Programme design document form for CDM programmes of activities

(Version 06.0)

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

PROGRAMME DESIGN DOCUMENT (PoA-DD)	
Title of the PoA	MPG Geothermal Energy PoA
Version number of the PoA-DD	Version 12
Completion date of the PoA-DD	12/07/2016
Coordinating/ managing entity	Marine Power Generation Company Limited (MPG)
Host Party(ies)	Kenya (host)
Applied methodology(ies) and, where applicable, applied standardized baseline(s)	ACM0002 (version 16.0): Grid-connected electricity generation from renewable sources
Sectoral scope(s) linked to the applied methodology(ies)	Sectoral scope 01: Energy industries (renewable-/ non-renewable sources)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

Title: MPG Geothermal Energy PoA
Version: 12
Date: 12/07/2016

A.2. Purpose and general description of the PoA

Policy/measure or stated goal of the PoA

The purpose of the MPG Geothermal Energy PoA (hereafter referred as the PoA), implemented by Marine Power Generation Company Limited (MPG), is to support the development and implementation of geothermal energy projects in the Rift Valley region, Kenya. As a result grid-connected, fossil fuel based electricity generation will be replaced by grid connected geothermal energy based electricity generation. This will lead to the reduction of greenhouse gas (GHG) emissions.

Greenhouse gas emissions in Kenya have been rapidly increasing - especially the emissions caused by the energy sector are estimated to have increased by as much as 50% over the last decade.[1] The electricity mix is dominated by hydro generation (over 50%) and thus highly vulnerable to weather conditions e.g. droughts and long term affected by climate change. Electricity demand is significantly rising mainly due to the economic development and increasing population. In cases of drought the reserve margin is not sufficient and load shedding and establishment of emergency power has been necessary.[2]

Therefore, the Government of Kenya targets to increase the geothermal capacity in the country to 5,110 MW by 2030 since the country's estimated potential capacity is 7,000-10,000 MW.[3] By 2016, the Government targets to have already implemented 887 MW of Geothermal energy capacity.[4]

Despite of the fact that a *Feed-in tariff*[5] for geothermal plants was established in 2010, only around 200 MW of geothermal capacity have been established since the first drilling started in 1955. Geothermal development in Kenya has been characterized by long gestation periods due to various constraints including financing and geothermal resource risks, e.g. detailed surface exploration, infrastructural development, drilling of exploratory and appraisal wells before the resource can be confirmed.[6]

According to the Scaling-Up Renewable Energy Program (SREP) - Investment Plan for Kenya, the geothermal sector in Kenya faces the following barriers:[7]

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[1] Stockholm Environment Institute. 2009. *The Economics of Climate Change in Kenya,* p. 52

[2] Climate Investment Funds. 2011. *SREP Investment Plan for Kenya*, p.18.

[3] Republic of Kenya. 2010. *Updated Least Cost Power Development Plan 2011-2030,* p. 139

[4] Republic of Kenya. 2013. *5000+ MW by 2016*

[5] http://kerea.org/wp-content/uploads/2012/12/Feed-in-Tariff-Policy-2010.pdf

[6] Climate Investment Funds. 2011. *SREP Investment Plan for Kenya,* p.6.

[7] Climate Investment Funds. 2011. *SREP Investment Plan for Kenya*, p.29.

Table 1:Barriers for implementation of geothermal power in Kenya

Technical and Human capacity
Insufficient/inadequate data
Limited capacity for equipment acquisition/ supply
Human resources constraints
High resource risk
Renewable energy resource distribution relative to existing grid/load centers
Economic and Financial
High capital cost
Challenges in reaching financial closure
High cost of resource assessment and feasibility studies

Marine Power Generation Company Limited (MPG) 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 geothermal power projects in the Rift Valley region, Kenya. This will enhance the financial attractiveness of geothermal projects and decrease the risk for potential investors.

The PoA involves geothermal grid connected power plant technologies. The PoA focuses on Greenfield CPAs and CPAs, which involve a capacity addition. CO_2 and CH_4 are the main and only GHG covered by the PoA- CO_2 from the substitution of fossil fuel based generated electricity in the baseline scenario and CH_4 and CO_2 as project emissions due to fugitive emissions of from non-condensable gases contained in geothermal steam. Since the PoA will involve the implementation of geothermal power plants, it corresponds to sectoral scope 1: Energy industries (renewable- / non-renewable sources) and applies the approved large-scale methodology ACM0002 *Grid-connected electricity generation from renewable sources* (EB 81, Annex 9, version 16.0).

