once for the crediting period *QA/QC procedures*: If the data obtained from the manufacturer, the utility, the dispatch center of official records is significantly lower than the default value provided in Annex 1 for the applicable technology, project proponents should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Data / Parameter	CAP_m
Unit	MW
Description	Total capacity of off-grid power plants included in off-grid power plant class *m*
Source of data	Survey of of-grid power plants included in the off-grid plant class m
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	As per the provisions in Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system*

Data / Parameter	$PLF_{default,off\text{-}grid,y}$
Unit	Dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per the provisions in step 3 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system*.

Data / Parameter	$T_{grid,y}$
Unit	hours
Description	Average time the grid was available to final electricity consumers in year *y*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system* and if equation (7)

Data / Parameter	Other parameters related to off-grid power plants
Unit	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Description	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Source of data	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	Value	Unit	Source
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for wind SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	[Insert]	tCO2/MWh	GEF calculations
W_{BM}	0.25		
$EF_{grid,OM,,y}$	[Insert]	tCO2/MWh	GEF calculations
W_{OM}	0.75		
$EF_{grid,CM,y}$	[Insert]	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = [Insert] tCO2/MWh

BE_y = [Insert] * [Insert] = [Insert] tCO2/year

Project emissions

For CPAs involving wind power, project emissions (PE_y) are considered 0.

$PE_y = 0$

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[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

GENERAL PARAMETERS

Data / Parameter	**$EG_{BL,y}$**
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR (Rwanda)

Data / Parameter	$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: If available, hourly, otherwise annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option); or annually during the crediting period for the relevant year, following the guidance in Step 3 of the *Tool to calculate the emission factor for an electricity system*; Dispatch data OM: Hourly. Further guidance can be found in Step 3 of the *Tool to calculate the emission factor for an electricity system*; BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{PJ,h}$ and $EG_{PJ,y}$
Unit	MWh
Description	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*
Source of data	As specified in the underlying methodology
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Hourly or yearly as applicable
QA/QC procedures	As specified in the underlying methodology
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

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

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

CPA implementing entity

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

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

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

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y	All

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures. These parameters are listed in the table below, although final monitoring may vary depending on the option chosen to calculate the grid emission factor for Rwanda.

Parameter	Description	Type of CPA
$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*	All
$EG_{m,y}$, EG_{y}, $EG_{k,y}$ and $EG_{n,h}$	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*	All
$EG_{PJ,h}$ and $EG_{PJ,y}$	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*	All

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 8: Solar photovoltaic energy project in Rwanda

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected solar photovoltaic (PV) energy project.

The generic SSC-CPA comprises the implementation and operation of a solar PV power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Rwandan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[56]:

Applicability criteria	Project activity
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind,	The generic SSC-CPA under the Programme will use solar PV that will

[56] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	supply electricity to the Rwandan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from solar PV energy and its supply to the Rwandan grid system.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is located in Rwanda This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) as it is a solar PV energy project
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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.

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

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for solar PV projects
		CH_4	No	Not applicable for solar PV projects
		N_2O	No	Not applicable for solar PV projects

	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for solar PV projects
		CH_4	No	Not applicable for solar PV projects
		N_2O	No	Not applicable for solar PV projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for solar PV projects
		CH_4	No	Not applicable for solar PV projects
		N_2O	No	Not applicable for solar PV projects

The figure below provides a flow chart 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 generic solar PV CPA.

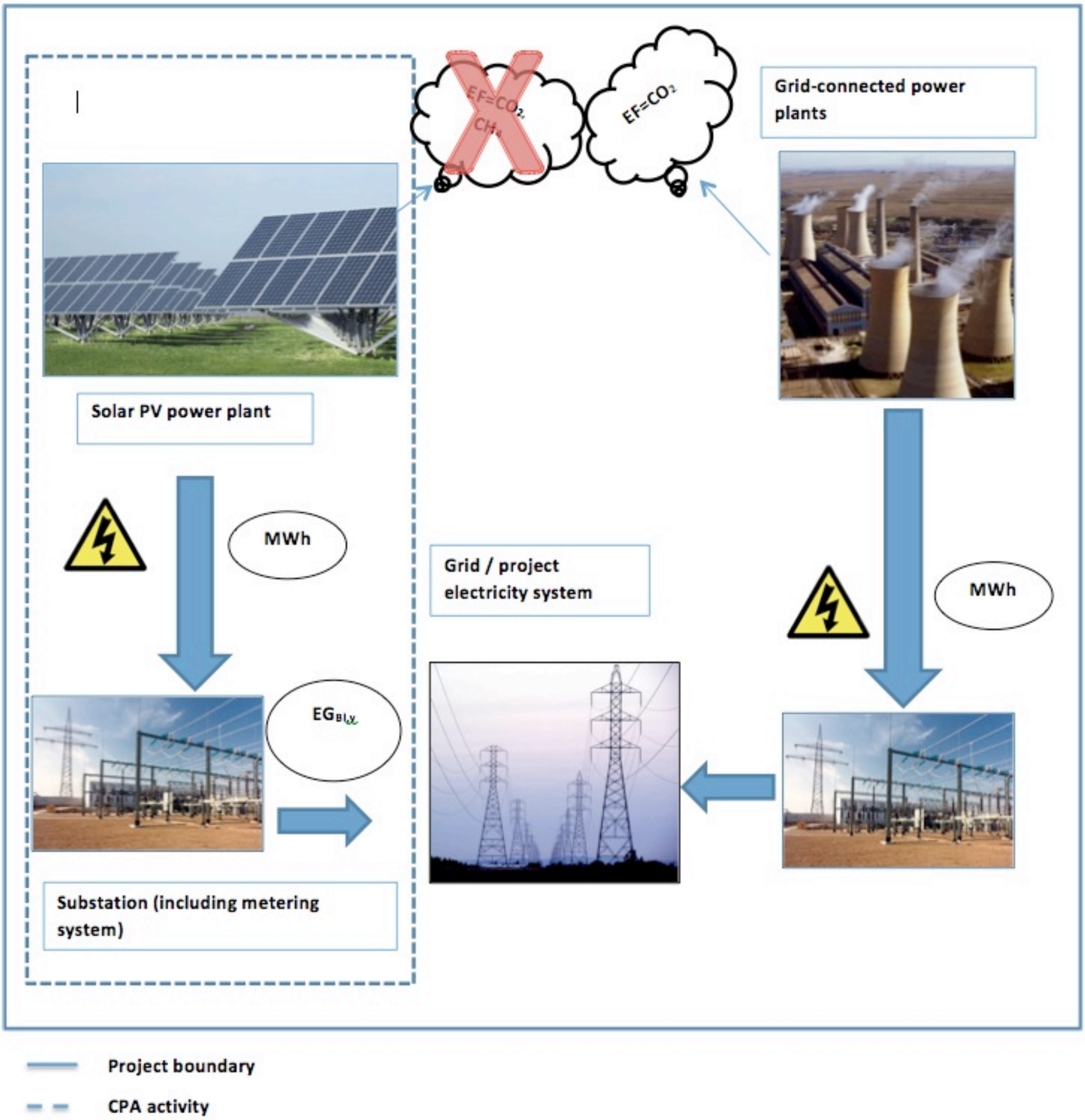


Figure 44: Solar PV CPA

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National electricity grids in countries in East Africa such as Rwanda typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[57] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in Rwanda.

Table 9: Installed Capacity in MW

	Rwanda[58]
Fossil fuel based	29.37
Large hydro	24.26
Small hydro[59]	3
Geothermal	0
Wind	0
Biomass/gas	0
Solar & other RE	0.25
Total	56.88
% Renewable	48%
% Fossil Fuel Based	52%

Figure 39 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

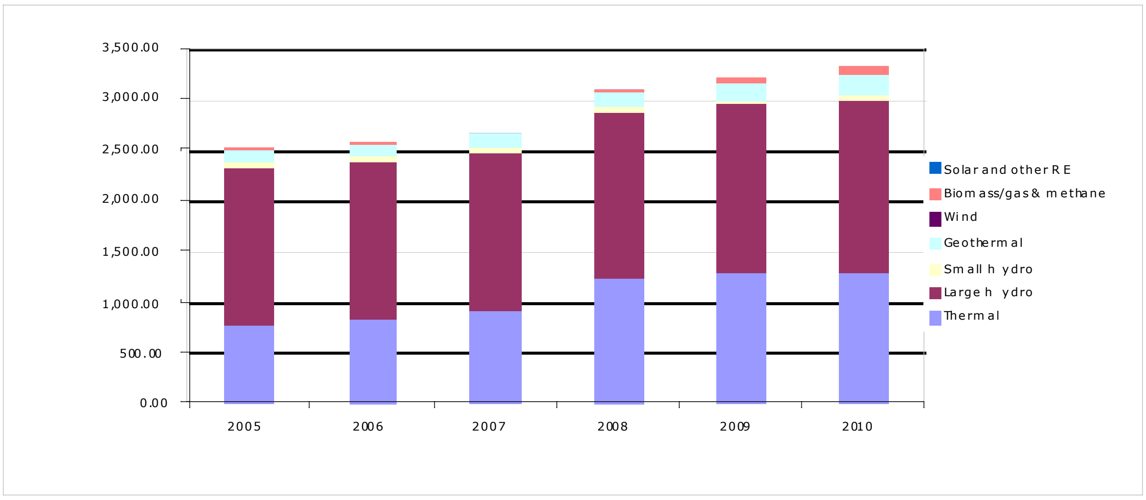


Figure 45: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[57] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.

[58] Rwanda Environment Management Authority (REMA) Energy Resources http://www.rema.gov.rw/soe/chap8.php (accessed on 7 September 2011)

[59] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 40 below represents the installed capacity of grid-connected power plants in Rwanda over the period 2005 to 2010.

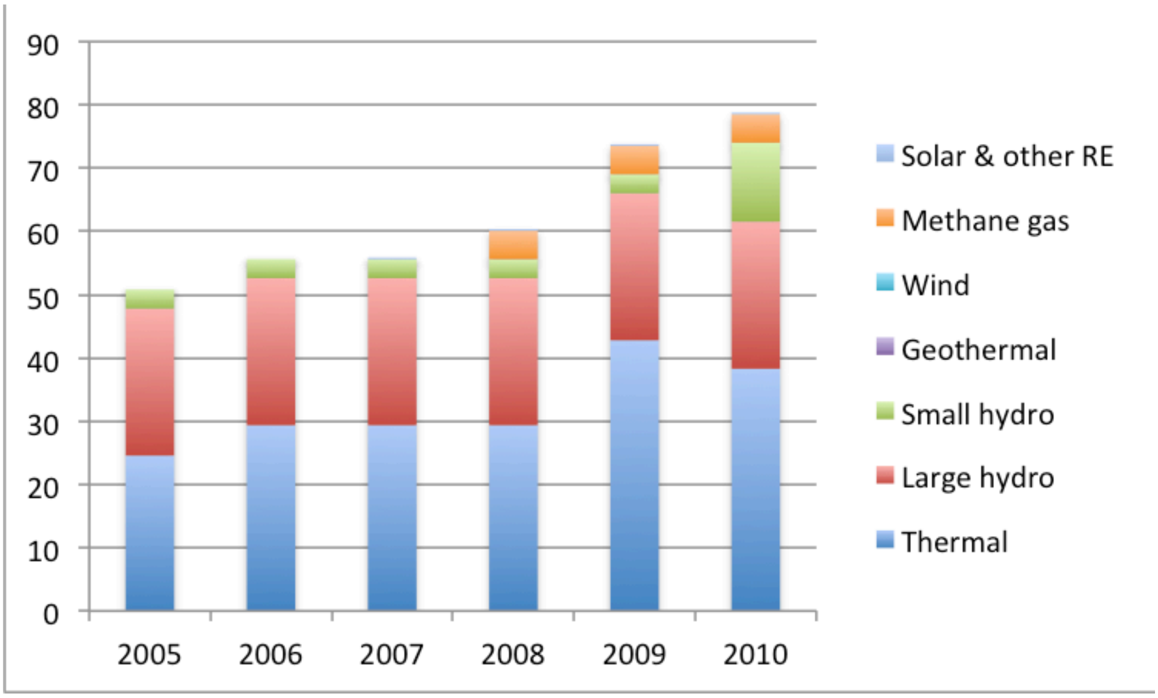


Figure 46: Grid - Connected Installed Capacity (MW) -Rwanda

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 41). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants.

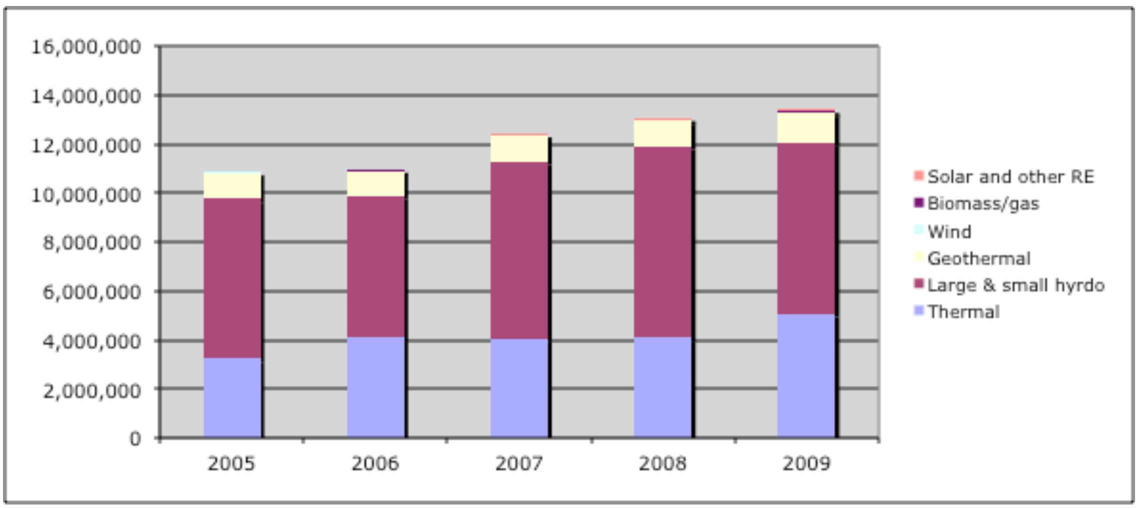


Figure 47: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

Figure 42 below shows the generation from grid-connected power plants by type in Rwanda.

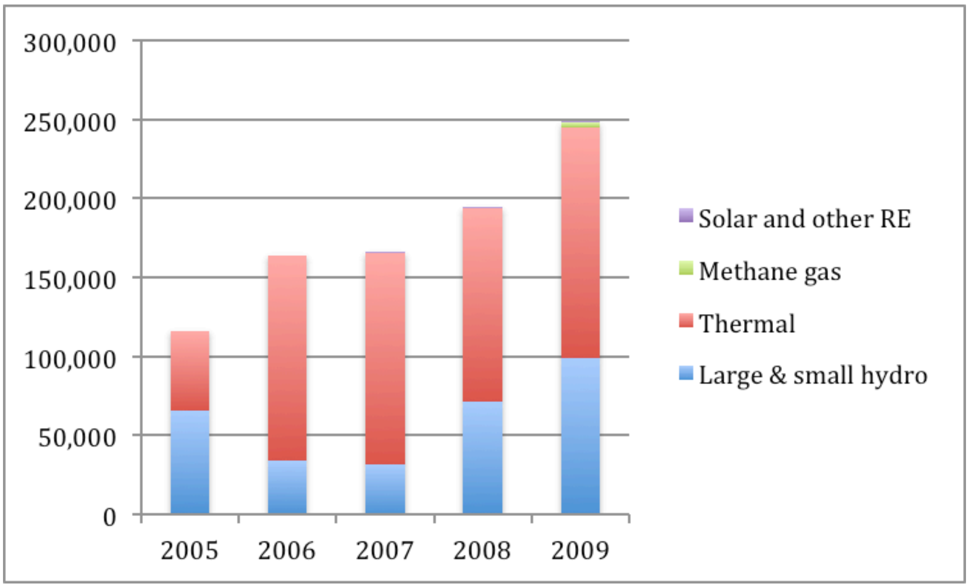


Figure 48: Generation from Grid- Connected Power Plants by Type (MWh), 2005-2009 -Rwanda

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. In Rwanda, the electrification rates are 35% in urban areas and 1% in the rural areas. The national electrification rate is 9%.

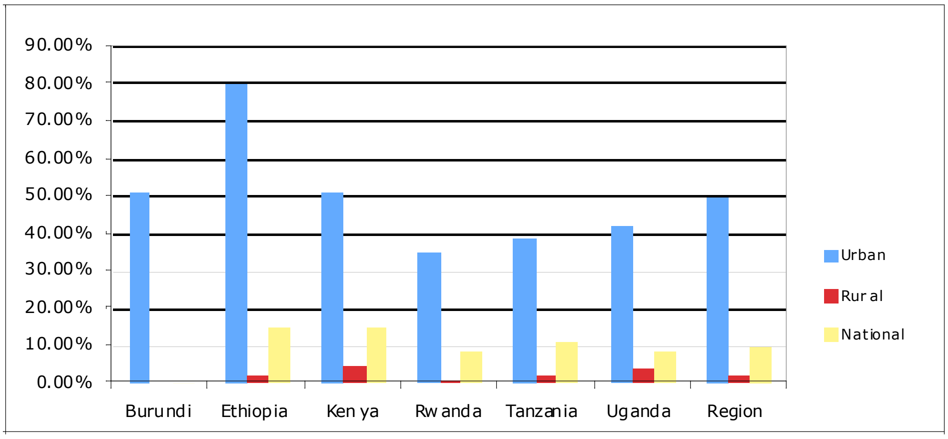


Figure 49: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Some countries have also introduced Feed-in-Tariff policies for renewable energy (e.g. Kenya and Uganda).

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that

is, unbundling, privatization, and wholesale and retail competition.[60] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[61]

More information regarding the baseline situation in Rwanda is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Rwandan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of Activities.	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a solar PV energy project, a technology eligible for inclusion in the PoA

[60] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[61] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for solar PV energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A, B.1, and B.2 are not necessary for solar PV CPAs as those are automatically additional through Option C.

Option C: Automatic additionality	
Criteria	*Justification*
The project activity uses a technology which is on the positive list of grid-connected renewable electricity generation technologies as specified in the latest version of the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27)	The project activity uses solar PV which is a technology on the positive list of grid-connected renewable electricity generation technologies.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from solar photovoltaic. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2,grid,y}$ = CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Rwandan electricity system that is covered by the PoA for each specific CPA and will be updated after the end of each crediting period of the CPA or annually depending on the data vintage applied following guidelines in the latest version of the tool to calculate the emission factor for an electricity system.

Project emissions

For most renewable energy project activities such as solar PV energy projects $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y = Project emissions in year *y* (tCO2e/yr)

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO2/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

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 form hydro power plants.

This CPA, which involves a solar PV power project, has no project emissions, $PE_y = 0$.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (RWANDA)

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ/mass or volume unit</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) of fossil fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>Values provided by the fuel supplier of the power plants in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Monitoring frequency

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation
(ex ante option) or annually during the crediting period for the relevant year. Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly. • BM: For the first crediting period, either once ex ante or annually ex post. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>The gross calorific value (GCV) of the fuel can be used, if gross calorific values are provided by the data sources used. Make sure that in such cases also a gross calorific value basis is used for CO2 emission factor</td></tr>
</table>

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$</td></tr>
<tr><td>Unit</td><td>tCO2/GJ</td></tr>
<tr><td>Description</td><td>CO2 emission factor of fossil fuel type i used in power unit m in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>Values provided by the fuel supplier of the power plant in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Monitoring frequency:

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or annually during the crediting period for the relevant year;

Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly.

BM: For the first crediting period, either once ex ante or annually ex post,. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>N/a</td></tr>
</table>

Data / Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* or *k* in year *y*
Source of data	Use either: • Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or • For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system* (if available for the type of power plant).
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be recorded in the specific CPA-DD *Monitoring frequency:* Once for the crediting period *QA/QC procedures*: If the data obtained from the manufacturer, the utility, the dispatch center of official records is significantly lower than the default value provided in Annex 1 for the applicable technology, project proponents should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Data / Parameter	CAP_m
Unit	MW
Description	Total capacity of off-grid power plants included in off-grid power plant class *m*
Source of data	Survey of of-grid power plants included in the off-grid plant class m
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	As per the provisions in Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system*

Data / Parameter	$PLF_{default,off\text{-}grid,y}$
Unit	Dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per the provisions in step 3 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system*.

Data / Parameter	$T_{grid,y}$
Unit	hours
Description	Average time the grid was available to final electricity consumers in year *y*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system* and if equation (7)

Data / Parameter	Other parameters related to off-grid power plants
Unit	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Description	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Source of data	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	Value	Unit	Source
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$
The combined margin emission factor for the grid is calculated using the following equations:

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for solar SSC-CPAs:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{BM}	0.25		
$EF_{grid,OM,,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{OM}	0.75		
$EF_{grid,CM,y}$	[insert value]	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = [insert value] tCO2/MWh

BE_y = [Insert] * [insert value] = [Insert] tCO2/year

Project emissions

For CPAs involving solar PV power, project emissions (PE_y) are considered 0.

$PE_y = 0$

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR (Rwanda)

Data / Parameter	$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: If available, hourly, otherwise annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option); or annually during the crediting period for the relevant year, following the guidance in Step 3 of the *Tool to calculate the emission factor for an electricity system*; Dispatch data OM: Hourly. Further guidance can be found in Step 3 of the *Tool to calculate the emission factor for an electricity system*; BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{PJ,h}$ and $EG_{PJ,y}$
Unit	MWh
Description	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*
Source of data	As specified in the underlying methodology
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Hourly or yearly as applicable
QA/QC procedures	As specified in the underlying methodology
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

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

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

CPA implementing entity

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

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

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

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures. These parameters are listed in the table below, although final monitoring may vary depending on the option chosen to calculate the grid emission factor for Rwanda.

Parameter	Description	Type of CPA
$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*	All
$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*	All
$EG_{PJ,h}$ and $EG_{PJ,y}$	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*	All

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 9: Geothermal (with fossil fuel combustion) energy project in Rwanda

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected geothermal energy project with fossil fuel combustion.

The generic SSC-CPA comprises the implementation and operation of a geothermal power plant with fossil fuel combustion implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Rwandan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[62]:

Applicability criteria	**Project activity**
This methodology comprises renewable energy generation	The generic SSC-CPA under the

[62] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Programme will use geothermal energy that will supply electricity to the Rwandan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from geothermal energy and its supply to the Rwandan grid system.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is located in Rwanda This country is not an annex I country.

The project also meets the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) as follows:

The tool can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.	Project emissions from fossil fuel combustion from geothermal CPAs will be calculated based on the fuel combusted and its properties.

Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA, however in case of inclusion of a geothermal project activity, sampling will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), “ 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.

The sources and gases included in the SSC-CPA boundary for individual geothermal CPAs with fossil fuel combustion is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source

	power plants that are displaced due to project activity	N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	Yes	Main emission source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for geothermal projects
		CH_4	No	Not applicable for geothermal projects
		N_2O	No	Not applicable for geothermal projects

The figure below provides a flow chart 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 generic geothermal energy project with fossil fuel combustion CPA.