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

For CPAs that consist of a capacity addition to an existing geothermal power plant/unit, the baseline scenario is the following: "the existing facility that would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$), and electricity delivered to the grid by the added capacity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system*. From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur."

As per 30 June 2013, the total installed capacity of power plants connected to the Kenyan national grid reached 1,740.36 MW. The grid-connected power plants consist of a mix of generation sources, including hydro, thermal and geothermal. Electricity generation from hydro sources accounted for approximately 53.8% of total electricity generation, followed by to thermal (25.12%) and geothermal (20.2%).[8] Biomass and Wind capacities have only a minor share in the power sector by now. In the medium term, Kenya is targeting to increase its generation capacity to 5,000 MW by 2016.[9] Several power generation projects are at various stages of implementation by Kenya Electricity Generation Company (KenGen) and Independent Power Producers (IPPs).

[8] Calculated based on KPLC. 2013.*Annual Report and Financial Statements*

[9] Republic of Kenya. 2013. *5000+ MW by 2016*

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

For both CPA types, the baseline scenario is the same as the scenario existing prior to the start of the implementation of the CPA.

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

- CPAs as part of the PoA are expected to provide reliable electricity to the national electricity system. This is in line with Kenya's Vision 2030, which recognizes reliable and cheap energy as one of the foundations for economic growth and essential for making Kenya a middle-income country by 2030 as well as the Government's 5000+ MW by 2016 strategy.[10]
- CPAs as part of the PoA are expected to provide local employment opportunities during the construction and operation phase.
- CPAs as part of the PoA are expected to contribute to Kenya's fiscal revenues through payment of taxes, and attract foreign direct investment.
- The PoA will improve the hydrocarbon trade balance through reduction of oil imports used for electricity generation.
- The PoA will have a positive impact on the transfer of geothermal energy technologies to Kenya, as well as know-how skills of local workers. The transfer of technology and know-how will be directly replicable to other future geothermal energy projects.

The PoA will reduce the consumer price of electricity: In line with the 2013 Schedule of Tariffs for Supply of Electricity by the Kenya Power and Lighting Company Limited, all electricity tariffs in Kenya are liable to a Fuel Cost Charge, which is calculated monthly and published in the Kenya Gazette.[11] 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. It is expected that the implementation of geothermal energy projects will reduce Kenya's reliance on expensive thermal power, especially thermal emergency power, and therefore the Fuel Cost Charge will be lower.

Framework for the implementation of the proposed PoA

MPG will act as the Coordinating/Managing Entity (CME) for the PoA. In July 2009, the Ministry of Energy and Petroleum (MoE&P) Kenya granted MPG the sole rights to explore and exploit geothermal resource in area adjacent to Naivasha, Kenya, for the purpose of generation of grid-electricity. The concessional area constitutes the geographical boundary of this PoA which is introduced in section A.5 of the CDM-PoA-DD. Since the CME has the sole legal rights to the geothermal resource in the concessional area, it will enter into contractual agreements with potential investors to form Special Purpose Vehicles (SPVs) or project companies who will develop the large-scale geothermal projects (specific CPAs) within the concessional area. While the amount of CPAs to be included to the PoA mostly depends on the actual available resource in the area as well as investment appetite, the first CPA to be included to the PoA is the Akiira I 35 MW Geothermal Project.

A brief timeline of the PoA implementation is being presented below:

Table 2: PoA implementation timeline

Event	Date
Submission of PoA CDM Prior Consideration to	23/05/2013

[10] Republic of Kenya. 2007. *Kenya Vision 2030 and* Republic of Kenya. 2013*. 5000+ MW by 2016*

[11] Energy Regulatory Commission. 2013. Approval of *Schedule of Tariffs set by the Energy Regulatory Commission for Supply of Electrical Energy by the Kenya Power and Lighting Company Limited pursuant to section 45 of the Energy Act, 2006.*

the UNFCCC and the Kenyan DNA	
Submission of PoA and first CPA-DD for CDM GSC	30/06/2014
Expected request for registration	31/08/2016
Commissioning of first CPA	01/04/2017
Lifetime of the PoA	28 years

As the CME, MPG will be responsible for the following coordination and managing tasks:

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

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

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

The CME will enter into agreements with all CPA implementing entities. The contractual agreements will summarize roles and responsibilities regarding the implementation of the 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. The agreement will also put in place measures that avoid double counting of the proposed CPA. Furthermore, every CPA will have a unique identification number.

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

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

A.3. CME and participants of PoA

Marine Power Generation Company Limited (MPG) will act as the coordinating/managing entity. There is no other project participant involved in the PoA apart from the CME.