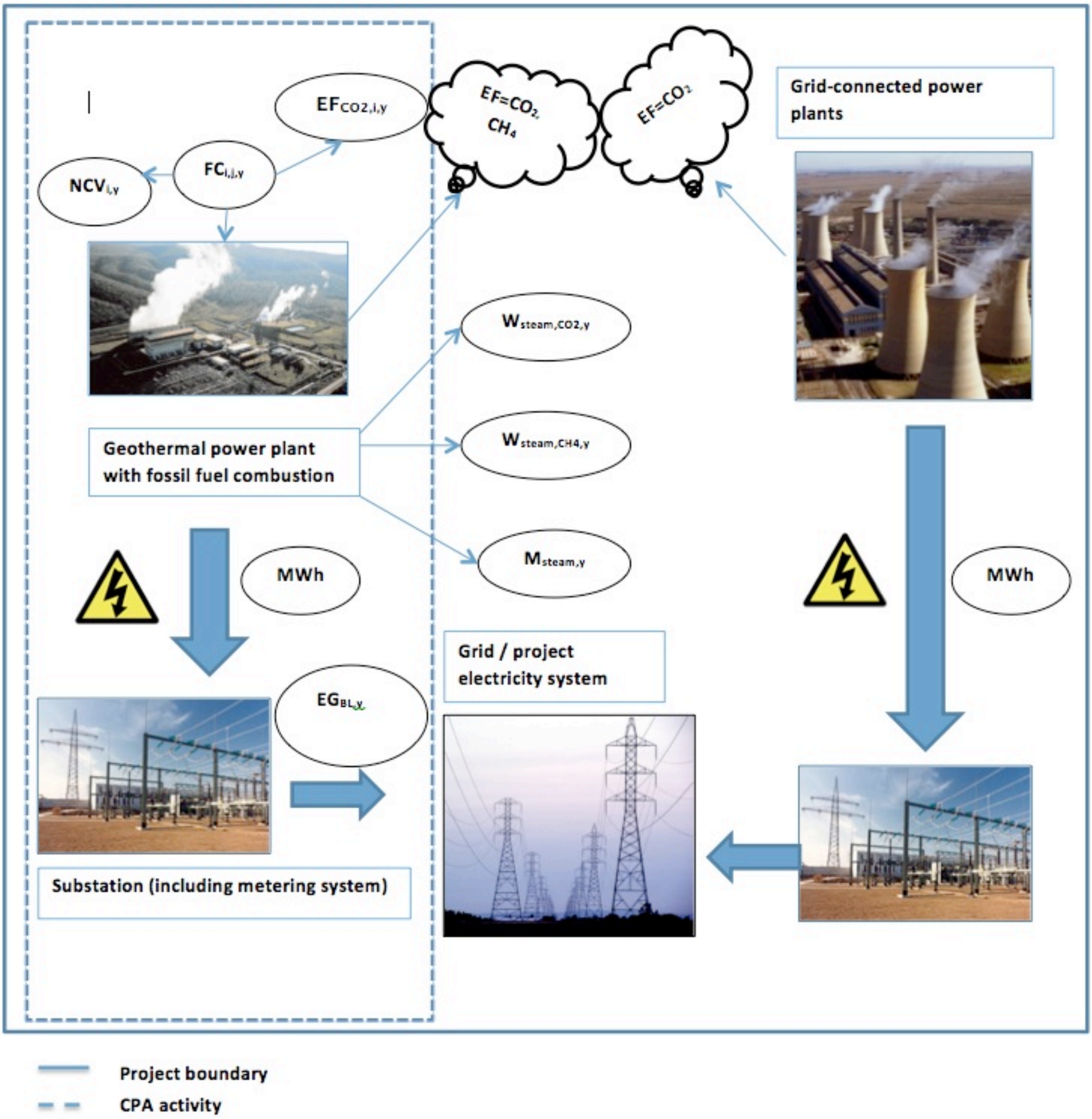


Figure 50: Geothermal CPA involving fossil fuel combustion

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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”.

National electricity grids in countries in East Africa such as Rwanda typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[63] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in Rwanda.

Table 10: Installed Capacity in MW

	Rwanda[64]
Fossil fuel based	29.37
Large hydro	24.26
Small hydro[65]	3
Geothermal	0
Wind	0
Biomass/gas	0
Solar & other RE	0.25
Total	56.88
% Renewable	48%
% Fossil Fuel Based	52%

Figure 39 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

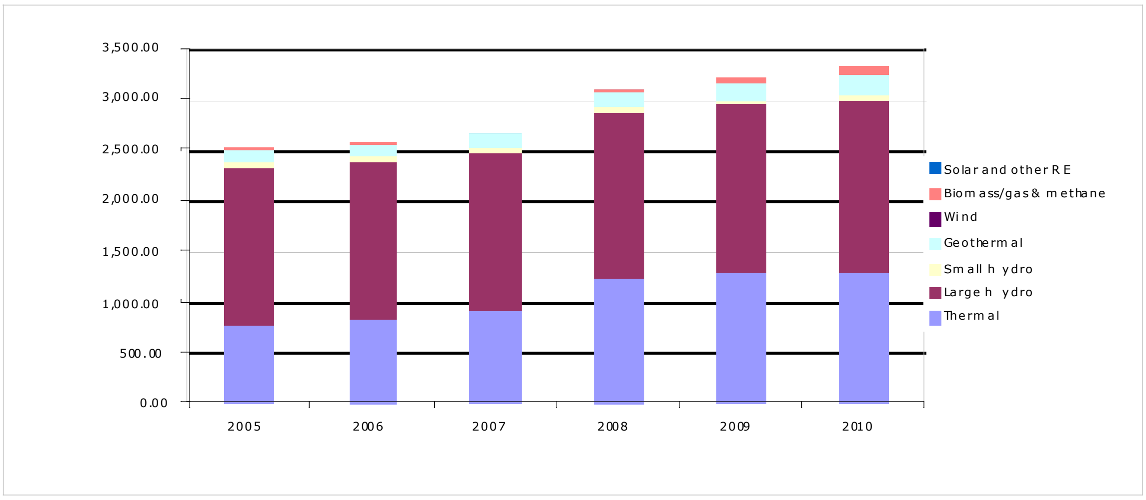


Figure 51: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[63] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.

[64] Rwanda Environment Management Authority (REMA) Energy Resources http://www.rema.gov.rw/soe/chap8.php (accessed on 7 September 2011)

[65] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 52: Grid - Connected Installed Capacity (MW) -Rwandabelow represents the installed capacity of grid-connected power plants in Rwanda over the period 2005 to 2010.

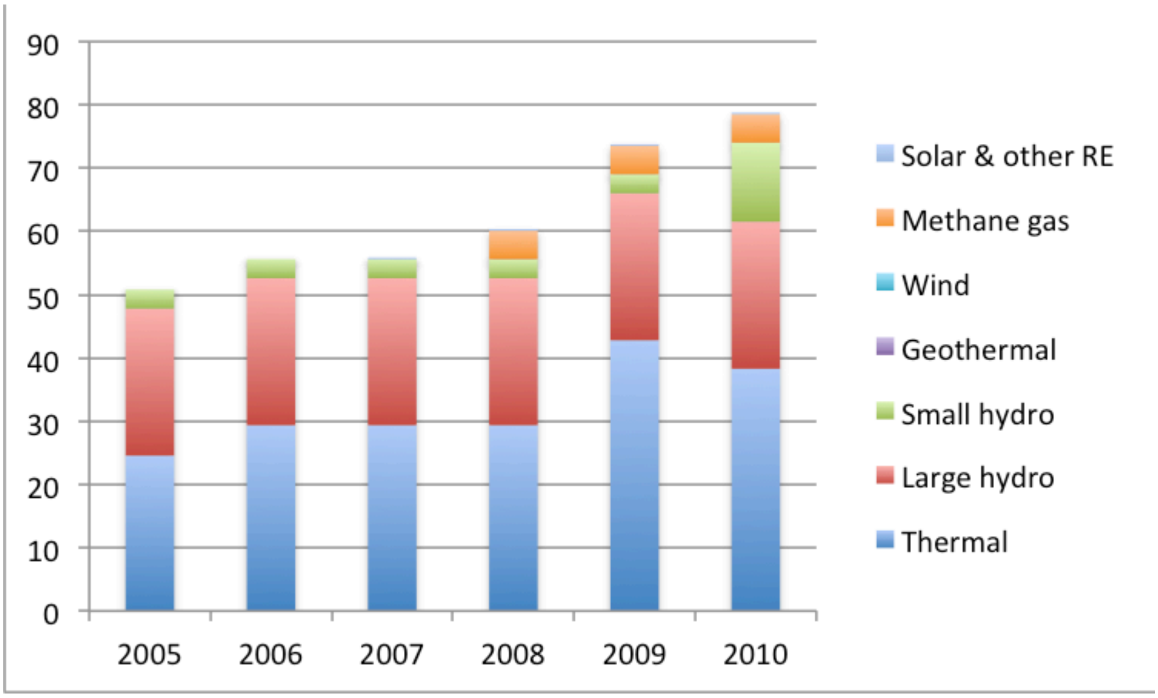


Figure 52: Grid - Connected Installed Capacity (MW) -Rwanda

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 41). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants.

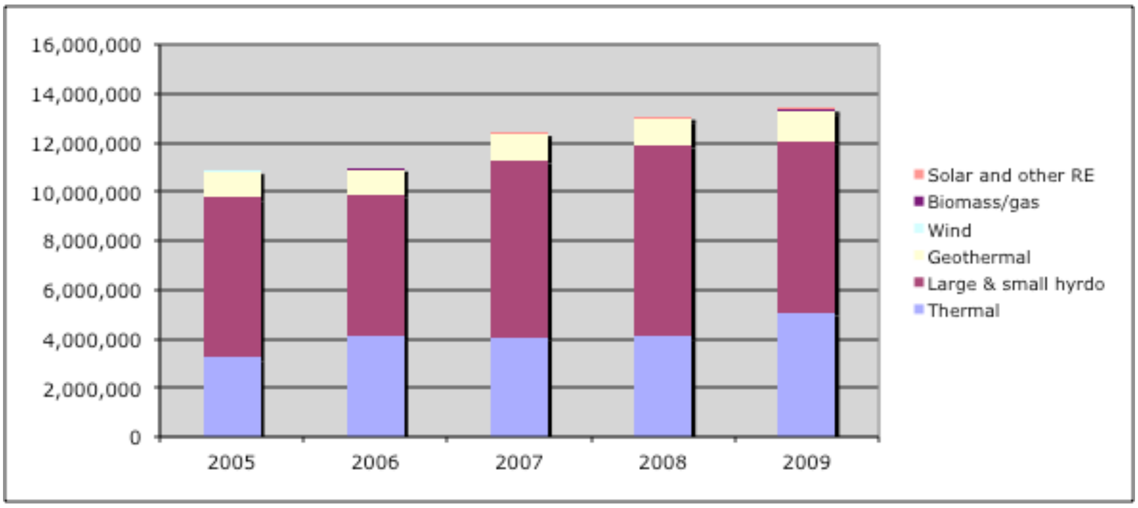


Figure 53: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

Figure 42 below shows the generation from grid-connected power plants by type in Rwanda.

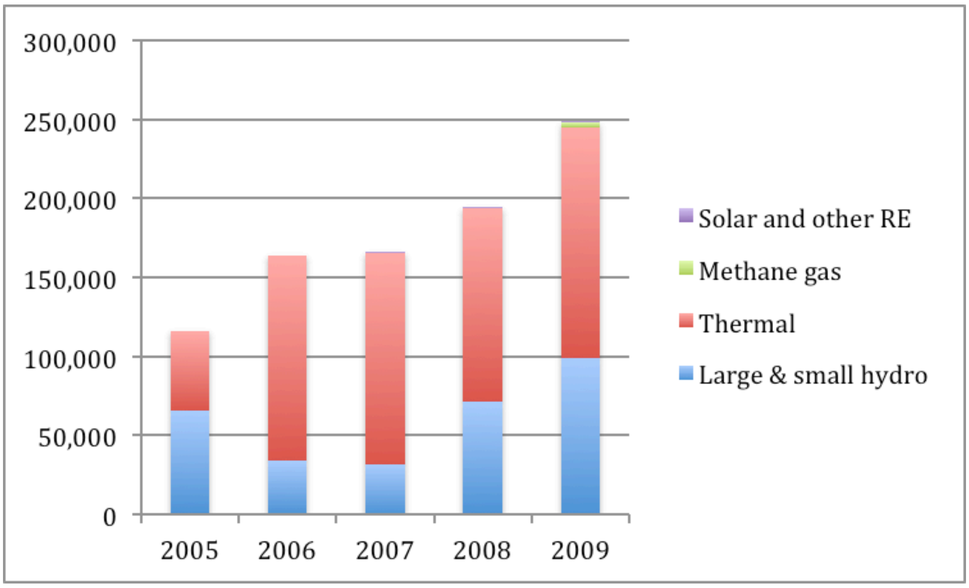


Figure 54: Generation from Grid- Connected Power Plants by Type (MWh), 2005-2009 -Rwanda

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. In Rwanda, the electrification rates are 35% in urban areas and 1% in the rural areas. The national electrification rate is 9%.

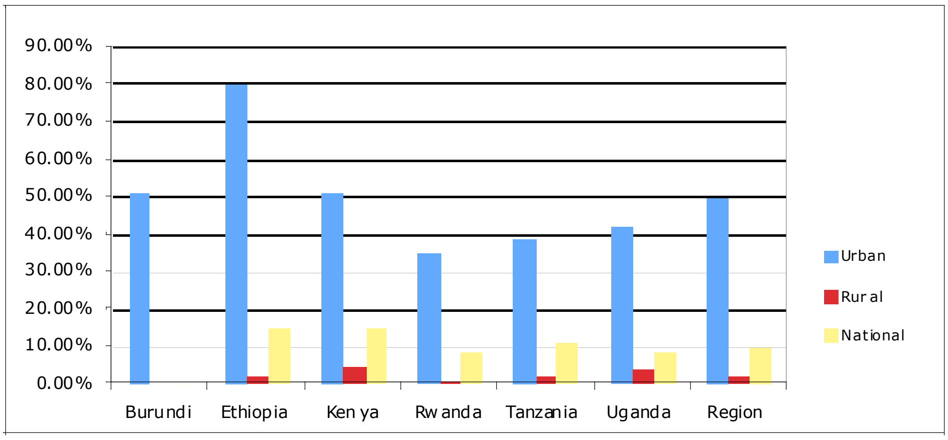


Figure 55: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Some countries have also introduced Feed-in-Tariff policies for renewable energy (e.g. Kenya and Uganda).

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the “standard” reform model, that

is, unbundling, privatization, and wholesale and retail competition.[66] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[67]

More information regarding the baseline situation in Rwanda is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Rwandan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a geothermal energy project, a technology eligible for inclusion in the PoA

[66] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[67] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

		Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	Monitoring section B.7 of the PoA-DD and D.7 of the specific CPA-DD *[Applicable for geothermal project types]*
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in Rwanda which is a Least Developed Country (LDC). or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for geothermal energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from geothermal projects with fossil fuel combustion. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Rwandan electricity system that is covered by the PoA for each specific CPA and will be updated after the end of each crediting period of the CPA or annually depending on the data vintage applied following guidelines in the latest version of the tool to calculate the emission factor for an electricity system.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

For geothermal projects that also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$).
($PE_{FF,y}$) shall be calculated as per the latest version of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*.

CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, using **equation (1)** of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*:

$$PE_{FC,y} = \Sigma\, FC_{i,j,y} * COEF_{i,y}$$

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr);
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr);
$COEF_{i,y}$	=	Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using Option B (**equation 4**) in the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*. Under Option B, the CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,i,y}$$

Where:

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

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

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

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

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)

$W_{steam,CO2,y}$ = Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO2/t steam)

$W_{steam,CH4,y}$ = Average mass fraction of methane in the produced steam in year *y* (tCH4/t steam)

GWP_{CH4} = Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)

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

According to the methodology, the default value for GWP_{CH4} is used, 21tCO_2e/tCH4.

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

This CPA involves geothermal power plants with fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (RWANDA)

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ/mass or volume unit</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) of fossil fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>Values provided by the fuel supplier of the power plants in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Monitoring frequency

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation
(ex ante option) or annually during the crediting period for the relevant year. Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly. • BM: For the first crediting period, either once ex ante or annually ex post. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>The gross calorific value (GCV) of the fuel can be used, if gross calorific values are provided by the data sources used. Make sure that in such cases also a gross calorific value basis is used for CO2 emission factor</td></tr>
</table>

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$</td></tr>
<tr><td>Unit</td><td>tCO2/GJ</td></tr>
<tr><td>Description</td><td>CO2 emission factor of fossil fuel type i used in power unit m in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>Values provided by the fuel supplier of the power plant in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Monitoring frequency:

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or annually during the crediting period for the relevant year;

Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly.

BM: For the first crediting period, either once ex ante or annually ex post,. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>N/a</td></tr>
</table>

Data / Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* or *k* in year *y*
Source of data	Use either: • Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or • For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system* (if available for the type of power plant).
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be recorded in the specific CPA-DD *Monitoring frequency:* Once for the crediting period *QA/QC procedures*: If the data obtained from the manufacturer, the utility, the dispatch center of official records is significantly lower than the default value provided in Annex 1 for the applicable technology, project proponents should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Data / Parameter	CAP_m
Unit	MW
Description	Total capacity of off-grid power plants included in off-grid power plant class *m*
Source of data	Survey of of-grid power plants included in the off-grid plant class m
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	As per the provisions in Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system*

Data / Parameter	$PLF_{default,off\text{-}grid,y}$
Unit	Dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per the provisions in step 3 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system*.

Data / Parameter	$T_{grid,y}$
Unit	hours
Description	Average time the grid was available to final electricity consumers in year *y*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system* and if equation (7)

Data / Parameter	Other parameters related to off-grid power plants
Unit	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Description	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Source of data	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	Value	Unit	Source
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for geothermal SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	[insert value]	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = [insert value] tCO2/MWh

BE_y = [Insert] * [insert value] = [Insert] tCO2/year

Project emissions

For most renewable energy project activities $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

<u>Project emissions from fossil fuel combustion (</u>$PE_{FF,y}$)

For geothermal projects, which also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$).
$PE_{FF,y}$ shall be calculated as per the version 2 of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion* (version 02).

CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, using **equation (1)** of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*:

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

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr);
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/yr);
$COEF_{i,y}$	=	Is the CO2 emission coefficient of fuel type *i* in year *y* (tCO2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using Option B **(equation 4)** in the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*. Under Option B, the CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

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

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit);
$NCV_{i,y}$	=	Is the weighted average net calorific value of the fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	Is the weighted average CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)
i	=	Are the fuel types combusted in process *j* during the year *y*

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from fossil fuel combustion:

Parameter	**Value**	**Unit**	**Source**
$NCV_{i,y}$	[insert value]	[insert unit]	[insert source]
$EF_{CO2,i,y}$	[insert value]	[insert value]	[insert source]
$FC_{i,j,y}$	[insert value]	[insert value]	[insert source]
$COEF_{i,y}$	[insert value]	[insert value]	Calculated
$PE_{FC,j,y}$	[insert value]	tCO2/y	Calculated

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)

$W_{steam,CO2,y}$ = Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO2/t steam)

$W_{steam,CH4,y}$ = Average mass fraction of methane in the produced steam in year *y* (tCH4/t steam)

GWP_{CH4} = Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)

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

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the operation of the geothermal power plant:

Parameter	**Value**	**Unit**	**Source**
$W_{steam,CO2,y}$	[insert value]	[insert unit]	[insert source]
$W_{steam,CH4,y}$	[insert value]	[insert unit]	[insert source]
GWP_{CH4}	21	tCO2e/tCH4	Default value
$M_{Steam,y}$	[insert value]	[insert unit]	[insert source]
$PE_{GP,y}$	[insert value]	tCO2e/y	Calculated

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

This CPA involves geothermal power plants with fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Total Project Emission for the project activity equal:

PE_y = [insert value] + [insert value] + 0

PE_y = [insert value]

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

PROJECTS THAT ALSO USE FOSSIL FUELS FOR ELECTRICITY GENERATION

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

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO2/GJ
Description	Weighted average CO_2 emission factor of fuel type *i* in year *y*
Source of data	The following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** e) Values provided by the fuel supplier in invoices — This is the preferred source f) Measurements by the project participants — If a) is not available g) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances) h) IPCC default values at the upper limit of the uncertainty at 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 — If a) is not available
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	For a) and b): Measurements should be undertaken in line with national or international fuel standards Monitoring Frequency: • For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated. • For c): Review appropriateness of the values annually. • For d): Any future revision of the IPCC Guidelines should be taken into account.
Purpose of data	Calculation of project emissions

Nested table within "Source of data":

Data source	Conditions for using the data source
e) Values provided by the fuel supplier in invoices	This is the preferred source
f) Measurements by the project participants	If a) is not available
g) Regional or national default values	If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)
h) IPCC default values at the upper limit of the uncertainty at 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	If a) is not available

Additional comment	For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, Options b), c) or d) should be used. This parameter is applicable to geothermal CPAs that involve fossil fuel combustion

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ per mass or volume unit (e.g. GJ/m³, GJ/ton)</td></tr>
<tr><td>Description</td><td>Weighted average net calorific value of fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>e) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>f) Measurements by the project participants</td><td>If a) is not available</td></tr>
<tr><td>g) Regional or national default values</td><td>If a) is not available
These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>h) IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If a) is not available</td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>For a) and b): Measurements should be undertaken in line with national or international fuel standards

Monitoring Frequency:
For a) and b): Measurements should be undertaken in line with national or international fuel standards
For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated
For c): Review appropriateness of the values annually
For d): Any future revision of the IPCC Guidelines should be taken into account
If a), b) of c) are used, the project will verify if the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.</td></tr>
</table>

Purpose of data	Calculation of project emissions
Additional comment	Applicable to geothermal CPAs that involve fossil fuel combustion

SPECIFIC PARAMETERS FOR GEOTHERMAL PROJECTS

Data / Parameter	$W_{steam,CO2,y}$
Unit	tCO2/t steam
Description	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in specific CPA-DD.
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal project activities

Data / Parameter	$W_{steam,CH4,y}$
Unit	tCH_4/t steam
Description	Average mass fraction of methane in the produced steam in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported in each specific CPA-DD
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane.
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

Data / Parameter	$M_{steam,y}$
Unit	t steam/yr
Description	Quantity of steam produced in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported by specific CPA-DD
Measurement methods and procedures	The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports.
Monitoring frequency	Daily
QA/QC procedures	Data will be read continuously and logged daily. Data will be entered into CDM monitoring workbook every day and will be checked for consistency when entered. Meters will be maintained and periodically verified according to manufacturer specifications to ensure accurate readings; they will be recalibrated within the schedule recommended by the manufacturer.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR (Rwanda)

Data / Parameter	$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: If available, hourly, otherwise annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option); or annually during the crediting period for the relevant year, following the guidance in Step 3 of the *Tool to calculate the emission factor for an electricity system*; Dispatch data OM: Hourly. Further guidance can be found in Step 3 of the *Tool to calculate the emission factor for an electricity system*; BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{PJ,h}$ and $EG_{PJ,y}$
Unit	MWh
Description	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*
Source of data	As specified in the underlying methodology
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Hourly or yearly as applicable
QA/QC procedures	As specified in the underlying methodology
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

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

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

CPA implementing entity

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

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

Each CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid. The quantity of electricity supplied to the grid will be reported to the CME on a biannual basis for the previous six months and will be accompanied by supporting evidence for cross-checking purposes. Project activities using geothermal technologies and involving fossil fuel consumption for electricity generation, will also monitor and keep records of additional parameters as specified in section B. 7.1. Additional parameter values will be reported on a quarterly basis with supporting evidence (if applicable). These parameters are listed in the table below:

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All
$W_{steam,CO2,y}$	Average mass fraction of carbon dioxide in the produced steam in year *y*	Geothermal CPAs
$W_{steam,CH4,y}$	Average mass fraction of methane in the produced steam in year *y*	Geothermal CPAs
$M_{steam,y}$	Quantity of steam produced in year *y*	Geothermal CPAs
$FC_{i,j,y}$	Quantity of fuel type *i* combusted in process *j* during the year *y*	Geothermal CPAs using fossil fuels
$EF_{CO2,i,y}$	Weighted average CO_2 emission factor of fuel type *i* in year *y*	Geothermal CPAs using fossil fuels
$NCV_{i,y}$	Weighted average net calorific value of fuel type *i* in year *y*	Geothermal CPAs using fossil fuels

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures. These parameters are listed in the table below, although final monitoring may vary depending on the option chosen to calculate the grid emission factor for Rwanda.

Parameter	Description	Type of CPA
$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*	All
$EG_{m,y}$, EG_{y}, $EG_{k,y}$ and $EG_{n,h}$	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*	All
$EG_{PJ,h}$ and $EG_{PJ,y}$	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*	All

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 10: Geothermal (without fossil fuel combustion) energy project in Rwanda

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected geothermal energy project without fossil fuel combustion.

The generic SSC-CPA comprises the implementation and operation of a geothermal power plant without fossil fuel combustion implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Rwandan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[68]:

Applicability criteria	**Project activity**
This methodology comprises renewable energy generation	The generic SSC-CPA under the

[68] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Programme will use geothermal energy that will supply electricity to the Rwandan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from geothermal energy and its supply to the Rwandan grid system.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is located in Rwanda This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) as it is a geothermal energy project without fossil fuel combustion.
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA, however in case of inclusion of a geothermal project activity, sampling will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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.

The sources and gases included in the SSC-CPA boundary for individual geothermal CPAs without fossil fuel combustion is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive	CO_2	Yes	Main emission source
		CH_4	Yes	Main emission source

	emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for geothermal projects without fossil fuel combustion
		CH_4	No	Not applicable for geothermal projects without fossil fuel combustion
		N_2O	No	Not applicable for geothermal projects without fossil fuel combustion
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for geothermal projects
		CH_4	No	Not applicable for geothermal projects
		N_2O	No	Not applicable for geothermal projects

The figure below provides a flow chart 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 generic geothermal CPA without fossil fuels combustion.

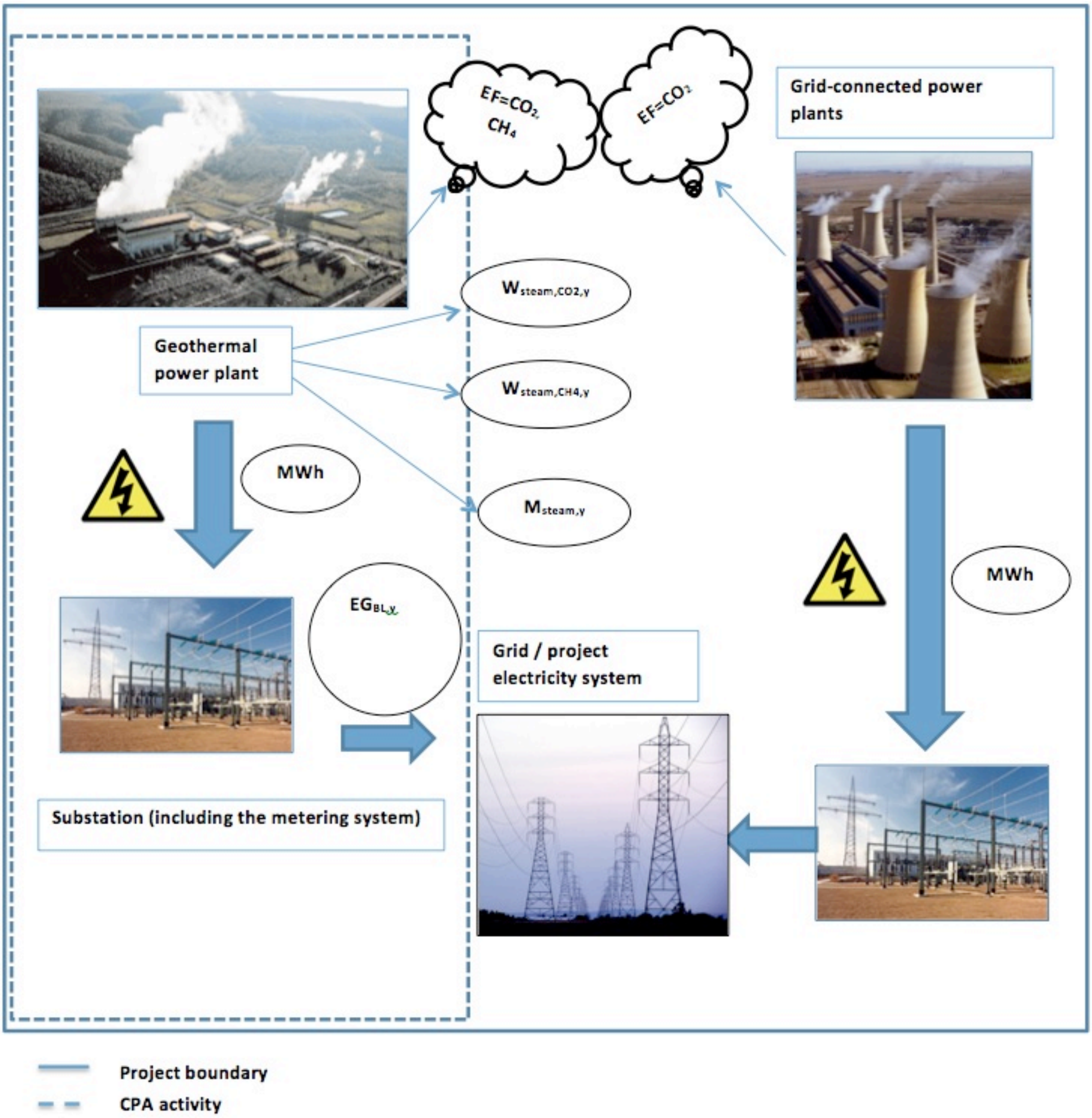


Figure 56: Geothermal CPA without fossil fuels combustion

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National electricity grids in countries in East Africa such as Rwanda typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[69] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in Rwanda.

Table 11: Installed Capacity in MW

	Rwanda[70]
Fossil fuel based	29.37
Large hydro	24.26
Small hydro[71]	3
Geothermal	0
Wind	0
Biomass/gas	0
Solar & other RE	0.25
Total	56.88
% Renewable	48%
% Fossil Fuel Based	52%

Figure 39 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

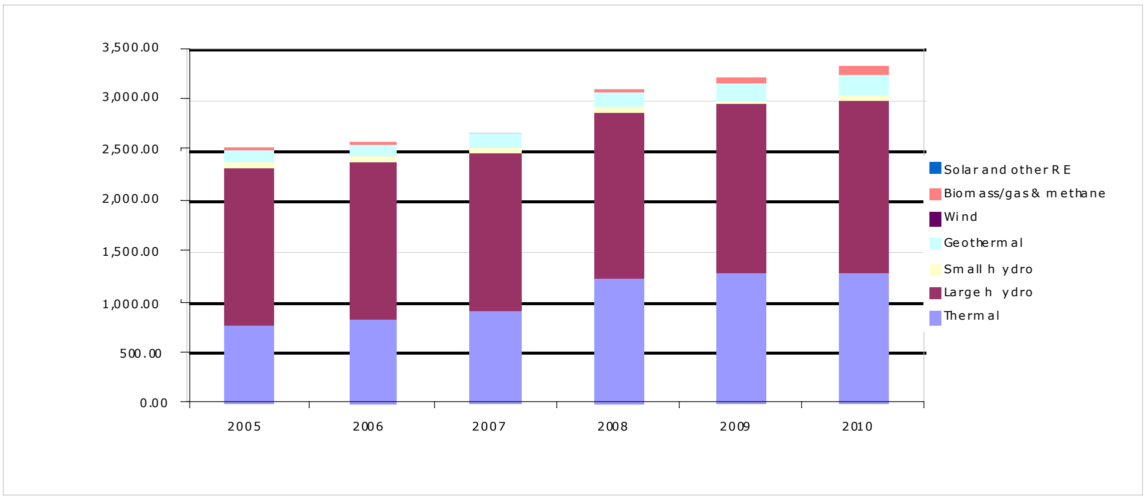


Figure 57: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[69] This is <u>installed</u> capacity and not <u>effective</u> capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.
[70] Rwanda Environment Management Authority (REMA) Energy Resources http://www.rema.gov.rw/soe/chap8.php (accessed on 7 September 2011)
[71] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 40 below represents the installed capacity of grid-connected power plants in Rwanda over the period 2005 to 2010.

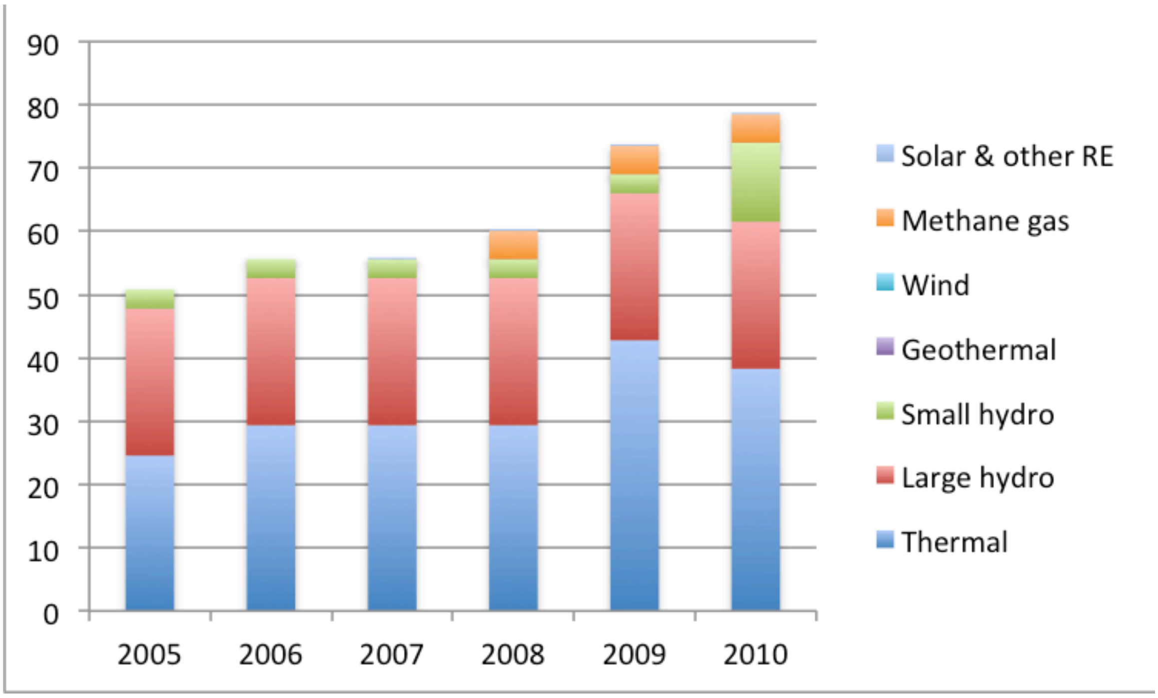


Figure 58: Grid - Connected Installed Capacity (MW) -Rwanda

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 41). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants.

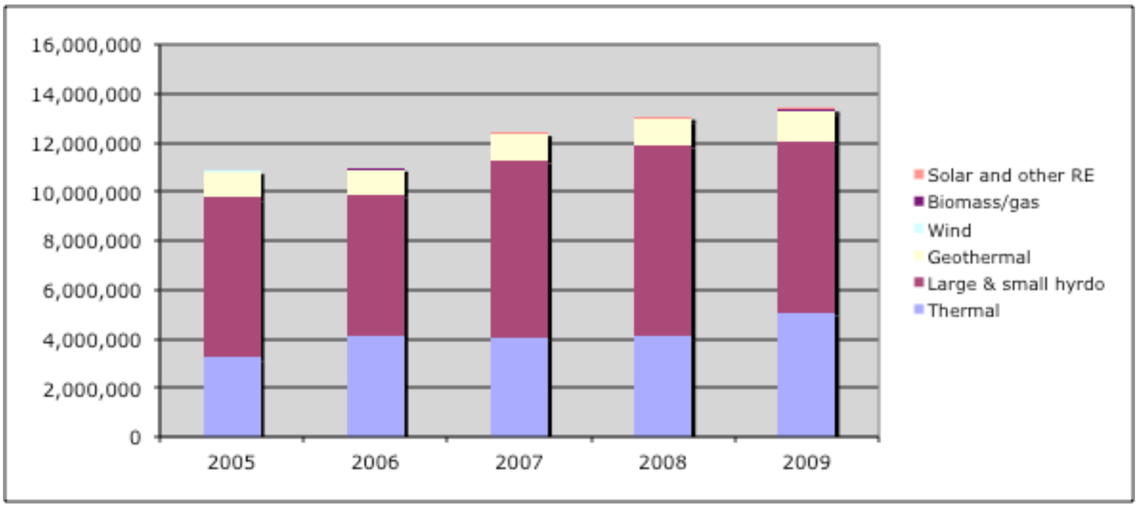


Figure 59: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

Figure 42 below shows the generation from grid-connected power plants by type in Rwanda.

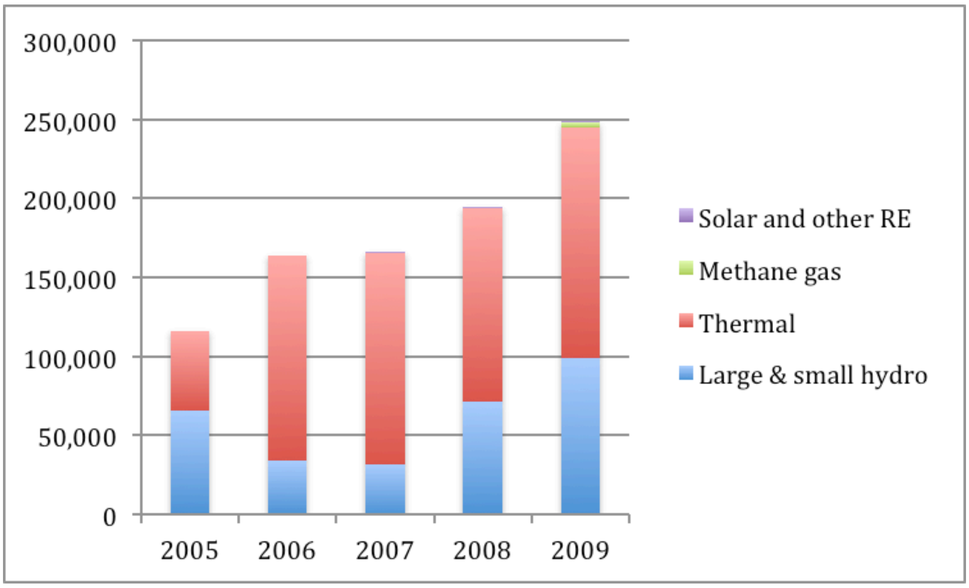


Figure 60: Generation from Grid- Connected Power Plants by Type (MWh), 2005-2009 -Rwanda

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. In Rwanda, the electrification rates are 35% in urban areas and 1% in the rural areas. The national electrification rate is 9%.

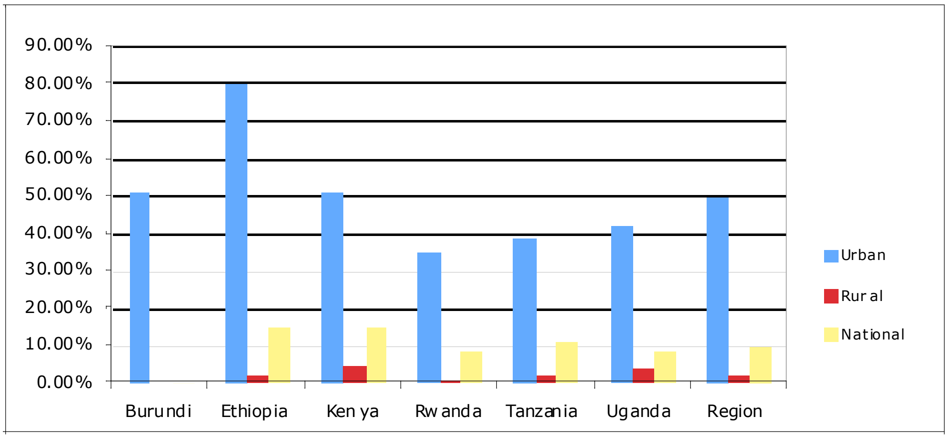


Figure 61: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Some countries have also introduced Feed-in-Tariff policies for renewable energy (e.g. Kenya and Uganda).

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the “standard” reform model, that

is, unbundling, privatization, and wholesale and retail competition.[72] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[73]

More information regarding the baseline situation in Rwanda is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Rwandan boundaries
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a geothermal energy project, a technology eligible for inclusion in the PoA

[72] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[73] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

		Activities.	
4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	Monitoring section B.7 of the PoA-DD and D.7 of the specific CPA-DD *[Applicable for geothermal project types]*
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in Rwanda which is a Least Developed Country (LDC). or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for geothermal energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from geothermal project without fossil fuel combustion Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Rwandan electricity system that is covered by the PoA for each specific CPA and will be updated after the end of each crediting period of the CPA or annually depending on the data vintage applied following guidelines in the latest version of the tool to calculate the emission factor for an electricity system.

Project emissions

For most renewable energy project activities $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

For geothermal projects that also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). However this generic CPA includes geothermal projects without fossil fuels combustion, therefore $PE_{FF,y} = 0$

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$W_{steam,CO2,y}$	=	Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO2/t steam)
$W_{steam,CH4,y}$	=	Average mass fraction of methane in the produced steam in year *y* (tCH4/t steam)
GWP_{CH4}	=	Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)
$M_{steam,y}$	=	Quantity of steam produced in year *y* (t steam/y)

According to the methodology, the default value for GWP_{CH4} is used, 21$tCO_2e/tCH4$.

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

This CPA involves geothermal power plants without fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (RWANDA)

<table>
<tr><td>Data / Parameter</td><td>$NCV_{i,y}$</td></tr>
<tr><td>Unit</td><td>GJ/mass or volume unit</td></tr>
<tr><td>Description</td><td>Net calorific value (energy content) of fossil fuel type i in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><td>Data source</td><td>Conditions for using the data source</td></tr>
<tr><td>Values provided by the fuel supplier of the power plants in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default
values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data
or
Measurement methods and procedures</td><td>Monitoring frequency

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation
(ex ante option) or annually during the crediting period for the relevant year. Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly. • BM: For the first crediting period, either once ex ante or annually ex post. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>The gross calorific value (GCV) of the fuel can be used, if gross calorific values are provided by the data sources used. Make sure that in such cases also a gross calorific value basis is used for CO2 emission factor</td></tr>
</table>

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$</td></tr>
<tr><td>Unit</td><td>tCO2/GJ</td></tr>
<tr><td>Description</td><td>CO2 emission factor of fossil fuel type i used in power unit m in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>Values provided by the fuel supplier of the power plant in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table></td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Monitoring frequency:

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or annually during the crediting period for the relevant year;

Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly.

BM: For the first crediting period, either once ex ante or annually ex post,. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>N/a</td></tr>
</table>

Data / Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* or *k* in year *y*
Source of data	Use either: • Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or • For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system* (if available for the type of power plant).
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be recorded in the specific CPA-DD *Monitoring frequency:* Once for the crediting period *QA/QC procedures*: If the data obtained from the manufacturer, the utility, the dispatch center of official records is significantly lower than the default value provided in Annex 1 for the applicable technology, project proponents should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Data / Parameter	CAP_m
Unit	MW
Description	Total capacity of off-grid power plants included in off-grid power plant class *m*
Source of data	Survey of of-grid power plants included in the off-grid plant class m
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	As per the provisions in Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system*

Data / Parameter	$PLF_{default,off-grid,y}$
Unit	Dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per the provisions in step 3 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system*.

Data / Parameter	$T_{grid,y}$
Unit	hours
Description	Average time the grid was available to final electricity consumers in year *y*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system* and if equation (7)

Data / Parameter	Other parameters related to off-grid power plants
Unit	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Description	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Source of data	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	Value	Unit	Source
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for geothermal SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	[insert value]	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = [insert value] tCO2/MWh

BE_y = [Insert] * [insert value] = [Insert] tCO2/year

Project emissions

For most renewable energy project activities $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

For geothermal projects that also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). However this generic CPA includes geothermal projects without fossil fuels combustion, therefore $PE_{FF,y} = 0$

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 version 13.0.0, as follows:

$$PE_{GP,y} = (W_{steam,CO2,y} + W_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$W_{steam,CO2,y}$	=	Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO2/t steam)
$W_{steam,CH4,y}$	=	Average mass fraction of methane in the produced steam in year *y* (tCH4/t steam)
GWP_{CH4}	=	Global warming potential of methane valid for the relevant commitment period (tCO2e/tCH4)
$M_{steam,y}$	=	Quantity of steam produced in year *y* (t steam/y)

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the operation of the geothermal power plant:

Parameter	**Value**	**Unit**	**Source**
$W_{steam,CO2,y}$	[insert value]	[insert unit]	[insert source]
$W_{steam,CH4,y}$	[insert value]	[insert unit]	[insert source]
GWP_{CH4}	21	tCO2e/tCH4	Default value
$M_{Steam,y}$	[insert value]	[insert unit]	[insert source]
$PE_{GP,y}$	[insert value]	tCO2e/y	Calculated

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

This CPA involves geothermal power plants without fossil fuel combustion, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

Total Project Emission for the project activity equal:

PE_y = 0 + [insert value] + 0

PE_y = [insert value]

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR GEOTHERMAL PROJECTS

Data / Parameter	$W_{steam,CO2,y}$
Unit	tCO2/t steam
Description	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in specific CPA-DD.
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal project activities

Data / Parameter	$W_{steam,CH4,y}$
Unit	tCH_4/t steam
Description	Average mass fraction of methane in the produced steam in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported in each specific CPA-DD
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane.
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

Data / Parameter	$M_{steam,y}$
Unit	t steam/yr
Description	Quantity of steam produced in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported by specific CPA-DD
Measurement methods and procedures	The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports.
Monitoring frequency	Daily
QA/QC procedures	Data will be read continuously and logged daily. Data will be entered into CDM monitoring workbook every day and will be checked for consistency when entered. Meters will be maintained and periodically verified according to manufacturer specifications to ensure accurate readings; they will be recalibrated within the schedule recommended by the manufacturer.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal projects

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR (Rwanda)

Data / Parameter	$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: If available, hourly, otherwise annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option); or annually during the crediting period for the relevant year, following the guidance in Step 3 of the *Tool to calculate the emission factor for an electricity system*; Dispatch data OM: Hourly. Further guidance can be found in Step 3 of the *Tool to calculate the emission factor for an electricity system*; BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{PJ,h}$ and $EG_{PJ,y}$
Unit	MWh
Description	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*
Source of data	As specified in the underlying methodology
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Hourly or yearly as applicable
QA/QC procedures	As specified in the underlying methodology
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

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

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

CPA implementing entity

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

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

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

Project activities using geothermal technologies (but not involving fossil fuel consumption for electricity generation) will also monitor and keep records of additional parameters as specified in section B. 7.1. Additional parameter values will be reported on a quarterly basis with supporting evidence (if applicable). These parameters are listed in the table below:

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All
$W_{steam,CO2,y}$	Average mass fraction of carbon dioxide in the produced steam in year *y*	Geothermal CPAs
$W_{steam,CH4,y}$	Average mass fraction of methane in the produced steam in year *y*	Geothermal CPAs
$M_{steam,y}$	Quantity of steam produced in year *y*	Geothermal CPAs

For geothermal project activity, sampling of the parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 03.0) whereby the requirements from the applicable methodology will have precedence. Therefore following the methodology ACM0002 version 13.0.0, ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis) will be used to sample these parameters.