A.4. Party(ies)

Name of Party involved ("host" indicates host Party)	Private and/or public entity(ies) project participants, CME (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Kenya (host)	Marine Power Generation Company Limited (MPG)	No

A.5. Physical/ Geographical boundary of the PoA

The geographical area in which CDM component project activities (CPAs) included in the PoA will be implemented is defined by the boundary of the geothermal resource exploration concession granted to the CME by the Ministry of Energy, Kenya.

The host country is therefore the Republic of Kenya. Kenya ratified the Kyoto Protocol on 25/02/2005 while it also ratified its second commitment period on 07/04/2014.[12] The Designated National Authority (DNA) is the National Environment Management Authority (NEMA).

MPG's geothermal concession area is adjacent to the Greater Olkaria geothermal area as well as Mt. Suswa and Mt. Longonot. This area is located in the East African Rift Valley to the south of Lake Naivasha and approximately 70 km North West of Nairobi (approximately 120 km by road). The nearest international airport is the Jomo Kenyatta International (JKIA) airport in Nairobi while the nearest train stations is in Naivasha town. The license thereby covers Mlima Panya and Mt Margaret and forms part of Nakuru County, located in Kenya's Rift Valley region.

The geographic boundary and coordinates of the concession area shown in the table and figure below:

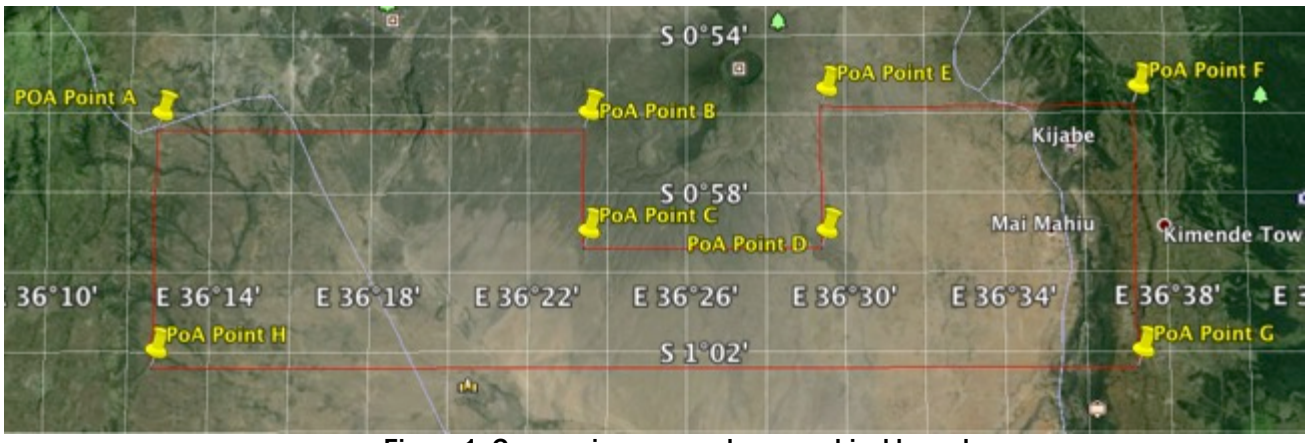

Figure 1: Concession area and geographical boundary

Table 3: Coordinates of the geographical boundary

Point	Latitude	Longitude
A	0° 56' 24" S	36° 12' 36" E
B	0° 56' 24" S	36° 23' 24" E
C	0° 59' 24" S	36° 23' 24" E
D	0° 59' 24" S	36° 29' 24" E
E	0° 55' 48" S	36° 29' 24" E
F	0° 55' 48" S	36° 37' 12" E
G	1° 2' 24" S	36° 37' 12" E
H	1° 2' 24" S	36° 12' 36" E

[12] http://unfccc.int/kyoto_protocol/doha_amendment/items/7362.php

The figure below shows the geographical boundary of the PoA within Kenya.

Concessional area / PoA Geographical boundary

Figure 2: Map of the Republic of Kenya

In line with the *CDM Project Standard* CDM-EB65-A05-STAN,[13] version 09.0 (EB 82, Annex 13) and the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities* CDM-EB65-A03-STAN, version 04.0[14] (EB 87, Annex 03) the programme boundary might be amended post-registration to extend its geographical coverage or to include additional host parties.