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data

and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures. These parameters are listed in the table below, although final monitoring may vary depending on the option chosen to calculate the grid emission factor for Rwanda.

Parameter	Description	Type of CPA
$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*	All
$EG_{m,y}$, EG_{y}, $EG_{k,y}$ and $EG_{n,h}$	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*	All
$EG_{PJ,h}$ and $EG_{PJ,y}$	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*	All

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 11: Hydro (run-of-river) project in Rwanda

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected hydro (run-of-river) project.

The generic SSC-CPA comprises the implementation and operation of a hydro (run-of-river) power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Rwandan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[74]:

Applicability criteria	Project activity
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind,	The generic SSC-CPA under the Programme will use hydro (run-of-river)

[74] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	energy that will supply electricity to the Rwandan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	N/A. These types of projects are not included in this CPA. Hydro run-of-river do not have reservoirs
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from hydro (run-of-river) energy and its supply to the Rwandan grid system.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is located in Rwanda This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) since it is a hydro (run-of-river) energy project
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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.

The sources and gases included in the SSC-CPA boundary for individual hydro (run-of-river) CPAs is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for hydro (run-of-river) projects
		CH_4	No	Not applicable for hydro (run-of-river) projects

		N_2O	No	Not applicable for hydro (run-of-river) projects
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for hydro (run-of-river) projects
		CH_4	No	Not applicable for hydro (run-of-river) projects
		N_2O	No	Not applicable for hydro (run-of-river) projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable for hydro (run-of-river) projects
		CH_4	No	Not applicable for hydro (run-of-river) projects
		N_2O	No	Not applicable for hydro (run-of-river) projects

The figure below provides a flow chart 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 generic hydro (run-of-river) CPA.

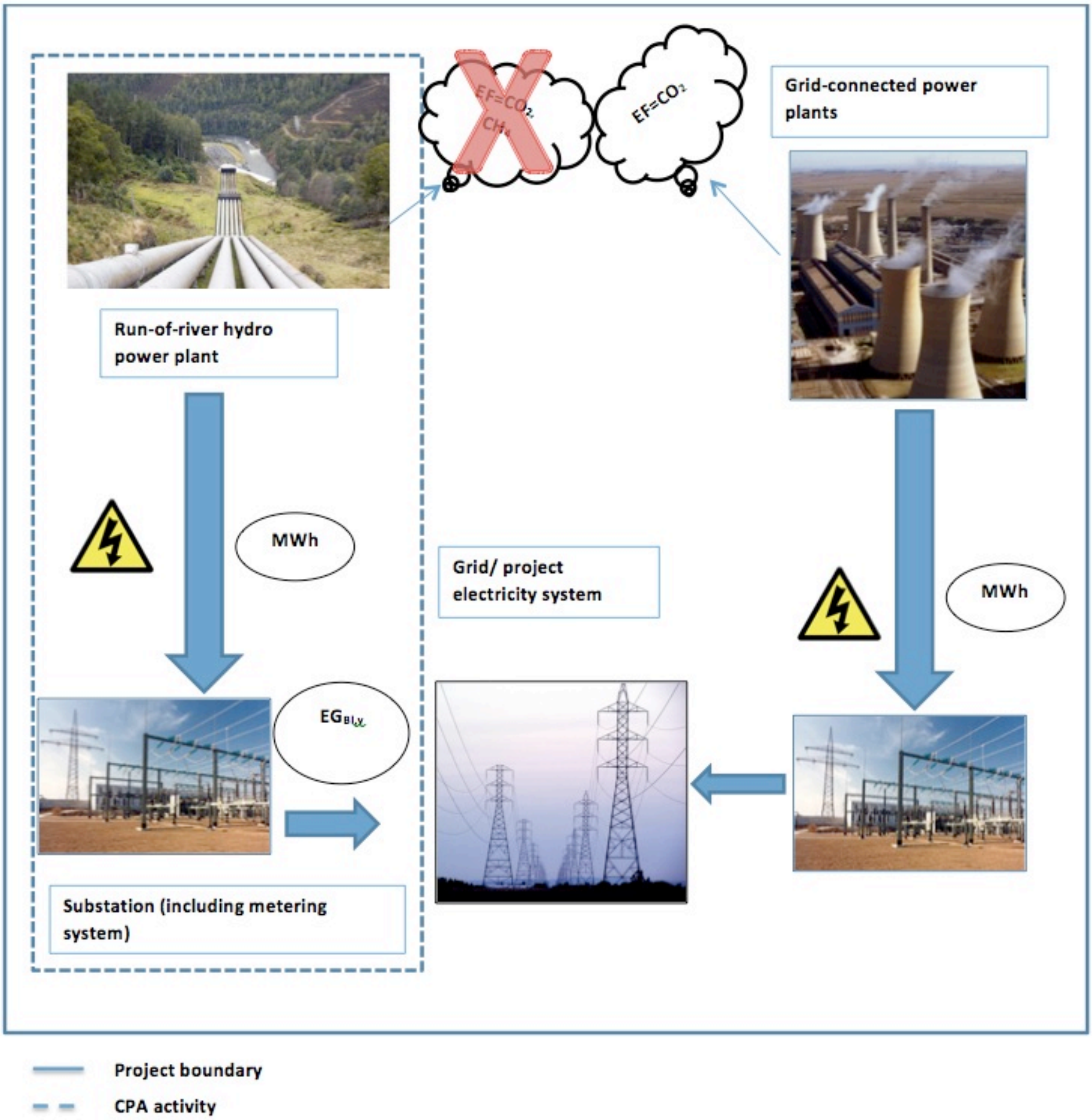


Figure 62: Run-of-river hydro CPA

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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".

National electricity grids in countries in East Africa such as Rwanda typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including

Ethiopia) is currently estimated at 5.3 GW.[75] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in Rwanda.

Table 12: Installed Capacity in MW

	Rwanda[76]
Fossil fuel based	29.37
Large hydro	24.26
Small hydro[77]	3
Geothermal	0
Wind	0
Biomass/gas	0
Solar & other RE	0.25
Total	56.88
% Renewable	48%
% Fossil Fuel Based	52%

Figure 39 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

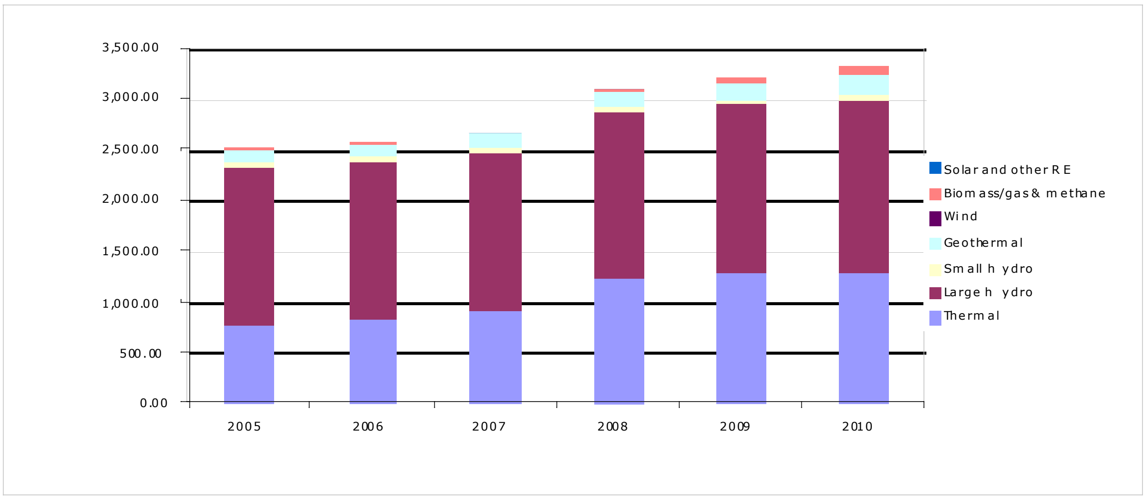


Figure 63: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

Figure 40 below represents the installed capacity of grid-connected power plants in Rwanda over the period 2005 to 2010.

[75] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.

[76] Rwanda Environment Management Authority (REMA) Energy Resources http://www.rema.gov.rw/soe/chap8.php (accessed on 7 September 2011)

[77] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

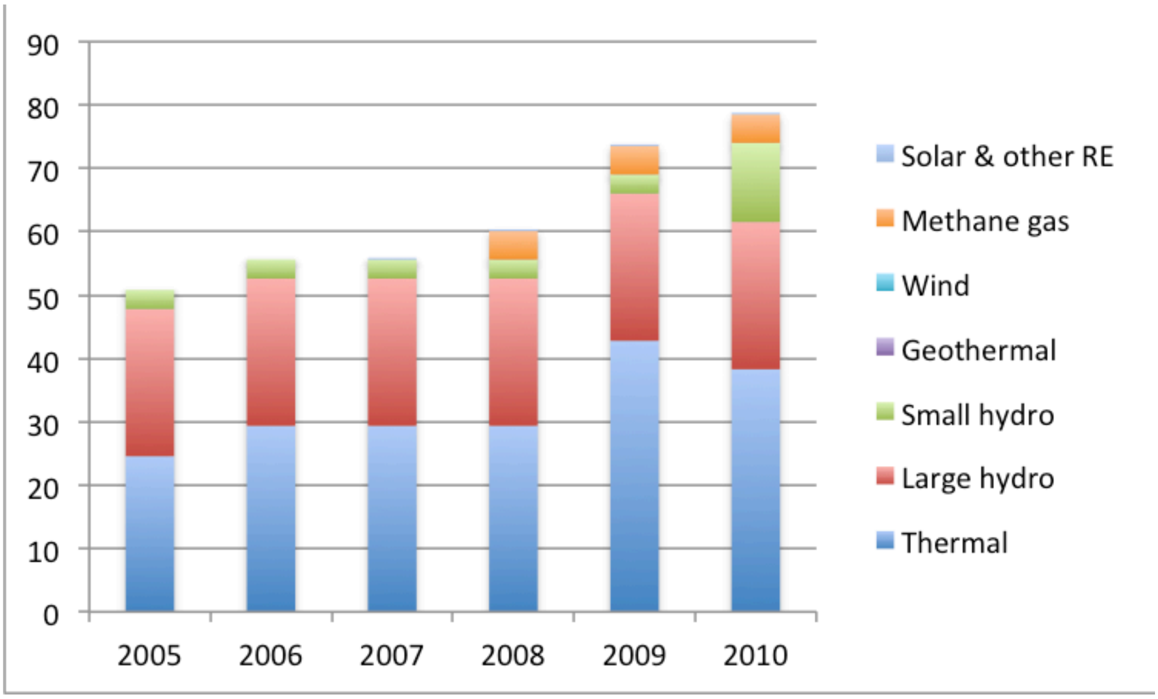


Figure 64: Grid - Connected Installed Capacity (MW) -Rwanda

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 41). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants.

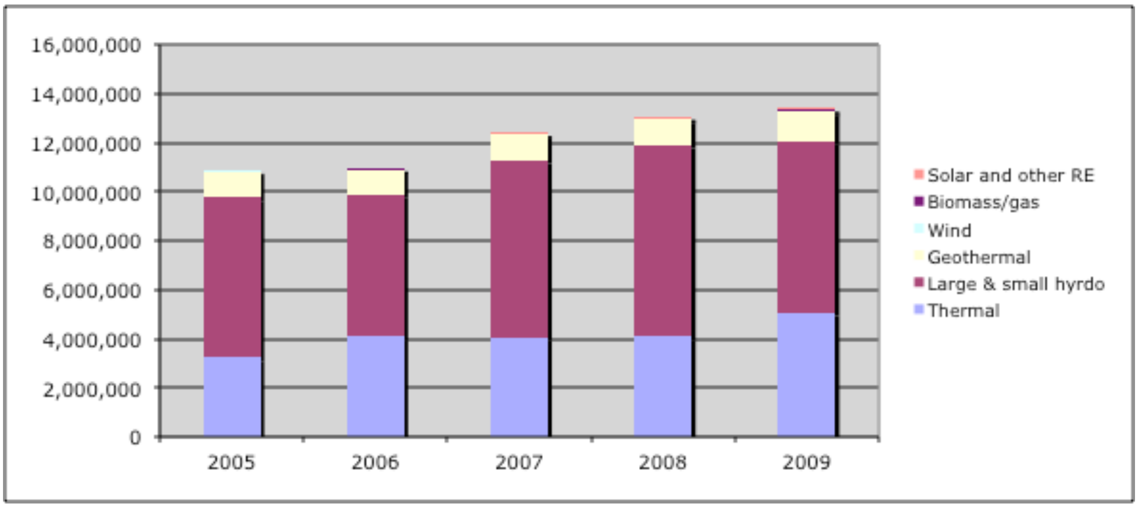


Figure 65: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

Figure 42 below shows the generation from grid-connected power plants by type in Rwanda.

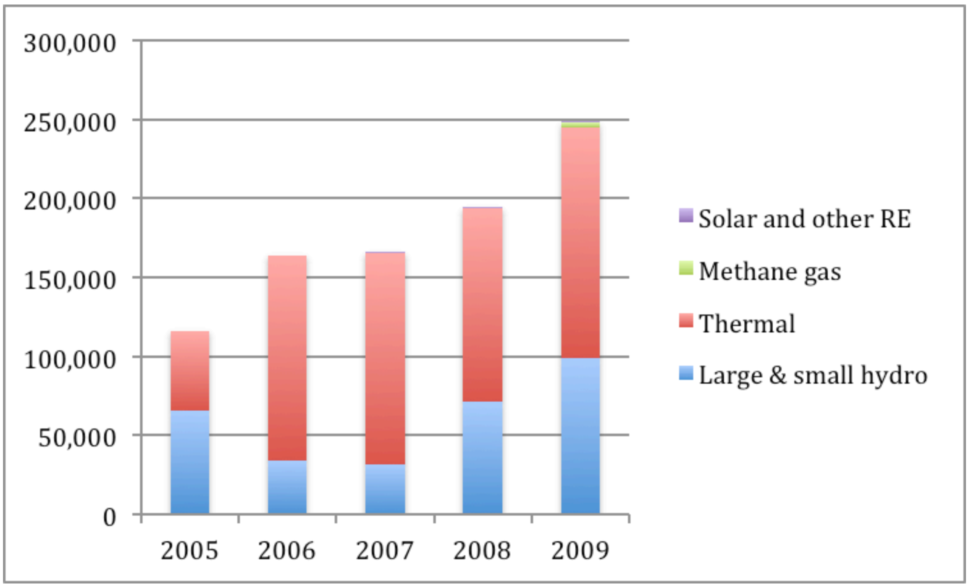


Figure 66: Generation from Grid- Connected Power Plants by Type (MWh), 2005-2009 -Rwanda

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. In Rwanda, the electrification rates are 35% in urban areas and 1% in the rural areas. The national electrification rate is 9%.

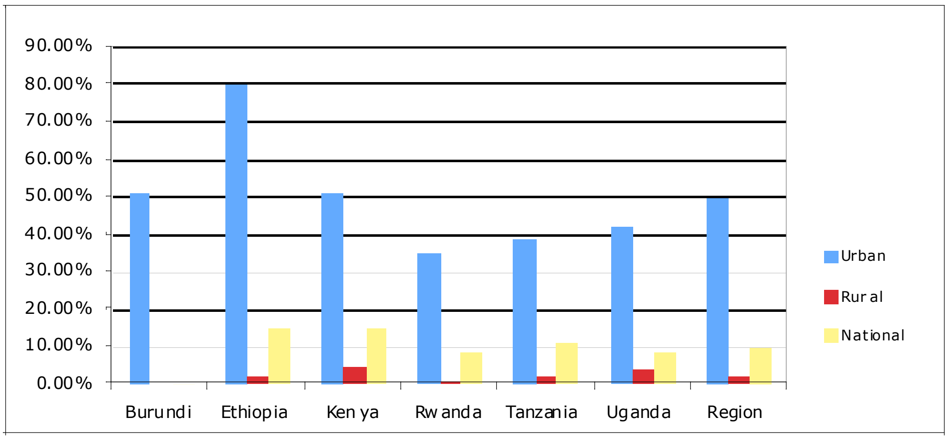


Figure 67: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Some countries have also introduced Feed-in-Tariff policies for renewable energy (e.g. Kenya and Uganda).

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that

is, unbundling, privatization, and wholesale and retail competition.[78] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[79]

More information regarding the baseline situation in Rwanda is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Rwandan boundaries.
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of Activities.	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a hydro energy project, a technology eligible for inclusion in the PoA

[78] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[79] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for hydro (run-of-river) energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in Rwanda which is a Least Developed Country (LDC). or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for hydro energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from hydro (run-of-river) projects. Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Rwandan electricity system that is covered by the PoA for each specific CPA and will be updated after the end of each crediting period of the CPA or annually depending on the data vintage applied following guidelines in the latest version of the tool to calculate the emission factor for an electricity system.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (run-of-river) 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 hydro (run-of-river) 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 hydro (run-of-river) power plants, which does not comprise water reservoirs. Therefore there are no emissions from water reservoirs.

This CPA, which involves a hydro (run-of-river) power project, has no project emissions, $PE_y = 0$.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)

PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (RWANDA)

Data / Parameter	$NCV_{i,y}$
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	The following data sources may be used if the relevant conditions apply: <table><tr><th>Data source</th><th>Conditions for using the data source</th></tr><tr><td>Values provided by the fuel supplier of the power plants in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr><tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr><tr><td>IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr></table>
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	*Monitoring frequency* Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: Annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. • BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	The gross calorific value (GCV) of the fuel can be used, if gross calorific values are provided by the data sources used. Make sure that in such cases also a gross calorific value basis is used for CO2 emission factor

<table>
<tr><td>Data / Parameter</td><td>$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$</td></tr>
<tr><td>Unit</td><td>tCO2/GJ</td></tr>
<tr><td>Description</td><td>CO2 emission factor of fossil fuel type i used in power unit m in year y</td></tr>
<tr><td>Source of data</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>Values provided by the fuel supplier of the power plant in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr>
<tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr>
<tr><td>IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr>
</table>
</td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>Monitoring frequency:

Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or annually during the crediting period for the relevant year;

Dispatch data OM: Annually for the year y in which the project activity is displacing grid electricity or, if available, hourly.

BM: For the first crediting period, either once ex ante or annually ex post,. For the second and third crediting period, only once ex ante at the start of the second crediting period</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>N/a</td></tr>
</table>

Data / Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* or *k* in year *y*
Source of data	Use either: • Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or • For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system* (if available for the type of power plant).
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be recorded in the specific CPA-DD *Monitoring frequency:* Once for the crediting period *QA/QC procedures*: If the data obtained from the manufacturer, the utility, the dispatch center of official records is significantly lower than the default value provided in Annex 1 for the applicable technology, project proponents should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Data / Parameter	CAP_m
Unit	MW
Description	Total capacity of off-grid power plants included in off-grid power plant class *m*
Source of data	Survey of of-grid power plants included in the off-grid plant class m
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	As per the provisions in Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system*

Data / Parameter	$PLF_{default,off-grid,y}$
Unit	Dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per the provisions in step 3 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system*.

Data / Parameter	$T_{grid,y}$
Unit	hours
Description	Average time the grid was available to final electricity consumers in year *y*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system* and if equation (7)

Data / Parameter	Other parameters related to off-grid power plants
Unit	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Description	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Source of data	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for hydro SSC-CPAs:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	[insert value]	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = [insert value] tCO2/MWh

BE_y = [Insert] * [insert value] = [Insert] tCO2/year

Project emissions

For most renewable energy project activities $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (run-of-river) 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 hydro (run-of-river) 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 hydro (run-of-river) power plants, which does not comprise water reservoirs. Therefore there are no emissions from water reservoirs.

This CPA, which involves a hydro (run-of-river) power project, has no project emissions, $PE_y = 0$.

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR (Rwanda)

Data / Parameter	$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: If available, hourly, otherwise annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option); or annually during the crediting period for the relevant year, following the guidance in Step 3 of the *Tool to calculate the emission factor for an electricity system*; Dispatch data OM: Hourly. Further guidance can be found in Step 3 of the *Tool to calculate the emission factor for an electricity system*; BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{PJ,h}$ and $EG_{PJ,y}$
Unit	MWh
Description	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*
Source of data	As specified in the underlying methodology
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Hourly or yearly as applicable
QA/QC procedures	As specified in the underlying methodology
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

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

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

CPA implementing entity

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

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

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

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures. These parameters are listed in the table below, although final monitoring may vary depending on the option chosen to calculate the grid emission factor for Rwanda.

Parameter	Description	Type of CPA
$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*	All
$EG_{m,y}$, EG_{y}, $EG_{k,y}$ and $EG_{n,h}$	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*	All
$EG_{PJ,h}$ and $EG_{PJ,y}$	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*	All

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

PART II. Generic component project activity (CPA)

CPA TYPE 12: Hydro (with accumulation reservoir) project in Rwanda

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The small-scale component project activity (SSC-CPA) which will be implemented under the East Africa Renewable Energy Programme (EA-REP) is a grid-connected hydro (with accumulation reservoir) project.

The generic SSC-CPA comprises the implementation and operation of a hydro (with accumulation reservoir) power plant implemented at a site where no renewable energy power plant was operated prior to the implementation of the project activity. The project activity will generate electricity, which will be fed into the Rwandan electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the project activity will lead to emission reductions.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

SSC-CPAs included in the PoA will apply approved SSC baseline and monitoring methodology AMS-I.D. "*Grid connected renewable electricity generation"* (version 17).

AMS-I.D (version 17) also refers to the latest versions of the following methodological tools:
- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

In addition, the PoA also refers to the *Tool for the demonstration and assessment of additionality* (version 06.1.0).

The approved SSC baseline and monitoring methodology AMS I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

The project activity qualifies as a small-scale project activity because the maximum output capacity achieved by individual CPAs will not exceed 15MW. The project activity will not exceed this threshold during every year of its crediting period. The project activity falls under category AMS-I.D *Grid connected renewable electricity generation* (version 17) because the project activity meets the applicability criteria as follows[80]:

Applicability criteria	Project activity
This methodology comprises renewable energy generation	The generic SSC-CPA under the

[80] Documentation that has been used as a basis of justification and references where applicable will be provided in section D.2 of the specific CPA-DD.

units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Programme will use hydropower energy that will supply electricity to the Rwandan national grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPAs under the PoA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant);
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	For SSC-CPAs under the PoA that implement a hydro power plant with a reservoir at least one of the following conditions will be satisfied: • The SSC-CPA is implemented in an existing reservoir with no change in the volume of reservoir; • The SSC-CPA is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the SSC-CPA, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The SSC-CPA results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.
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.	N/A. These types of projects are not included in the PoA.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.

In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic project activity involves the generation of electricity from hydro (with accumulation reservoir) energy and its supply to the Rwandan grid system.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is located in Rwanda This country is not an annex I country.

The project does not need to meet the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) since it is a hydro (with accumulated reservoir) energy project
Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA.

B.3. Sources and GHGs

According to the approved SSC- methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), " 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.

The sources and gases included in the SSC-CPA boundary for individual hydro (with accumulation reservoir) CPAs is as shown in the table below:

Source		**Gas**	**Included?**	**Justification/ Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source

Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable for hydro (with accumulation reservoir) projects
		CH_4	No	Not applicable for hydro (with accumulation reservoir) projects
		N_2O	No	Not applicable for hydro (with accumulation reservoir) projects
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Not applicable for hydro (with accumulation reservoir) projects
		CH_4	No	Not applicable for hydro (with accumulation reservoir) projects
		N_2O	No	Not applicable for hydro (with accumulation reservoir) projects
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	Yes	Main emission source
		N_2O	No	Minor emission source

The figure below provides a flow chart 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 generic hydro (with accumulation reservoir) CPA.

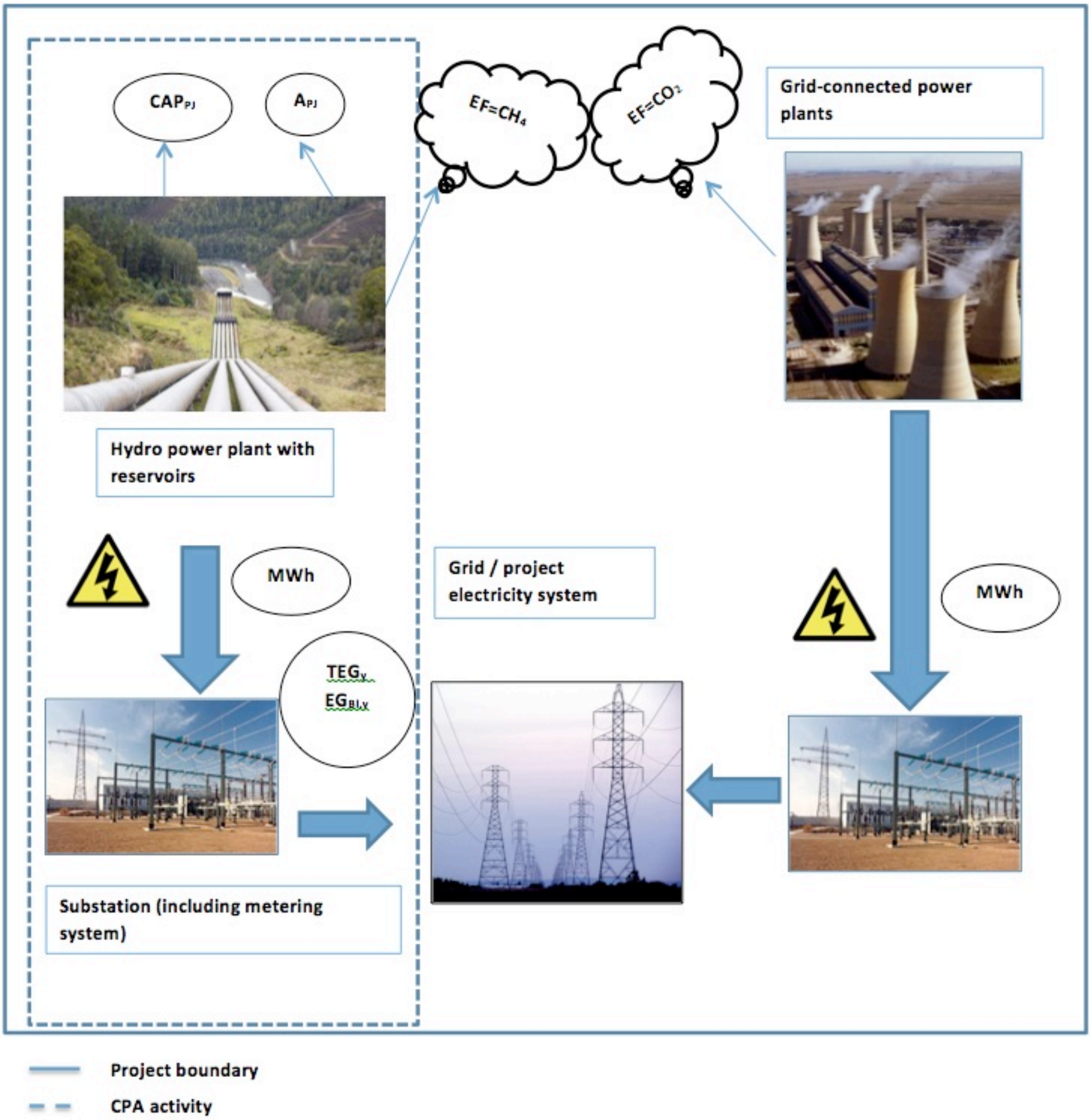


Figure 68: Hydro CPA with accumulation reservoir

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *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”.

National electricity grids in countries in East Africa such as Rwanda typically consist of a mix of hydro and fossil fuel based power plants sometimes complemented with some other form of renewable energy generation like geothermal, biomass and/or wind. The total installed capacity in East Africa (including Ethiopia) is currently estimated at 5.3 GW.[81] This is less than 5% of the installed capacity in a country like Germany. The table below provides an overview of the energy mix in Rwanda.

Table 13: Installed Capacity in MW

	Rwanda[82]
Fossil fuel based	29.37
Large hydro	24.26
Small hydro[83]	3
Geothermal	0
Wind	0
Biomass/gas	0
Solar & other RE	0.25
Total	56.88
% Renewable	48%
% Fossil Fuel Based	52%

Figure 39 further illustrates the installed capacity of grid-connected power plants in East Africa (excluding Ethiopia). As can be seen from the figure, the East African grid is dominated by a combination of large hydro plants and fossil fuel based thermal power plants. Over the last number of years, the increase in installed capacity has been mostly due to an increase in thermal power (approximately 500 MW), large hydro (approximately 150 MW) and geothermal (70 MW).

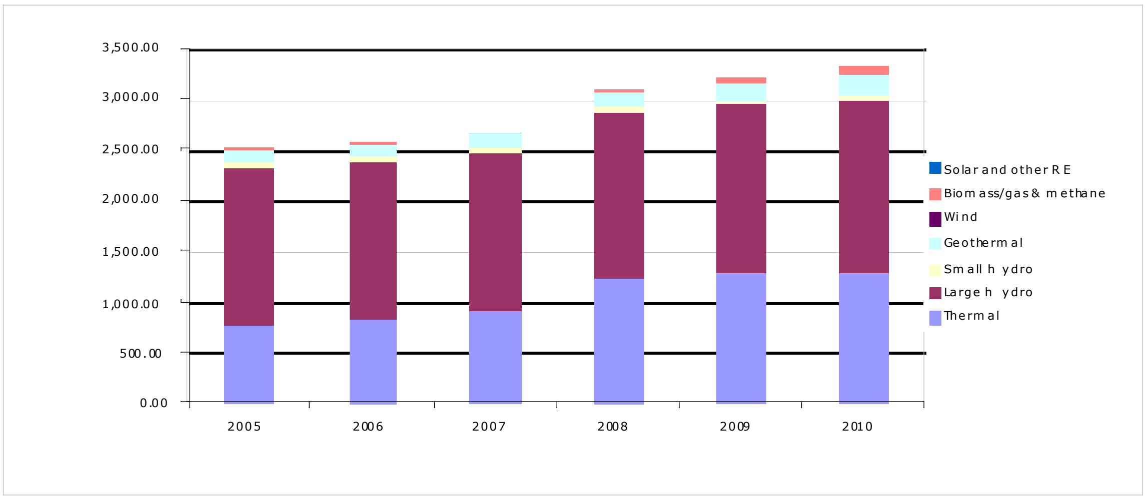


Figure 69: Regional Grid-Connected Installed Capacity (MW), 2005-2010 - excluding Ethiopia

[81] This is installed capacity and not effective capacity. In some countries effective capacity can be much lower than installed capacity, e.g. in Tanzania effective capacity is only 873 MW whereas installed capacity is estimated at 1027 MW.
[82] Rwanda Environment Management Authority (REMA) Energy Resources http://www.rema.gov.rw/soe/chap8.php (accessed on 7 September 2011)
[83] Small Hydro power plants are defined as power plants with an installed capacity of <10MW

Figure 40 below represents the installed capacity of grid-connected power plants in Rwanda over the period 2005 to 2010.

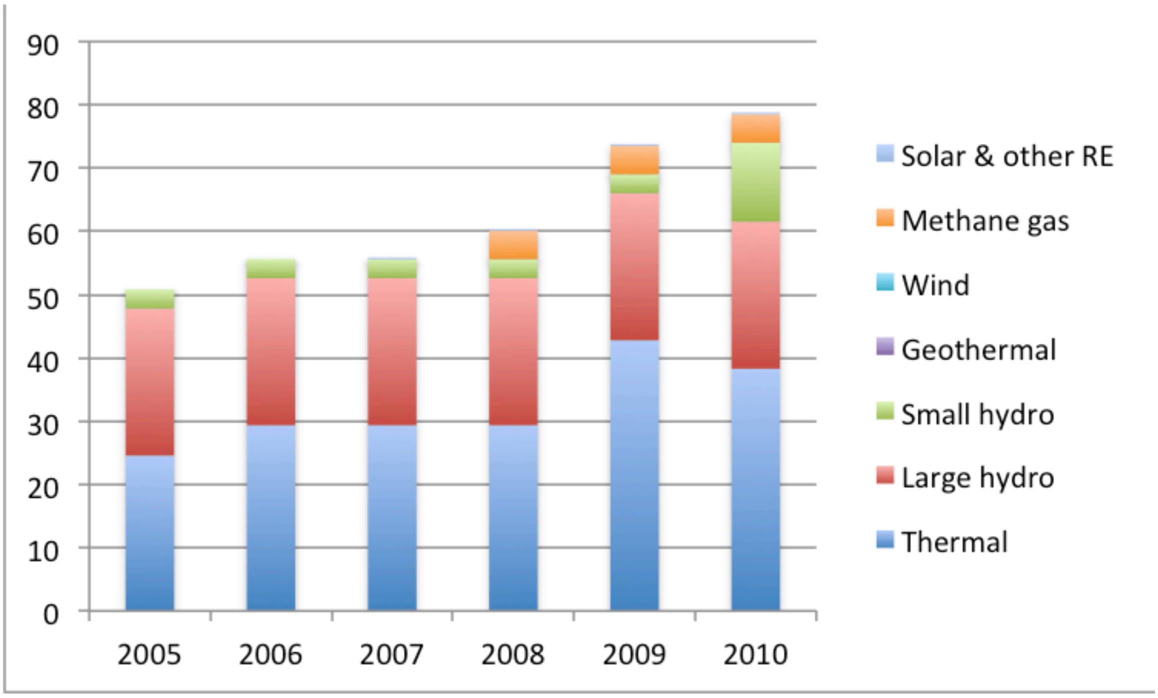


Figure 70: Grid - Connected Installed Capacity (MW) -Rwanda

Electricity generation in East Africa (including Ethiopia) reached approximately 17,000 GWh in 2009. On a regional basis, between 60-70% of the electricity generation is based on large hydro power plants. Over the last number of years, the share of fossil based electricity generation has rapidly increased from 3,264 GWh in 2005 to 5,401 GWh in 2009, i.e. an increase of approximately 65% (see Figure 41). Part of the increase in fossil fuel based electricity generation can be explained by the frequent droughts that have hit the region and which affect water levels at the hydro plants.

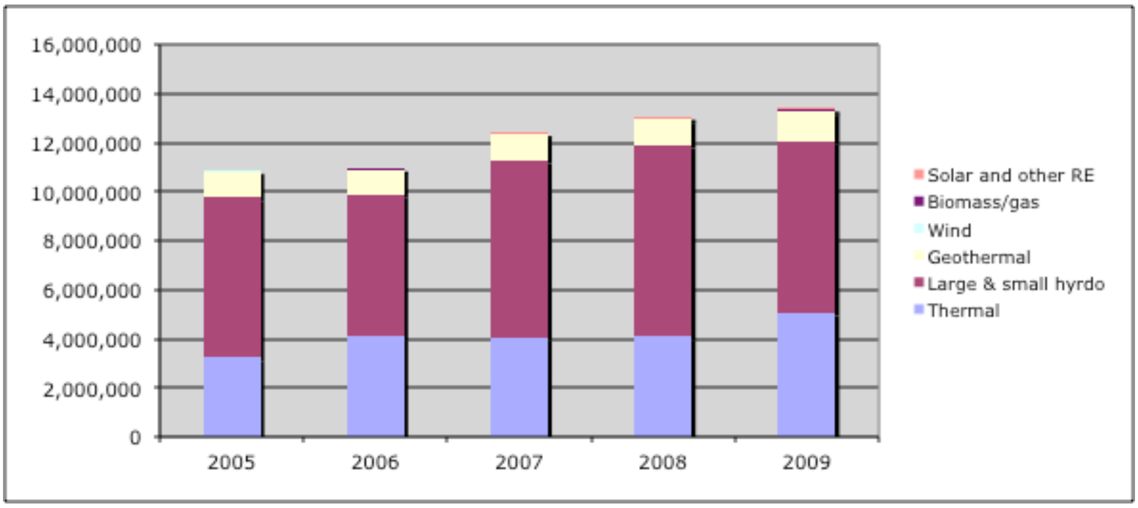


Figure 71: Regional Generation from Grid-Connected Power Plants by Type (MWh), 2005 - 2009

Figure 42 below shows the generation from grid-connected power plants by type in Rwanda.

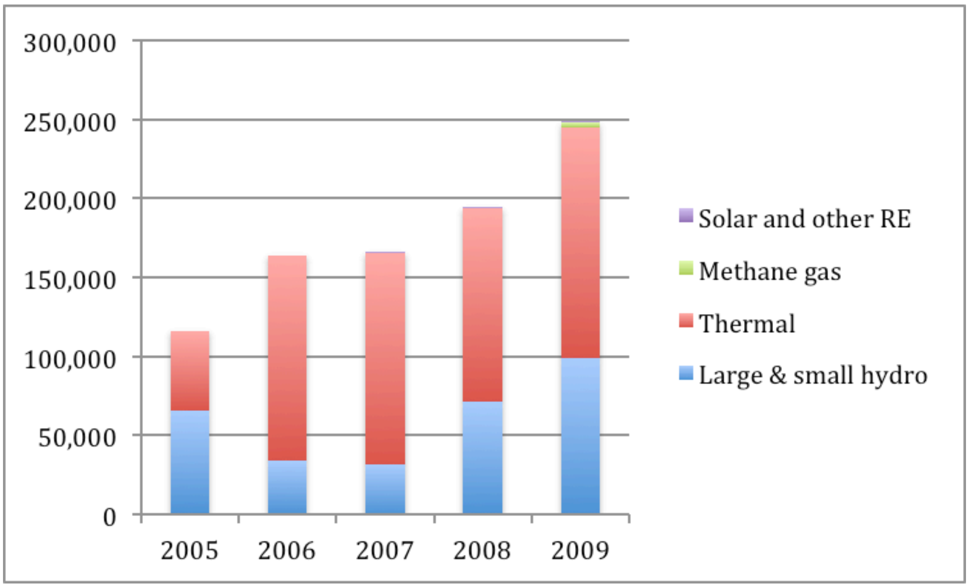


Figure 72: Generation from Grid- Connected Power Plants by Type (MWh), 2005-2009 -Rwanda

Electrification rates in most East African countries remain very low, especially in rural areas. On average, 10% of the population has access to the national electricity grid. In Rwanda, the electrification rates are 35% in urban areas and 1% in the rural areas. The national electrification rate is 9%.

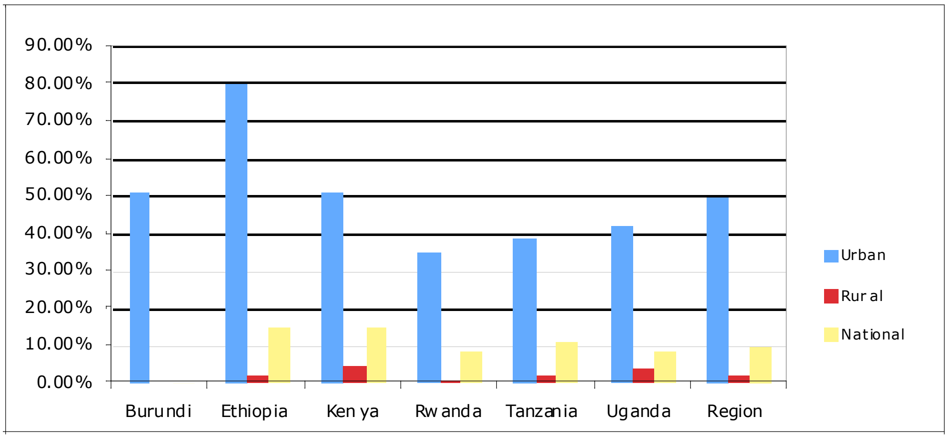


Figure 73: Electrification rate in East Africa (% population with access)

In order to reach their development targets, countries in East Africa have highlighted the importance of increasing electricity generation in the region and improve access to electricity in the rural areas. Since the late 1990, countries in East Africa have gradually moved towards power sector reform focusing on deregulation and gradual reduction of government participation in the electricity sector. Power sector reforms have taken different paths in different countries but have typically involved the passing of electricity acts, 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. Some countries have also introduced Feed-in-Tariff policies for renewable energy (e.g. Kenya and Uganda).

Despite the formulation of new energy policies and the enactment of new laws and regulations, it has been observed that nowhere in Sub-Saharan Africa does one encounter the "standard" reform model, that

is, unbundling, privatization, and wholesale and retail competition.[84] Instead one finds what might be termed hybrid power markets. In most countries, the national state-owned utility retains its dominant market position, serving as the single buyer of electricity and maintaining its own generation plants. Private sector cooperation is either temporary—for example, a limited-term management contract—or marginal, in the form of independent power producers (IPPs) that contract with the state-owned national utility.

According to the same study, the move towards independent regulation has not delivered, either. Regulators are far from independent in many situations. Governments still pressure regulators to modify or overturn decisions. In some countries, turnover among commissioners has been high, with many resigning under pressure before completing their full term. The gap between law (or rule) and practice is often wide. Tariff-setting remains highly politicized, and governments are sensitive to popular resentment against price increases that are often necessary to cover costs.[85]

More information regarding the baseline situation in Rwanda is provided in Appendix 6.

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1.	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA.	The SSC-CPA's exact geographical location as shown in the detailed project documentation is within the geographical boundary set in section A.5 of the PoA-DD and more specifically within the Rwandan boundaries.
2.	Double counting (b)	The CPA has not yet been included in another Programme of Activities or has not yet been registered as a single CDM Project Activity.	A signed confirmation from the entity implementing the SSC-CPA, confirms that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity. Each SSC-CPA has a unique name, which at least refers to the location, technology and the installed capacity of the CPA.
3.	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this Programme of Activities.	The feasibility study or other project documentation proves that the SSC-CPA involves the implementation of a hydro energy project, a technology eligible for inclusion in the PoA

[84] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.
[85] Eberhard, A., V. Foster, C. Briceño-Garmendia, F. Ouedraogo, D. Camos and M. Shkaratan (2008) *Underpowered: The State of the Power Sector in Sub-Saharan Africa*. World Bank. Africa Infrastructure Country Diagnostic.

4.	Start date (d)	The start of the CPA occurs after the start of the validation of the programme of activities, 21/01/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA.	The contract with the party providing equipment/construction/operation services [is expected to be signed *or* has been signed] on the [insert date]. The start of validation the PoA was 21/01/2012. Thus the project meets the start date requirements.
5.	Applicability of methodology (e)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
6.	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation.*	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* Explanation is provided in section D.2 of the specific CPA-DD
7.	Applicability of methodology (e)	The CPA does not use generating equipment which is transferred from another activity.	Feasibility study report or other relevant documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
8.	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below.	Additionality check carried out in section D.5 of the SSC-CPA-DD and in line with the additionality related eligibility criteria shown below demonstrates that the project is additional.
9.	Stakeholder consultation and EIA (g)	The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations.	An Environmental Impact Assessment has been conducted in line with the relevant environmental laws as detailed in the Environmental Impact Assessment Report as well as section B of the CPA-DD.

10.	Stakeholder consultation and EIA (g)	The CPA has carried out a local stakeholder consultation.	A local stakeholder consultation was carried out as indicated in the local stakeholder consultation report as well as section C of the CPA-DD.
11.	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance.	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
12.	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As in eligibility criterion 5 above]*	Power Purchase Agreement, wheeling contract or any other project documentation e.g. records of discussions with the Utility company or draft PPA proving that the CPA supplies electricity to the Rwandan national grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. *[As eligibility criteria 5 above]*
13.	Sampling requirements (j)	Sampling will be carried in line with paragraph 3 of the *Standard for sampling and surveys for CDM project activities and programme of activities* (version 03.0, EB 69, Annex 4) whereby the requirements from the applicable methodology will have precedence. *[Applicable for geothermal project types]*	N/A. Sampling with not necessary for hydro (with accumulation reservoir) energy projects.
14.	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a project activity is applying the additionality Option A for microscale project activities, the installed capacity of the CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small scale or the microscale project threshold.
15.	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of*	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* shows that the project is not a debundled component of

		debundling for SSC project activities.	a large-scale project activity

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country or The project activity employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in Rwanda which is a Least Developed Country (LDC). or The CPA employs [technology] which is a recommended technology by the Kenyan DNA.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable Project or Equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 06.1.0)
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA implementer is not a subsidiary of a multinational group
Investment or debt financing is done by a company that also purchases the CERs In case the company that provides financing described above is different from the one that purchases the CERs a clear relationship between the two should exist e.g. subsidies under the same holding/parent company may be considered eligible	Loan or equity investment in the project activity is done by a company that purchases the CERs Annual financial reports or published documents shows that the company that provides the investment and the one that buys the credits are related

Option C on automatic additionality is not applicable for hydro energy projects.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from hydro (with accumulation reservoir) Grid-connected renewable electricity generation from biomass is excluded from this PoA.

The PoA will focus on 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 project activity (greenfield plant).

The emission factor of the grid will be 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 prescribed in the *Tool to calculate the emission factor for an electricity system (version 02.2.1)*.

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

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

The grid emission factor will be calculated for the Rwandan electricity system that is covered by the PoA for each specific CPA and will be updated after the end of each crediting period of the CPA or annually depending on the data vintage applied following guidelines in the latest version of the tool to calculate the emission factor for an electricity system.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water

reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (with accumulation reservoir) 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 hydro (with accumulation reservoir) 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 ($PE_{HP,y}$)

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

(a) If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2, **equation 3** in ACM0002 (version 13.0.0) will be used to calculate $PE_{HP,y}$:

$$PE_{HP,y} = (EF_{Res} – TEG_y) / 1000$$

Where:

$PE_{HP,y}$	=	Project emissions from water reservoirs (tCO2e/yr)
EF_{Res}	=	Default emission factor for emissions from reservoirs of hydro power plants in year *y* (kgCO2e/MWh)
TEG_y	=	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

According to the methodology, the default value for EF_{Res} is used, 90 kgCO_2e/MWh.

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

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

The power density of the project activity (*PD*) will be calculated using **equation (5)** in ACM0002 version 13.0.0, as follows:

$$PD = (Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL})$$

Where:

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

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

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

SPECIFIC PARAMETERS FOR HYDRO PROJECT ACTIVITIES (WITH ACCUMULATION RESERVOIR)

Data / Parameter	Cap_{BL}
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.
Source of data	Project site
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	Determine the installed capacity based on recognized standards
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

Data / Parameter	A_{BL}
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m2). For new reservoirs, this value is zero
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR – (RWANDA)

Data / Parameter	$NCV_{i,y}$
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	The following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** Values provided by the fuel supplier of the power plants in invoices / If data is collected from power plant operators (e.g. utilities) Regional or national average default values / If values are reliable and documented in regional or national energy statistics / energy balances IPCC default values at the upper limit of the uncertainty at 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 reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	*Monitoring frequency* Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: Annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. • BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	The gross calorific value (GCV) of the fuel can be used, if gross calorific values are provided by the data sources used. Make sure that in such cases also a gross calorific value basis is used for CO2 emission factor

Nested table (Source of data):

Data source	Conditions for using the data source
Values provided by the fuel supplier of the power plants in invoices	If data is collected from power plant operators (e.g. utilities)
Regional or national average default values	If values are reliable and documented in regional or national energy statistics / energy balances
IPCC default values at the upper limit of the uncertainty at 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	

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO2/GJ
Description	CO2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data	The following data sources may be used if the relevant conditions apply: **Data source** — **Conditions for using the data source** Values provided by the fuel supplier of the power plant in invoices — If data is collected from power plant operators (e.g. utilities) Regional or national average default values — If values are reliable and documented in regional or national energy statistics / energy balances IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories —
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	*Monitoring frequency:* Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year; Dispatch data OM: Annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*,. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Data / Parameter	$\eta_{m,y}$ and $\eta_{k,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* or *k* in year *y*
Source of data	Use either: • Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or • For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or The default values provided in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system* (if available for the type of power plant).
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be recorded in the specific CPA-DD *Monitoring frequency:* Once for the crediting period *QA/QC procedures*: If the data obtained from the manufacturer, the utility, the dispatch center of official records is significantly lower than the default value provided in Annex 1 for the applicable technology, project proponents should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

Data / Parameter	CAP_m
Unit	MW
Description	Total capacity of off-grid power plants included in off-grid power plant class *m*
Source of data	Survey of of-grid power plants included in the off-grid plant class m
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	As per the provisions in Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system*

Data / Parameter	$PLF_{default,off-grid,y}$
Unit	Dimensionless
Description	Plant load factor for off-grid generation in year *y*
Source of data	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	Default value of 300 hours per year or calculate on the basis of equation 7 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per the provisions in step 3 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system*.

Data / Parameter	$T_{grid,y}$
Unit	hours
Description	Average time the grid was available to final electricity consumers in year *y*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of baseline emissions
Additional comment	Only applicable if Option II is chosen in Step 2 of the *Tool to calculate the emission factor for an electricity system* and if Option 3 is chosen to determine $EG_{m,y}$ in Step 4 of the *Tool to calculate the emission factor for an electricity system* and if equation (7)

Data / Parameter	Other parameters related to off-grid power plants
Unit	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Description	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Source of data	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Value(s) applied	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Choice of data or Measurement methods and procedures	As per Annex 2 of the *Tool to calculate the emission factor for an electricity system*
Purpose of data	Calculation of baseline emissions
Additional comment	N/a

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

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

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	=	CO2 emission factor of the grid in year *y* (tCO2/MWh)

Calculation of $EG_{BL,y}$

Parameter	Value	Unit	Source
$EG_{BL,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for hydro SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{BM}	0.5		
$EF_{grid,OM,y}$	[insert value]	tCO2/MWh	GEF calculations
W_{OM}	0.5		
$EF_{grid,CM,y}$	[insert value]	tCO2/MWh	

Therefore:

$EF_{CO2,grid,y}$ = [insert value] tCO2/MWh

BE_y = [Insert] * [insert value] = [Insert] tCO2/year

Project emissions

For most renewable energy project activities $PE_y = 0$. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS-I.D (version 17)

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

Where:

PE_y	=	Project emissions in year *y* (tCO2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO2e/yr)

Project emissions from fossil fuel combustion ($PE_{FF,y}$)

This CPA involves hydro (with accumulation reservoir) 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 hydro (with accumulation reservoir) 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 ($PE_{HP,y}$)

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir. The project emissions will depend on the power density of the single or multiple reservoirs.

The power density of the single or multiple reservoirs (*PD*) will be calculated using **equation (5)** in ACM0002 version 13.0.0, as follows:

$$PD = (Cap_{PJ} - Cap_{BL}) / (A_{PJ} - A_{BL})$$

Where:

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

The table(s) provide(s) an overview of the parameter values used to calculate the power density of the single or multiple reservoirs:

Parameter	**Value**	**Unit**	**Source**
Cap_{PJ}	[insert value]	[insert unit]	[insert source]
Cap_{BL}	[insert value]	[insert unit]	[insert source]
A_{PJ}	[insert value]	[insert unit]	[insert source]
A_{BL}	[insert value]	[insert unit]	[insert source]

The power density of the single or multiple reservoirs equals [insert value] W/m^2. Therefore, the following formula is used to calculate the project emissions:

(a) If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2 **equation 3** in ACM0002 (version 13.0.0) will be used to calculate $PE_{HP,y}$:

$$PE_{HP,y} = (EF_{Res} - TEG_y) / 1000$$

Where:

$PE_{HP,y}$	=	Project emissions from water reservoirs (tCO2e/yr)
EF_{Res}	=	Default emission factor for emissions from reservoirs of hydro power plants in year *y* (kgCO2e/MWh)
TEG_y	=	Total electricity produced by the project activity, including the electricity supplied to the

grid and the electricity supplied to internal loads, in year *y* (MWh)

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the water reservoir:

Parameter	Value	Unit	Source
EF_{Res}	90	kgCO2e/MWh	ACM0002 version 13.0.0
TEG_y	[insert value]	[insert unit]	[insert source]
$PE_{HP,y}$	[insert value]	[insert unit]	Calculated

b) If the power density of the single or multiple reservoirs (*PD*) is greater than 10 W/m^2:

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

Total Project Emission for the project activity equal:

$PE_y = 0 + 0 +$ [insert value]

$PE_y =$ [insert value]

Leakage emissions

The project activity does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with AMS-I.D. (version 17) the emission reductions are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y – PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO2/y)
BE_y	=	Baseline Emissions in year *y* (t CO2/y)
PE_y	=	Project emissions in year *y* (t CO2/y)
LE_y	=	Leakage emissions in year *y* (t CO2/y)

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_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

GENERAL PARAMETERS

Data / Parameter	$EG_{BL,y}$
Unit	MWh/y
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The meter will be installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards. In case the grid operator will install their own electricity meter, the meter by the project owner will be used to cross check the measured values. If values differ, the values from the meter with a higher precision will be used.
Monitoring frequency	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a meter owned by the project owner.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. invoices). The equipment will be calibrated and tested according to the national standards and reference points or IEC standards as agreed with the grid operator and recalibrated at appropriate intervals according to manufactures specifications. The metering equipment will also be certified to national or IEC standards.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR HYDRO PROJECTS (WITH ACCUMULATION RESERVOIR)

Data / Parameter	TEG_Y
Unit	MWh/yr
Description	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Electricity meters
Monitoring frequency	Continuous measurement and at least monthly recording.
QA/QC procedures	Calculation of project emissions
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2

Data / Parameter	CAP_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data	Project site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Determine the installed capacity based on recognized standards
Monitoring frequency	Monitoring must be done on an annual basis
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

Data / Parameter	**A_{PJ}**
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc
Monitoring frequency	Monitoring must be done on an annual basis
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

SPECIFIC PARAMETERS FOR THE CALCULATION OF THE GRID EMISSION FACTOR (Rwanda)

Data / Parameter	$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$
Unit	Mass or volume unit
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) or annually during the crediting period for the relevant year. Dispatch data OM: If available, hourly, otherwise annually for the year *y* in which the project activity is displacing grid electricity or, if available, hourly. BM: For the first crediting period, either once *ex ante* or annually *ex post*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{m,y}$, EG_y, $EG_{k,y}$ and $EG_{n,h}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*
Source of data	Utility or government records or official publications
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Simple OM, simple adjusted OM, average OM: Either once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option); or annually during the crediting period for the relevant year, following the guidance in Step 3 of the *Tool to calculate the emission factor for an electricity system*; Dispatch data OM: Hourly. Further guidance can be found in Step 3 of the *Tool to calculate the emission factor for an electricity system*; BM: For the first crediting period, either once *ex ante* or annually *ex post*, following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
QA/QC procedures	To be reported in the specific CPA-DD
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

Data / Parameter	$EG_{PJ,h}$ and $EG_{PJ,y}$
Unit	MWh
Description	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*
Source of data	As specified in the underlying methodology
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	To be reported in the specific CPA-DD
Monitoring frequency	Hourly or yearly as applicable
QA/QC procedures	As specified in the underlying methodology
Purpose of data	Calculation of the baseline emissions
Additional comment	N/a

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

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

CPA implementing entity

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

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

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

Project activities using hydro technologies (with accumulated reservoir) will also monitor and keep records of additional parameters as specified in section B. 7.1. Additional parameter values will be reported on a quarterly basis with supporting evidence (if applicable). These parameters are listed in the table below:

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All
TEG_Y	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*	Hydro CPAs with reservoirs
CAP_{PJ}	Installed capacity of the hydro power plant after the implementation of the project activity.	Hydro CPAs with reservoirs
A_{PJ}	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.	Hydro CPAs with reservoirs

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

Coordinating/managing entity

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

If problems occur that may affect the quality of data, the CME will inform the project proponent/ CPA implementing entity and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA implementing entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare periodic monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA implementing entities, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures. These parameters are listed in the table below, although final monitoring may vary depending on the option chosen to calculate the grid emission factor for Rwanda.

Parameter	Description	Type of CPA
$FC_{i,m,y}$, $FC_{i,y}$, $FC_{i,k,y}$, $FC_{i,n,y}$ and $FC_{i,n,h}$	Amount of fossil fuel type *i* consumed by power plant / unit *m*, *k* or *n* (or in the project electricity system in case of *FCi,y*) in year *y* or hour *h*	All
$EG_{m,y}$, EG_{y}, $EG_{k,y}$ and $EG_{n,h}$	Net electricity generated by power plant/unit *m*, *k* or *n* (or in the project electricity system in case of *EGy*) in year *y* or hour *h*	All
$EG_{PJ,h}$ and $EG_{PJ,y}$	Electricity displaced by the project activity in hour *h* of year *y* or in year *y*	All

Data and information for the calculation of the grid emission factors will be stored electronically by the CME for at least two years following the end of the last crediting period.

- - - - -

Appendix 1: Contact information on entity/individual responsible for the PoA

Organization	Standard Bank Plc
Street/P.O. Box	20 Gresham Street
Building	-
City	London
State/Region	-
Postcode	EC2V 7JE
Country	United Kingdom
Telephone	+44 20 31456890
Fax	+44 20 31896930
E-mail	co2@standardbank.com
Website	www.standardbank.com
Contact person	Fenella Aouane
Title	Senior Manager - Carbon Trading
Salutation	Ms.
Last name	Aouane
Middle name	-
First name	Fenella
Department	-
Mobile	+44 7824434777
Direct fax	-
Direct tel.	+44 20 3145 6890
Personal e-mail	Fenella.Aouane@standardbank.com

Appendix 2: Affirmation regarding public funding

Not applicable.

Appendix 3: Application of methodology(ies)

Not applicable.

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

GRID EMISSION FACTOR KENYA

The combined margin CO2 emission factor for the Kenyan grid ($EF_{grid,CM,y}$) was calculated using the *Tool to calculate the emission factor for an electricity system* (version 02.2.1). The following steps were taken:

Step 1. Identify the relevant electricity systems

For calculating the grid emission factor, the project activity has identified the Kenyan national grid as the relevant electricity system. The identification of the Kenyan national grid as the relevant electricity system is based on the following arguments:

- The Kenyan DNA has not published a delineation of the project electricity system and connected electricity system.
- The Kenya grid is connected to the Ugandan grid through a double circuit 132 kV transmission line. However, the Ugandan grid is not considered a connected electricity system because there are no spot markets in the Kenyan and Ugandan electricity system and the transmission line is not operated at 90% of its rated capacity during 90% or more of the hours of the year.
- Finally, Kenya does not have a layered dispatch system and the country has only one electricity grid system that serves the entire country. Therefore, and in line with version 02.2.1 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 Option II and both grid and off-grid power plants were included in the calculation.

Following the procedures related to off-grid power generation (Annex 2 of the *Tool to calculate the emission factor for an electricity system*), the following steps have been taken:

<u>STEP 1: Obtain data on off-grid power generation</u>

A survey was carried out to collect data on off-grid power generation. The data were statistically evaluated to infer estimates for the entire electricity system.

Step 1.1: Choose the data to be collected

The following data were collected:

Data	**Description**
CAP_p	Nominal electric capacity of the off-grid power plant p (MW)
$TECH_p$	The type of technology of the off-grid power plant *p*. This includes, inter alia, the following types of technologies: (a) Reciprocating engines (b) Steam turbine (c) Gas turbine (d) Combined cycle power generation

	(e) Hydro, solar wind or geothermal power generation
$FUEL_p$	The fuel type(s) used in the off-grid power plant *p*. This should include at least the following fuel types: (a) Diesel (b) Gasoline (c) Kerosene (d) Natural gas (e) Coal (f) Biomass/biofuels (g) Any relevant blends or other fuels
$GRID_p$	Are the consumers supplied by the off-grid power plant also connected to an electricity grid which is capable of supplying their power demand entirely during time intervals where grid electricity is available, reliable and stable? (True/false)
$SWITCH_p$	Can the consumers supplied by the off-grid power plant easily switch between electricity supply from the grid and off-grid power plants? This applies, for example, if the consumers have a manual or automatic change-over-switch system in place. (True/false)

Step 1.2: Define the classification of off-grid power plants

Default efficiencies, as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* are used to the determine the emission factor for off-grid power plants (Option A2 in Step 4 of the *Tool to calculate the emission factor for an electricity system*). Therefore, the power plant classification as provided in Annex 1 of the *Tool to calculate the emission factor of an electricity system* is used to classify off-grid power plants.

Off-grid power plants are not included in the build margin.

Step 1.3: Define the sectors for which data is collected

Data is collected for the whole economy, including:

- Households
- Commercial sector
- Industrial sector

Step 1.4: Establish the survey design and management scheme

The survey was carried out by Research Solutions Africa, a company with extensive experience in conducting surveys in Africa.

The survey was conducted in August 2011. The field researchers were recruited by Research Solutions Africa and jointly trained by Research Solutions Africa and Carbon Africa (the CDM consultants).

Interviewees were the persons responsible for the operation of a generator and/or persons who were in charge of the documentation of generator related costs (acquisition, fuel, maintenance, etc.). If no such person could be identified for a generator, the questionnaire was terminated and not included in the sample.

The interviews were conducted using smart phones (model: Huawei/Google IDEOS) using a mapping and survey software developed exclusively for Research Solutions Africa. The logging of GPS locations, the pictures taken and the survey questionnaire were all an integrated part of the same device and software.

Every questionnaire, including picture and GPS location was uploaded to the servers of Research Solutions Africa directly after completion of the interview. This process allows for a detailed visibility on where and when an interview was conducted and therefore marginalizes the possibility for error or cheating. Additional cross-checks by team supervisors and control phone calls to confirm interviewee answers further enhanced the quality control of the field work.

During the data collection process, the surveyors encountered a number of challenges to correctly identify the generator make, type, capacity and fuel consumption. Some of the issues encountered included generators without any legible labels, generators combining the case, engine and alternator from three different producers, self built generators and counterfeit generators. In most cases, data regarding fuel consumption and electricity generation were also lacking.

In order to address the lack of reliable data for electricity generation and fuel consumption, the project decided not to include them in the further analysis. Instead, default values were used which are given in the *Tool to calculate the emission factor for an electricity system*.

In order to address the issue of identifying the capacity of the off-grid power plants, the project engaged an expert on back-up power systems in Kenya. The expert went through all the data records to carry out a quality check. Based on his assessment, it had to be concluded that for 58% of the off-grid power plants in the sample, insufficient information was available to reliably determine the correct capacity. For the remaining 42% of the data, the expert confirmed the capacity and provided a weblink to documentation that confirms the listed capacity. The analysis only considered the off-grid systems for which reliable data was collected.

The survey covered a total of 1,174 back-up generators, distributed over sectors as outlined in the table below. The table also provides the number and percentage (%) of generators for which reliable data was obtained:[86]

Sector	**Number of entities with generator**	**Number of generators with reliable data**	**% of generators with reliable data**
Household generators	266	119	45%
Industrial generators	383	153	40%
Service/Commercial generators[87]	521	220	42%
Public services and government generators	4	2	50%
Total	**1,174**	**494**	**42%**

Step 1.5: Collect the data

For the households, the project focused the survey on upper class households (socio-economic class AB) because it is unlikely other socio-economic classes will use back-up power systems. Households in socio-economic class AB were therefore considered as the sampling frame.

A sample of 655 households were randomly selected and interviewed in various districts of Kenya, including Eldoret, Embu, Kisumu, Kitale, Machakos, Mombasa, Nairobi, Nakuru, Nyeri and Thika.

[86] Classification is based on Kenyan Census 1999
[87] Universities, schools and hospitals were classified under commercial services

Two hundred sixty-six of the 655 households (40.6%) had backup generation systems, which were used during interruptions of grid supply. The remaining 389 interviews with households without backup generation capacity were terminated at this point.

Of the 266 generators, the survey team managed to conduct interviews and gather complete information on 119 generators. For the remaining 147 generators, either the responsible person refused to collaborate or there was insufficient information to reliably determine the correct capacity, technology and/or fuel type.

The sample of 119 household generators was distributed as follows across the different districts: Eldoret (18), Embu (0), Kisumu (19), Kitale (4), Machakos (2), Mombasa (9), Nairobi (37), Nakuru (23), Nyeri (3) and Thika (4).

Ninety-two of the 119 generators (77%) had a capacity of less than 10kW and 13 (11%) a capacity of 10-50kW. The remaining 12% were split among 50-100kW (4 generators; 3%), 100-200kW (9 generators; 7.5%), 200-400kW (2 generators; 1.5%) and a single 440kW generator in Nairobi.

The overall capacity of all generators sampled was 3.21 MW. The average capacity of all household generators was 27 kW.

It is noteworthy, that many households have generators larger than necessary as backup capacity. This was crosschecked and confirmed in the field. Some generators, however, serve more than one household. In compounds and apartment buildings, several households share one backup generator. Initially, the survey did not record the number of households per generator. To close this gap, the survey team carried out 59 follow up calls with interviewees included in the sample to verify the number of households connected to a single backup generator. This phone survey revealed 5 generators serving more than 1 household: 3 generators serving 2, 1 generator serving 16 and 1 generator serving 20 households. In total, the 59 generators served 98 households. Extrapolating this to 119 generators delivers a sample size of 198 households (after rounding errors). The average backup capacity per household was therefore estimated at 16.2kW (3.21 MW divided by 198 households).

The capacity of the 147 household generators for which no reliable data could be collected was assumed to be zero. This is a conservative assumption. The installed capacity of the 266 (119 + 147) generators is therefore assumed to be 3.21 MW and the generators supply energy to 442 households. The average capacity per household is therefore 7.3 kW (3.21 MW divided by 442 households).

In terms of off-grid power systems used by industrial, commercial and government entities, the survey team randomly sampled a total of 908 backup generators. Reliable data was available for 373 generators (41.3%) the rest, i.e. 531 generators were considered to have unreliable information. Surveys were carried out in various districts as follows: Eldoret (37), Embu (11), Kisumu (50), Kitale (12), Kisii (17), Machakos (6), Mombasa (26), Malindi (4), Nairobi (72), Nakuru (47), Nyeri (20), Bungoma (10), Kakamega (23) and Thika (38) The total installed capacity of off-grid power plants in the sample of industrial, commercial and government entities amounted to 35.17 MW. The generators included in the sample were divided as follows between different capacities and fuel types:

Capacity limits (kW)	CAP<=10	10<CAP <=50	50<CAP <=100	100<CAP <=200	200<CAP <=400	400<CAP <=1000	Grand Total
Combined Cycle	**86**	**61**	**15**	**25**	**27**	**3**	**217**
Diesel	27	49	13	20	26	3	138
Gasoline/Petrol	58	12	2	5	1	0	78
Other	1						1
Reciprocating Engines	**73**	**25**	**10**	**26**	**14**	**5**	**153**

Diesel	38	22	10	25	13	5	113
Gasoline/Petrol	35	3	0	1	0	0	39
Other					1		1
Gas turbines	1			**1**			**2**
Diesel	1			1			2
Steam Turbines	**1**						**1**
Gasoline/Petrol	1						1
Grand Total	**161**	**86**	**25**	**52**	**41**	**8**	**373**

STEP 2: Exclude plants that do not qualify as off-grid power plants

Power plants (back up generators) which cannot be considered as off-grid power plants were excluded from the sample.

Option (c) "Demonstrate that OMC > TEL once for all off-grid power plants included in a class of off-grid power plants and a sector by showing that this condition generally applies to all plants in the class and sector, e.g. using the fuel costs (e.g. official statistics or projections on fuel prices), the efficiency of the plants in that class (e.g. using typical the default efficiencies provided in Annex 1) and relevant information on electricity purchase costs in the sector (e.g. statistics on electricity prices)" was used to demonstrate that $OMC_{p,y}>T_{EL}$.

Where:

$OMC_{p,y}$	=	Variable operation and maintenance costs of off-grid power plant *p* in year *y* (currency/MWh)
$T_{EL,p,y}$	=	Tariff of purchasing grid electricity for consumers supplied by off-grid power plant *p* in year *y*

To estimate $OMC_{p,y}$ official fuel prices for diesel[88] were used and plant efficiencies as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system*. Electricity purchase costs for grid electricity were taken from the *Schedule of Tariffs for supply of electricity by the Kenya Power and Lighting Company Limited set by the Energy Regulatory Commission under powers conferred under section 45 of the Energy Act, 2006.* The Electricity Regulatory Commission (ERC) was established in 2007 as an autonomous, independent energy sector regulator with powers to, inter alia, review and adjust electric power tariffs.[89] The value T_{EL} applied in the comparison between OMC and T_{EL} are set by this body. Other parameter values used to demonstrate that $OMC_{p,y}>T_{EL}$ generally applies to all off-grid plants in various classes and sectors are the following:

Parameter	**Value**	**Unit**	**Source**
Price of diesel	104.18	KES/l	Energy Regulatory Commission (Average diesel price – 2011)
NCV of diesel	0.043	GJ/kg	IPCC (2006)
Density of diesel	0.832	kg/l	European Commission Joint Research Centre - Tanks to wheels report version 2c, March 2007

[88] Petrol prices are not included in the assessment because they are generally higher than diesel prices.
[89] http://www.erc.go.ke/erc/energy_sub_sectors/?ContentID=1 accessed on 25/05/2011

Based on the efficiencies in the table in Annex 1 of the *Tool to calculate the emission factor for an electricity system*, it can be calculated how much electricity is produced with one kilogram of diesel using the following formula:

$$EG_m = \frac{FC_{diesel,m} \ x \ NCV_{diesel} \ x \ \eta_m \ x \ 1000}{3.6}$$

Where:

EG_m	=	Quantity of electricity generated by off-grid power plant class *m* (kWh)
$FC_{diesel,m}$	=	Amount of diesel consumed by off-grid power plant class *m* (kg)
NCV_{diesel}	=	Net calorific value of diesel (GJ/kg)
η_m	=	Default net energy conversion efficiency of off-grid power plant class *m*

The formula above derived from **equation 4** of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1), was multiplied by 1000 in order to convert the units to kWh.

The table below provides an overview of the electricity generated by the different off-grid power plant classes using one kilogram of diesel:

Table 14: Electricity generation by different off-grid power plant classes using 1 kg of diesel (kWh)

Generation Technology	***CAP<=10***	***10<CAP<=50***	***50<CAP<=100***	***100<CAP<=200***	***200<CAP<=400***	***400<CAP<=1000***	***CAP>1000***
Reciprocant engine system (e.g. diesel-, fuel oil-, gasengines)	3.34	3.94	4.18	4.42	4.66	5.02	5.38
Gas turbine systems	3.35	3.83	4.06	4.18	4.42	4.78	5.02
Small boiler/steam/turbine system	0.84	0.84	0.84	0.84	0.84	0.84	N/a

Given the cost of one kilogram of diesel, the resulting cost of producing electricity from the different off-grid power plant classes can now be calculated. The results are given in Table 15.

Table 15: Cost of electricity generation for various types of off-grid power plants (KES/kWh)

Generation Technology	***CAP<=10***	***10<CAP<=50***	***50<CAP<=100***	***100<CAP<=200***	***200<CAP<=400***	***400<CAP<=1000***	***CAP>1000***
Reciprocant engine system (e.g. diesel-, fuel oil-, gasengines)	37.44	31.77	29.95	28.33	26.88	24.96	23.30
Gas turbine systems	37.44	32.76	30.83	29.95	28.33	26.21	24.96
Small boiler/steam/turbine system	149.76	149.76	149.76	149.76	149.76	149.76	0.00

The lowest price achieved using off-grid power plants is 23.30 KES/kWh for a power plant system with an installed capacity of more than 1 MW. As can be seen from the table below, the cost of grid electricity is generally much lower than the lowest cost achieved using off-grid power plants.

Consumer Class	KES/kWh	As % of cheapest cost from off-grid power plants
Domestic consumers (0-50 units consumed)	2	8.59%
Domestic consumers (51-1,500 units consumed)	8.1	34.77%
Domestic consumers (above 1,500 units consumed)	18.57	79.71%
Non-domestic small commercial consumers	8.96	38.46%
Commercial and industrial consumers (at 415 Volts)	5.75	24.68%
Commercial and industrial consumers (at 11,000 Volts)	4.73	20.30%
Commercial and industrial consumers (at 33,000 Volts)	4.49	19.27%
Commercial and industrial consumers (at 66,000 Volts)	4.25	18.24%
Commercial and industrial consumers (at 132,000 Volts)	4.1	17.60%

STEP 3: Aggregate data according to classes of off-grid power plants

In the absence of data information regarding the global population of each stratum, a number of simplifications have been introduced to simplify the global estimates.

a. In the analysis, it is assumed that all off-grid power plants use a reciprocating engine system[90]. This is considered conservative because reciprocating engine systems have the highest conversion efficiency (see table in Annex 1 of the *Tool to calculate the emission factor for an electricity system*)
b. In the analysis, it is assumed that all off-grid power plants use a gasoline/petrol. This is considered conservative because diesel has a higher CO2 emission factor (0.0726 tCO2/GJ) than petrol (0.0675 tCO2/GJ).
c. It is assumed that off-grid power plants owned by households fall in the following two capacity classes: <10kW and 10<CAP<=50kW. Therefore, the conversion efficiency for all household off-grid plants is assumed to be 33%.
d. Off-grid power plant classes for industrial and commercial off-grid plants have been reclassified to correspond with the consumer classes from KPLC.

More details regarding the analysis and assumptions of the survey data are given below.

In terms of households, the total number of households connected to the electricity grid is estimated to be 1,286,310, excluding clients of the Rural Electrification Programme (REP). However, it is expected that only part of the grid-connected households will have the purchasing power to buy and operate a back-up power system. Therefore, it is assumed that only households in the upper class will have back-up power systems.

[90] Please note that the *Tool to calculate the emission factor for an electricity system refers to these systems as 'reciprocant' engine systems. In out case, we have labeled them as 'reciprocating' engine systems*

Assumption 1: According to Kenya's 1999 Census, 8% of all households nationwide can be socio-economically classified as AB (upper class).

More recent numbers on this are not available. Since 1999, the Kenyan economy has undergone an average real growth of 3.7% per year, outgrowing the global economy.[91] With that growth, the population share of the Kenyan upper class has been strengthened. This is further supported by the fact that the income inequality in Kenya (Gini coefficient) has slightly decreased in a similar period from 44.9 in 1997 to 42.5 in 2008.[92] Therefore, 8% is most likely to be on the conservative side.

In addition, among those with a connection to the electricity grid, the share of upper class households can be expected to be much higher compared to their share in the national population (8,767,954 households). Assuming due to a lack of more reliable numbers, that only 8% of those connected to the grid are upper class households is considered very conservative.

Assumption 2: According to the survey carried out by Research Solutions, 41% of households in the sampled areas have backup generation capacity.

Based on the above assumptions, the number of households with back-up power systems can be estimated as follows:

- Total number of grid-connected households consists of 1,286,310 households.
- 8% (102,905 households) of these households are upper class households (assumption 1)
- Of these, 41% (a universe of 42,191 households) have access to backup generation capacity (assumption 2).

The 266 generators of 442 households have been included in our sample.

The extrapolation from the sample of 442 households with grid capacity to the universe of 42,191 households with a 95% confidence interval is done using the following formula:

$$\overline{x} \pm z \times \frac{\sigma}{\sqrt{n}}$$

where

z	=	Is the upper critical value for the standard normal distribution for a population with unknown mean μ and known standard deviation σ
σ	=	Standard deviation derived from the primary data
n	=	Sample size

Using the lower limit at the 95% confidence interval results in an estimated installed capacity of 141.39 MW among households in Kenya.

In terms of industrial and commercial off-grid power plants, the analysis only focused on the combined cycle and reciprocating engine generators fuelled by diesel or gasoline/petrol (368 off-grid power plants). The remaining 5 off-grid power plants with a different technology or fuel type were not extrapolated, as the sample sizes were too small. Assumption 6 below explains, how this omission has been factored into the extrapolation.

[91] Source: 'International Monetary Fund – World Economic Outlook' in http://www.indexmundi.com/kenya/gdp_real_growth_rate.html (accessed 3 October 2011)
[92] Source: CIA World Factbook https://www.cia.gov/library/publications/the-world-factbook/fields/2172.html (accessed 3 October 2011)

Again, since the capacities of the remaining 531 generators in the sample were unknown, their capacity has been estimated at zero.

KPLC has a total of 154,756 commercial clients, the vast majority of which are small commercial clients (150,687 businesses) with an electricity consumption of less than 15,000 units per billing period.

Assumption 3: According to a 2007 Enterprise Survey for the World Bank, 33.25% of small businesses, 67.19% of medium sized businesses and 91.85% of large businesses have backup generation capacity for usage during interrupted grid supply.[93]

Since 2007, the share of companies using backup generation capacity has most likely increased, given the expansion of the Kenyan economy with simultaneous increasing power cuts, mainly due to drought.

In addition, comparing the sample with the list of KPLC's 100 largest clients reveals, that the sample underestimates the off-grid power plant capacity of large companies as the project sampled only 2 out of the 100 top electricity users. Another indication for omission of the biggest users is the fact, that no business in the sample has an off-grid power plant capacity of more than 1MW. Therefore, the average capacity is on the conservative side.

Assumption 4: Small generators (0-50kW) will supply small energy users, i.e. those in KPLC tariffs SC and SC&IT; medium sized generators (50-200kW) supply medium sized users, i.e. those in KPLC tariff CI1; and large generators (>200kW) supply KPLC clients in tariffs CI2-CI5 (11,000-132,000 V).[94]

Assumption 4 is considered conservative as generators of a smaller class will not suffice to supply a larger energy user, but generators of a larger class will sometimes be used to supply a smaller company. If a larger (e.g. 100kW) generator is used to supply a small business (0-50kW), our estimate would increase, since the universe of small companies is significantly larger than the universe of medium sized companies, leading to a larger universe to extrapolate to.

Assumptions 3 and 4 combined result in a highly conservative estimate of the installed capacity of off-grid power plants for industrial and commercial entities in Kenya. Only 318 (91.85% of 346) generators have, according to the conservative assumptions, a capacity larger than 200kW, only 1,678 (67.19% of 2,373) generators have a capacity between 50 and 200 kW and 50,524 (33.25% of 151,939) generators have a lower capacity.

Assumption 5: For the subdivision within each subgroup (small, medium and large), we assume the shares found in our primary data as listed in the table below.

Assumption 5 is considered to be conservative since it is easier for fieldworkers to gain access to and receive information on smaller generators. The largest generators are most difficult to sample, because the reception desks of large companies will have the highest rate of refusals.

Assumption 6: To account for the5 generators omitted from the original sample of 373, the project has reduced the universes per capacity class proportionate to the prevalence of the omitted generator types. The universes for 0-10kW have been reduced by 2%, 10-50kW by 0%, 50-100kW by 0%, 100-200kW by

[93] Enterprise Survey done in 2007 for the World Bank, accessed 3 October 2011 http://www.enterprisesurveys.org/CustomQuery/Country.aspx?economyid=101&year=2007&characteristic=size

[94] An overview of the tariff classes can be found in the Energy Regulatory Commission, Energy Act (no. 12 of 2006)

2%, 200-400kW by 2.5% and 400-1000kW by 0%.

The universe per capacity class is calculated as follows: the number of KPLC clients is divided according to assumptions 4 and 5 into the total number of KPLC clients per capacity class. This number for each class is then reduced by the share of excluded technologies and fuel types as to their prevalence in that capacity class (assumption 6). The result is included in the table below.

Sector	***Capacity***	***Percentage from primary research***	***Average generator capacity (n=368)***	***Average generator capacity (n=904)***	***Universe per capacity class***
Small	*0-10kW* *10-50kW*	*43%* *23%*	*3.1 kW* *28.1 kW*	*2.0 kW* *13.7 kW*	*32,259* *17,607*
Medium	*50-100kW* *100-200kW*	*7%* *14%*	*76.8 kW* *164.5 kW*	*35.4 kW* *79.0 kW*	*599* *1,097*
Large	*200-400kW* *400-1000kW*	*11%* *2%*	*340.6 kW* *591.2 kW*	*141.0 kW* *295.6 kW*	*262* *49*

The average capacities (n=904) include the assumption of zero capacity for all generators with insufficient data. The 536 generators, that had insufficient data have been distributed according to the percentage shares as shown in the table above. This is a conservative assumption since larger generators are generally more likely to be identified as they are usually better maintained. Assuming a distribution as above, results in a relatively larger proportion of generators with insufficient data being assigned to the large kW classes and as a result a reduction of the average capacities in these classes.

The global estimation of the installed capacity of industrial and commercial off-grid power plants in Kenya is conducted per capacity class. The estimation is based on a 95% confidence interval and yields the following results:

			kW	MW		
CAP<=10	~Universe	32,259	64,518	64.52		
	Sample	389			z	1.96
	Average kW	2			δ	2.463415
	Upper Limit	2.24	72,415	72.42	$Z * \frac{\sigma}{\sqrt{n}}$	0.244804
	Lower Limit	1.76	56,620	56.62		

			kW	MW		
10<CAP<=50	~Universe	17,607	241,216	241.22		
	Sample	208			z	1.96
	Average kW	13.7			δ	11.00786
	Upper Limit	15.2	267,556	267.56	$Z * \frac{\sigma}{\sqrt{n}}$	1.495986
	Lower Limit	12.2	214,876	214.88		

			kW	MW		
50<CAP<=100	~Universe	599	21,205	21.20		
	Sample	63			z	1.96
	Average kW	35.4			δ	14.82060
	Upper Limit	39.06	23,397	23.40	$Z * \frac{\sigma}{\sqrt{n}}$	3.659752

	Lower Limit	31.74	19,012	19.01		

			kW	MW		
100<CAP<=200	~Universe	1,097	86,663	86.66		
	Sample	127			z	1.96
	Average kW	79			δ	31.384090
	Upper Limit	84.46	92,651	92.65	$Z * \frac{\sigma}{\sqrt{n}}$	5.45838
	Lower Limit	73.54	80,675	80.68		

			kW	MW		
200<CAP<=400	~Universe	262	36,942	36.94		
	Sample	99			z	1.96
	Average kW	141			δ	65.613934
	Upper Limit	153.93	40,328	40.33	$Z * \frac{\sigma}{\sqrt{n}}$	12.92512
	Lower Limit	128.07	33,556	33.56		

			kW	MW		
400<CAP<=1000	~Universe	49	14,484	14.48		
	Sample	18			z	1.96
	Average kW	295.6			δ	106.1248
	Upper Limit	344.63	16,887	16.89	$Z * \frac{\sigma}{\sqrt{n}}$	49.02714
	Lower Limit	246.57	12,082	12.08		

Based on the above analysis, the total installed capacity of off-grid power plants in the industrial, commercial and government sector amounts to 416.82 MW estimated at the lower level of the 95% confidence interval.

Taken together, the total installed capacity of off-grid power plants in all sectors in Kenya is estimated at 558.21 MW.

STEP 4: Assess the extent of off-grid power

Based on the survey, the total capacity of off-grid power plants is estimated at 558 MW which is 35% of the total capacity of grid power plants in the electricity system.[95] This is more than 10% as required by the *Tool to calculate the emission factor for an electricity system.*

STEP 5: Assess the reliability and stability of the grid and that this is primarily due to constraints in generation, and not to other aspects such as transmission capacity

In line with step 5 of Annex 2 of the *Tool to calculate the emission factor for an electricity system,* it can be demonstrated that the grid to which project participants have access is not reliable and not stable and that this is primarily due to constraints in generation and not due to other issues, such as limited transmission capacity.

Shortages, blinks, black-outs, load shedding and/or large variations in frequency and voltage ranges are

[95] Total installed capacity as per 30 June 2011 was 1,573.61 MW (KPLC, 2011)

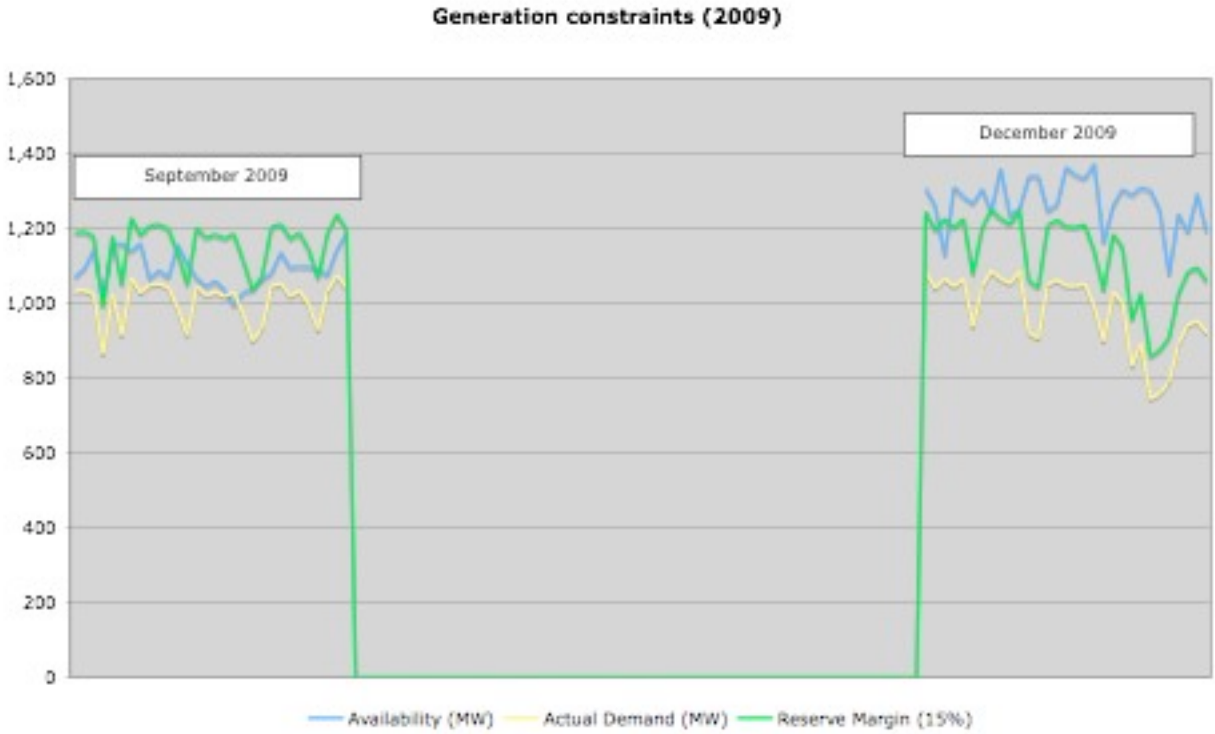
common practice in the grid operation. A World Bank Enterprise Survey, for instance, shows that 48.15% of firms in Kenya cited electricity as a business constraint. The survey indicates that in 2007 the average number of outages in a month in Kenya was 6.9[96] and the average duration of power outages was 4.45 hours.[97] Using these values it can be estimated that on average Kenya experiences black outs for 368 hours in a year.

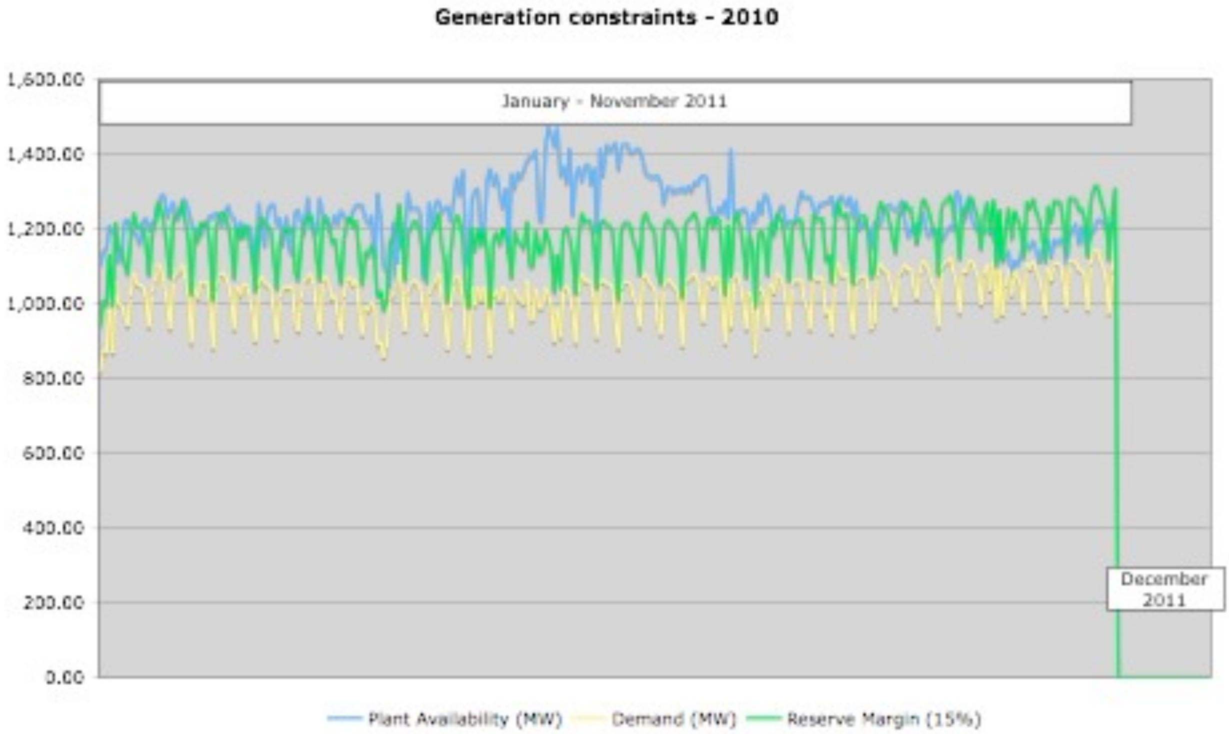
A more recent survey carried out by the Lighting Africa initiative has found that 54% of grid-connected households in Kenya experience power cuts at least once a week.[98]

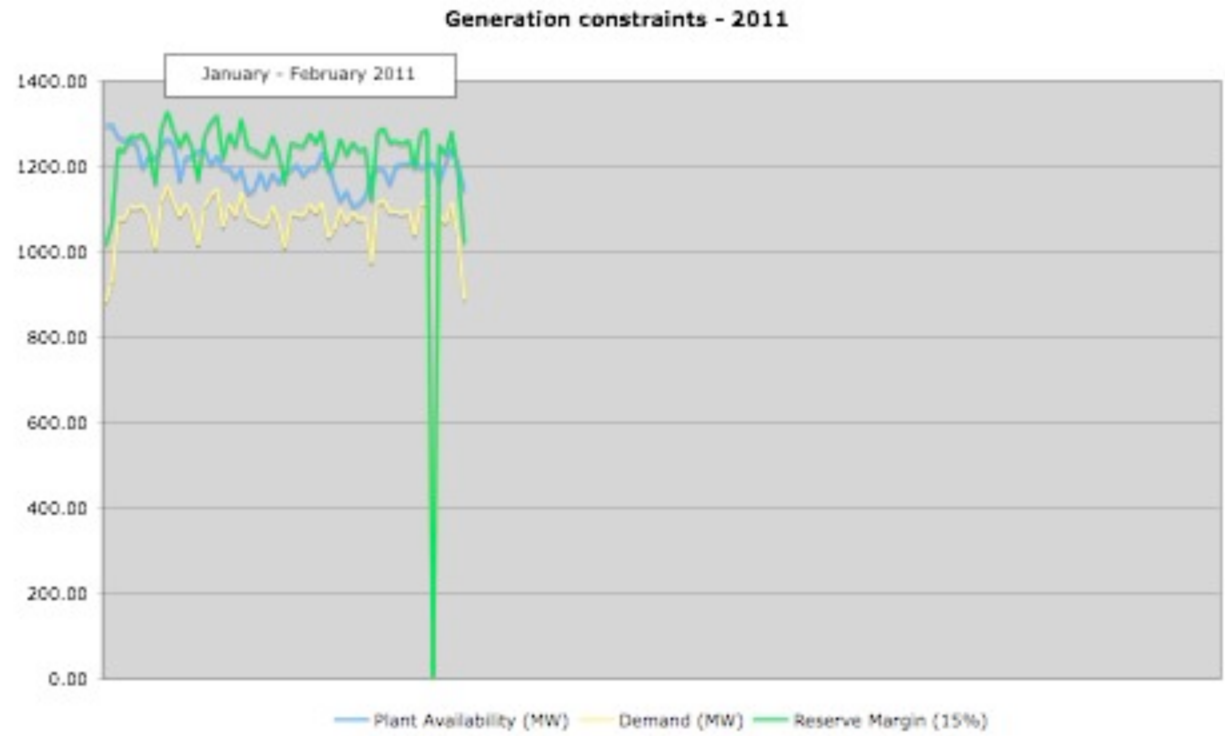
The fact that instability of the grid is primarily due to the constraints in generation capacity can be demonstrated through analysing the reserve margin in Kenya. The reserve margin is described as the difference between the generating capacity and the electricity demand. This value is a measurement of a grid's capacity to generate more energy than the system generally requires at peak usage and is important in order to accommodate for sudden increases in energy usage. The reserve margin is used to ensure grid system stability.[99] The international norm for the reserve margin is 15%. With such a value, there is guarantee of available capacity in case one looses a plant due to generation constraints that in most cases in Kenya, is due to poor hydrology.

According to the updated least cost power development plan for the period 2009-2029, Kenya's reserve margin for the year 2008 was 5% and was expected to increase to 6% in the year 2009.[100] The same plan updated for the period 2011- 2031 shows that the reserve margin for the year 2010 was only 11%.[101] An analysis of plant availability and actual demand also shows that plant availability is often below the internationally recommended reserve margin of 15% (see figures below)

[96] http://www.enterprisesurveys.org/CustomQuery/Indicators.aspx?characteristic=size&indicator=55 accessed on the 27th September 2011.
[97] http://www.enterprisesurveys.org/CustomQuery/Indicators.aspx?characteristic=size&indicator=56 accessed on the 27th September 2011
[98] Lighting Africa Market Assessment Results. Quantitative Assessment – Kenya IFC and the World Bank 2008
[99] Reserve Margin Definition http://www.teachmefinance.com/Scientific_Terms/Reserve_margin_operating.html
[100] Update on the Least Cost Power Development Plan 2009-2029 Final Report May 2009
[101] Update on the Least Cost Power Development Plan Study Period 2011-2031 March 2011


Generation constraints (2009)
September 2009
December 2009
1,600
1,400
1,200
1,000
800
600
400
200
0
Availability (MW)
Actual Demand (MW)
Reserve Margin (15%)


Generation constraints - 2010
January - November 2011
December 2011
1,600.00
1,400.00
1,200.00
1,000.00
800.00
600.00
400.00
200.00
0.00
Plant Availability (MW)
Demand (MW)
Reserve Margin (15%)



Based on the above analysis, it can be concluded that the grid to which project participants have access is not reliable and not stable and that this is primarily due to constraints in generation and not due to other issues, such as limited transmission capacity.

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

In Kenya, low-cost/must-run resources constitute more than 50% of total grid generation. Therefore, the simple OM method cannot be used.

The project activity will also include off-grid power plants in the project electricity system and, hence, the dispatch data analysis method cannot be used.

Therefore, the project activity has selected the simple adjusted OM method for calculating the operating margin.

In terms of data vintage, the project will use the *ex ante* option, and the emission factor is determined once at the validation stage based on a 3-year generation weighted average based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. For the off-grid power plants, a single calendar year within the 5 most recent calendar years prior to the time of submission of the CDM- PDD for validation will be used.

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

The simple adjusted OM emission factor ($EF_{grid,OM-adj,y}$), a variation of the simple OM is used where the power plants / units are separated in low-cost/must-run power sources (*k*) and other power sources (*m*). The calculation is based on the net electricity generated as under option A of the simple OM.

The simple adjusted OM emission factor is calculated using **equation 7**

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

Where:

$EF_{grid,OM-adj,y}$	=	Simple adjusted operating margin CO_2 emission factor in year y (tCO_2/MWh)
λ_y	=	Factor expressing the percentage of time when low cost/must-run power units are on the margin in year *y*
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EG_{k,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$EF_{EL,k,y}$	=	CO_2 emission factor of power unit k in year y (tCO_2/MWh)
m	=	All grid power units serving the grid in year y except low-cost/must-run power units
k	=	All low-cost/must run grid power units serving the grid in year y
y	=	The relevant year as per the data vintage chosen in Step 3

Off-grid power plants are included in the operating margin emission factor and are treated as other power units *m*.

Determination of $EG_{m,y}$ and $EG_{k,y}$

For grid power plants, $EG_{m,y}$ and $EG_{k,y}$ is based on records from Kenya Power and Lighting Company. (Please refer to the latest version of the emission reduction calculation spread sheet).

For off-grid power plants, $EG_{m,y}$ is determined using **equation 4** under Option 3 of the *Tool to calculate the emission factor for an electricity system*. The calculation is based on the capacity of off-grid electricity generation in that class and a default plant load factor as follows:

$$EG_{m,y} = CAP_m \times PLF_{default,off-grid,y} \times 8760$$

Where:

$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
CAP_m	=	Total capacity of off-grid power plants in included in off-grid power plant class *m* (MW)
$PLF_{default,off\text{-}grid,y}$	=	Default plant load factor for off-grid generation in year *y* (ratio)
m	=	Off-grid power plant class considered as one power unit (as per the provisions in Annex 2 to this tool)
y	=	The relevant year as per the data vintage chosen in Step 3

For the default plant load factor for off-grid generation ($PLF_{default,off\text{-}grid,y}$) in the equation above, a conservative value of 300 hours per year was used where it was assumed that the off-grid power plants would at least operate for one hour per day at six days at full capacity (i.e. $PLF_{default,off\text{-}grid,y} = 300/8760$).

The electricity generation by off-grid power plants *m* are summarized in the table below:

Class *m*	**CAP_m (MW)**	**$EG_{m,y}$ (MWh)**
Households	141.39	42,417
ICG[102] CAP<=10	56.62	16,986
ICG 10<CAP<=50	214.88	64,464
ICG 50<CAP<=100	19.01	5,703
ICG 100<CAP<=200	80.68	24,204
ICG 200<CAP<=400	33.56	10,068
ICG 400<CAP<=1,000	12.08	3,624

Determination of $EF_{EL,m,y}$ and $EF_{EL,k,y}$

Because data on fuel consumption and electricity generation of the grid-connected units is available, Option A1, i.e. **equation (2)**, is used to determine the emission factors of the grid power units.

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year

[102] Industrial, commercial and government

y (MWh)

m = All grid power units serving the grid in year *y* except low-cost/must-run power units

i = All fossil fuel types combusted in power unit *m* in year y

y = The relevant year as per the data vintage chosen in Step 3

For off-grid power plants, no data is available on fuel consumption. Therefore, **equation (3)** under option A2 is selected to determine the emission factor:

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

Where:

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$EF_{CO2,m,i,y}$ = Average CO2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO2/GJ)
$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m = Off-grid power unit

In order to be conservative, it is assumed that all off-grid power plants use gasoline/petrol. Therefore, the average emission factor of power unit *m* is assumed to be 0.0675 tCO2/GJ as opposed to 0.0726 from diesel. In addition, it is assumed that off-grid power plants use the most efficient generation technology (i.e. reciprocating engine system).

Class *m*	**Efficiency ($\eta_{m,y}$)**	**$EF_{EL,m,y}$**
Households	33%	0.74
ICG[103] CAP<=10	28%	0.87
ICG 10<CAP<=50	33%	0.74
ICG 50<CAP<=100	35%	0.69
ICG 100<CAP<=200	37%	0.66
ICG 200<CAP<=400	39%	0.62
ICG 400<CAP<=1,000	42%	0.58

Determination of λ_y

The parameter λ_y is defined as follows:

λ_y(%) = Number of hours low-cost must-run sources are on the margin in year y/8760 hours per year

The calculation of λ_y is done as follows:

Step (i) Plot a load duration curve. Collect chronological load data (typically in MW) for each hour of the year y, and sort the load data from the highest to the lowest MW level.

[103] Industrial, commercial and government

Plot MW against 8760 hours in the year, in descending order.

Step (ii) Collect power generation data from each power plant/unit. Calculate the total annual generation (in MWh) from low-cost/must-run power plants/units (i.e. $\Sigma_k EG_{k,y}$).

Step (iii) Fill the load duration curve. Plot a horizontal line across the load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from low-cost/must-run power plants/units (i.e. ΣkEGk,y).

Step (iv) Determine the "Number of hours for which low-cost/must-run sources are on the margin in year y". First, locate the intersection of the horizontal line plotted in Step (iii) and the load duration curve plotted in Step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and λ_y is equal to zero.

In determining λ_y no off-grid plants are considered, only grid power units were considered.

The results of the determination of λ_y for the most recent three years are given in the graphs below.

Year	**λ_y**	**1-λ_y**
July 2008 – June 2009	0.027	0.973
July 2009 – June 2010	0.024	0.976
July 2010 – June 2011	0.046	0.954

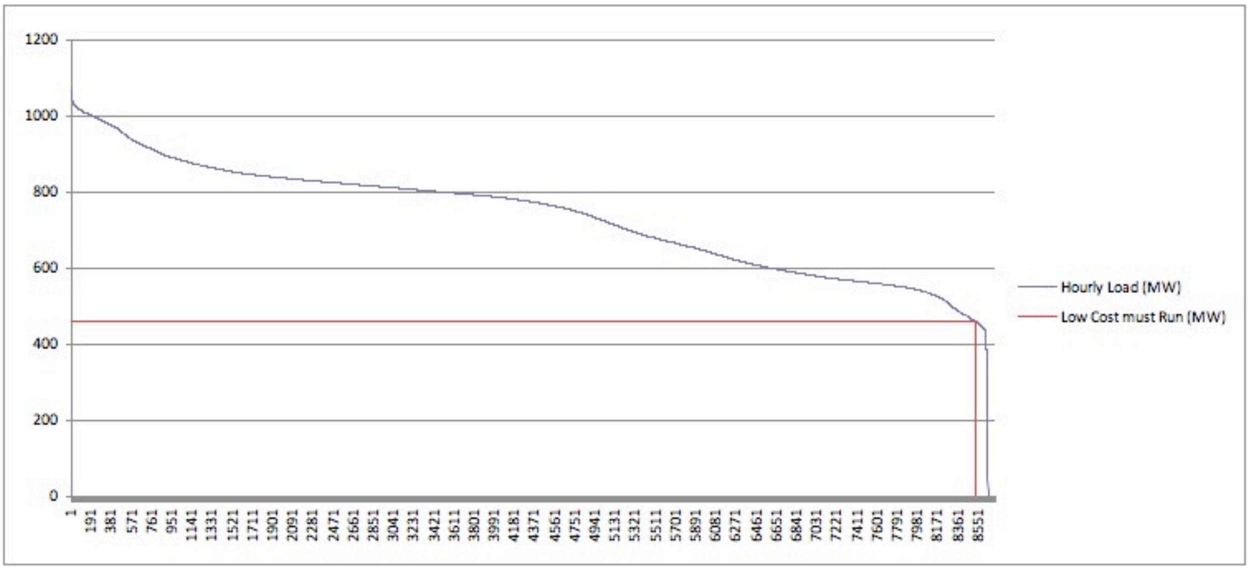


Figure 74: Lambda illustration (July 2008 - June 2009)

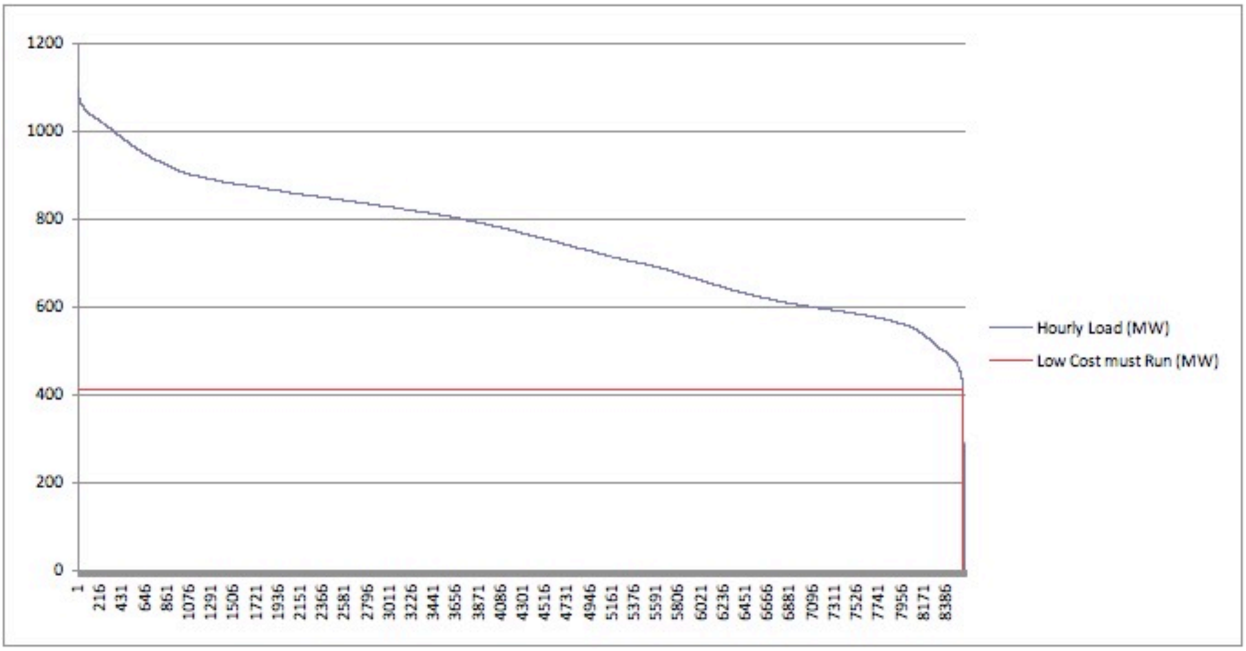


Figure 75: Lambda illustration (July 2009 - June 2010)

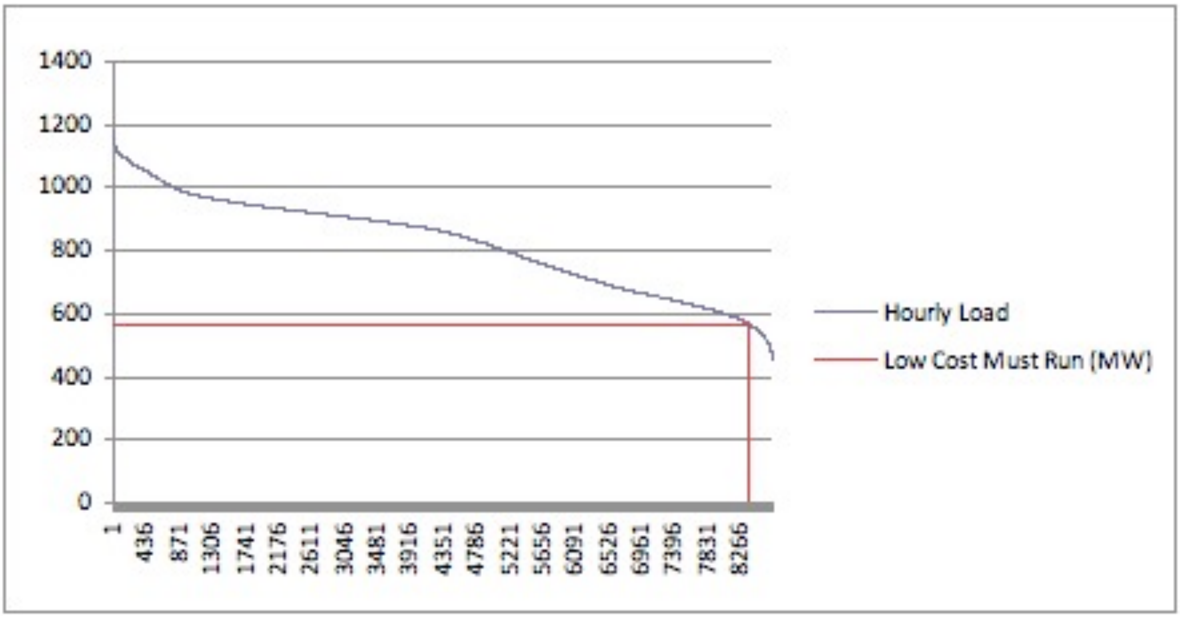


Figure 76: Lambda illustration (July 2010 - June 2011)

Therefore, following **equation 7** for calculating the Simple Adjusted Operating Margin, the Operating Margin ($EF_{grid,OM\text{-}adj,y}$) equals to 0.65530 tCO2/MWh

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

For the calculation of the build margin (BM) emission factor, Option 1 data vintage has been chosen. Hence, for the first crediting period, the build margin emission factor will be calculated *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD 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 will be used.

In accordance with the *Tool to calculate the grid emission factor for an electricity system*, $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ were identified. $SET_{\geq 20\%}$ has been selected for the calculations because it comprises the larger annual electricity generation. $SET_{\geq 20\%}$ doesn't include power units which started to supply electricity to the grid more than 10 years ago thus steps (d), (e) and (f) are ignored.

Below is a table with all power plants in the project electricity system. The power plants are ranked according to commissioning date.

	Name of power plant	Commissioning date	Electricity generation 2010 – 2011 (MWh)	%
1	Tana	Apr-11	0	0%
2	Kipevu Diesel 3	Jan-11	267,911	4%
3	Imenti Tea	July-10	232	4%
4	Aggreko Embakasi 5	Mar-10	80,425	5%
5	New Ngong/ Ngong 2	Aug-09	17,696	5%
6	Iberafrica 2 Additional-52.5 MW	May-09	369,606	10%
7	Rabai	May-09	394,223	16%
8	Aggreko Naivasha	May-09	0	16%
9	Aggreko Embakasi IV	May-09	186,116	19%
10	Aggreko Embakasi III	May-09	0	19%
11	Aggreko Embakasi II	May-09	0	19%
12	Kiambere II	Feb-09	0	19%
13	Orpower 4- 35MW/ Olkaria III	Jan-09	0	19%
14	Sondu Miriu	2008	364,305	24%
15	Aggreko Embakasi I	2006	0	24%
16	Aggreko Eldoret	2006	0	24%
17	Mumias	2005	0	24%
18	Olkaria II	2003	846,245	36%
19	Tsavo Diesel	2001	368,489	41%
20	Orpower 4 - 13MW	2000	372,498	46%
21	Gitaru	1999	801,654	57%
22	Kipevu Diesel	1999	222,694	61%
23	Kipevu GT2	1999	439	61%
24	Iberafrica	1997	352,038	65%
25	Turkwel	1991	455,102	72%
26	Kiambere	1988	898,770	85%
27	Kipevu GT1	1987	456	85%
28	Olkaria I	1985	235,075	88%
29	Masinga	1981	201,075	91%
30	Kamburu	1976	407,527	96%
31	Kindaruma	1968	191,308	99%
32	Gogo	1958	6,737	99%
33	Sagana	1955	8,020	99%
34	Sosiani	1955	1,538	99%

35	Wanji	1954	40,389	100 %
36	Mesco	1933	0	100 %
37	Ndula	1925	433	100 %

Orpower 4 (CDM Ref. 2975), Tana (CDM Ref. 5023), and Mumias (CDM Ref. 1404) are excluded from this list because these projects are registered as a CDM projects. Kiambere II involves a capacity addition from retrofit and is, therefore, not included in the calculation of the build margin.

The build margin emission factor is thus calculated using **equation 12** of the *Tool to calculate the emission factor for an electricity system*, as shown below:

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

Where:

$EF_{,grid,BM,y}$	=	Build margin CO2 emission factor in year *y* (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in step 4 (a) for the simple OM, using **equation (2)** under option A1 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.

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)

$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/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 fossil fuel types combusted in power unit m in year y
y	=	The relevant year as per the data vintage chosen in Step 3

Off-grid power plants were not included in the build margin calculations.

Therefore, following **equation 12** for calculating the build margin, $EF_{grid,BM,y}$ equals to 0.49000 tCO2/MWh

Step 6: Calculate the combined margin emissions factor

Option A i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated as follows using **equation 13**

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

Where:

$EF_{,grid,BM,y}$	=	Build margin CO2 emission factor in year *y* (tCO2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO2 emission factor in year (tCO2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

The following default values are used for w_{OM} and w_{BM}:

- Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and subsequent crediting period;
- All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

The values to be applied for SSC- CPAs that supply electricity to the Kenyan grid system are summarised in the table below:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	0.49000	tCO2/MWh	GEF calculations

W_{BM}	[insert value]		
$EF_{grid,OM,,y}$	0.65530	tCO2/MWh	GEF calculations
W_{OM}	[insert value]		
$EF_{grid,CM,y}$	[insert value]	tCO2/MWh	

Appendix 5: Further background information on the monitoring plan

Not applicable.

Appendix 6: Further information on the baseline descriptions

BASELINE INFORMATION

KENYA	
Energy policy and regulation	2004 *National Energy Policy, Draft Sessional Paper on Energy*[104] is a comprehensive policy framework covering the period 2004-2023. *Electric Power Act No. 11 of 1997*[105] resulted in the unbundling of the then vertically integrated Kenya Power and Lighting Company (KPLC) into a public sector generation company (KenGen) and a transmission and distribution company. The act also established the Electricity Regulatory Board (ERB) as an independent regulator. The *Energy Act, No. 12 of 2006*[106] consolidated the *Electric Power Act No. 11 of 1997* and the *Petroleum Act Cap. 116*[107]. The Act, among other things, further unbundles the electricity sector and provides for the establishment, powers and functions of the Energy Regulatory Commission.
Regulatory body	*Energy Regulatory Commission* (ERC) established under the Energy Act (2006) replacing the Energy Regulatory Board as an autonomous, independent energy sector regulator.
Rural energy	The *Rural Electrification Authority* (REA), mandated to, *inter alia,* develop and update the rural electrification master plan, implement the rural electrification programme and promote the use of renewable energy sources.
Feed-in-Tariff Policy	*2008 Feed-in-Tariffs Policy on Wind, Biomass, and Small-Hydro Resource Generated Electricity*[108] updated in 2010 to also include Feed-in-Tariffs for Geothermal, Biogas and Solar.
Unbundling	The Kenyan electricity sector has been completely unbundled. Principal **generators** in the electricity sector are the *Kenya Electricity Generating Company* (KenGen) which accounts for close to 80% of generation, the balance being provided by five *Independent Power Producers* (IPPs). The *Kenya Power and Lighting Company* (KPLC)[109] is responsible for

[104] Sessional Paper No.4 on Energy, May 2004, Ministry of Energy, Kenya
[105] Electric Power Act, No. 11, 1997
[106] The Energy Act, No. 12, 2006, Kenya
[107] Petroleum Act, Chapter 116, 1948, Kenya
[108] Feed-in-Tariffs Policy on Wind, Biomass, and Small-Hydro Resource Generated Electricity, 2008

	distribution and retail supply of electrical energy to end-users. KPLC purchases power in bulk from KenGen and the IPPs through bilateral contracts or Power Purchase Agreements (PPAs) approved by ERC. The *Kenya Electricity Transmission Company* (KETRACO) was formed in 2008 to develop and operate new **transmission** lines.
Independent Power Producers	In total, six Independent Power Producers have operational power plants in Kenya: • Iberafrica Power (EA) Ltd. • Tsavo Power Company Ltd. • OrPower4 Inc • Mumias Sugar Company Ltd. • Rabai Power Ltd. • Imenti Tea Aggreko is an emergency power producer with a number of short-term contracts for power generation.

RWANDA	
Energy policy and regulation	The main policy framework for the electricity sector can be found in the Economic Development and Poverty Reduction Strategy (EDPRS)[110] and Electricity Access Roll Out Programme (EARP)[111] which formulate a number of targets for the expansion of the electricity sector in Rwanda. In 2009 a National Energy Policy and National Energy Strategy 2008-2012[112] was finalized. The policy contains a program of activities, including the establishment of new institutions and the reform of existing ones. An electricity law is currently under review, which will govern the generation, transmission and distribution of electricity in Rwanda.
Regulatory body	The Rwanda Utilities Regulatory Agency (RURA) was created by law n° 39*2001 of 13th September 2001 and was published in the Government Gazette n° 20 of 15th October 2001 with the mission to regulate certain public utilities, including electricity utilities.
Rural energy	N/A
Feed-in-Tariff Policy	Under development
Unbundling	The main entity in charge of electricity generation and distribution in Rwanda is the Electricity, Water and Sanitation Authority (EWSA). EWSA was formed in 2010 under law no 43/2000 of 7/Dec/2010

[109] The Kenya Power and Lighting Company changed its name to Kenya Power in 2011.
[110] Economic Development and Poverty Reduction Strategy 2008-2012, Ministry of Finance and Economic Planning, Rwanda
[111] Rwanda Electricity Access Scale Up Program, Rwanda
[112] National Energy Policy and National Energy Strategy 2008-2012, Ministry of Infrastructure, Rwanda

	through a merger of the Rwanda Electricity Corporation (RECO) and the Rwanda Water and Sanitation Corporation (RWASCO). RECO and RWASCO themselves were established in 2008 as a result of a split of ELECTROGAZ.
Independent Power Producers	A number of Independent Power Producers are active in Rwanda mostly operating micro-scale power plants (100 kW – 1 MW)

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
01	EB33, Annex43 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		