A.6. Technologies/measures

CPAs under the PoA will use grid-connected geothermal power technologies to generate electricity. Geothermal energy technologies and measures to be employed by a CPA might include:

- CPA – Type I: Geothermal power plant/unit (Greenfield)
- CPA – Type II: Geothermal power plant/unit (Capacity addition)

Geothermal Power:
Geothermal energy is extracted from the heat of the earth in form of steam, which is used to generate electricity. The main geothermal technologies applied are dry steam, flash steam and binary steam power plants The technologies currently operating in Kenya are flash steam power and binary steam power plants.[15] However, all these technologies are considered as one type (geothermal power) in accordance with para 67 of the approved consolidated methodology ACM0002 (version 16.0)

A flash steam power plant uses steam coming from the earth as the medium to run the plants

[13] This is the referenced title of version (version 09.0) of the CDM Project Standard. The standard is however, also provided as EB 82, Annex 13 of the EB meeting reports.

[14] This is the referenced title of version (version 04.0) of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities*. The standard is however, also provided as EB 87, Annex 3 of the EB meeting reports.

[15] Republic of Kenya. 2010. *Updated Least Cost Power Development Plan 2011-2030,* p. 89

turbine. Hot water from deep in the earth is under high pressure and is thus prevented from boiling. After drilling wells this hot water moves from deeper in the earth to more shallow levels. The water thereby quickly losses pressure, boils and "flashes" to steam. The steam extracted from the wells is separated from the liquid in a surface vessel (steam separator) and is then used to turn the turbine. If any liquid remains in the separator, it can be flashed again in a second separator to extract even more energy. The turbine then powers a generator, which generates electricity.[16]

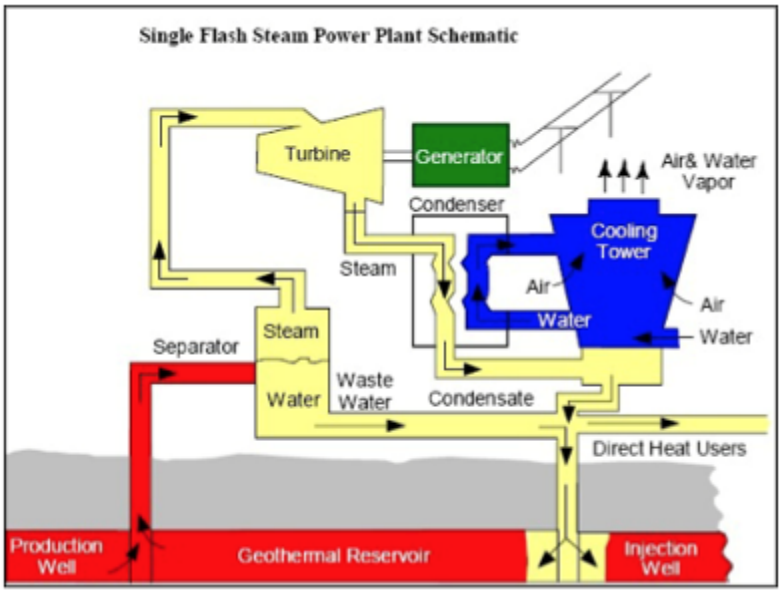

Figure 3: Flash steam power plant[17]

"Dry steam plants" are the oldest and simplest geothermal power technology. In a dry steam plant, the steam travels directly to a turbine, which drives a generator that produces electricity.

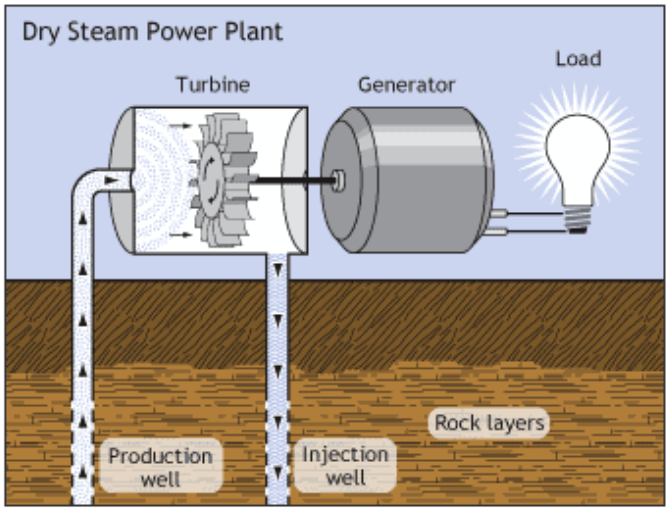

Figure 4: Dry steam power plant[18]

In the binary process, the geothermal fluid, which can be hot water, steam, or a mixture of the two, heats another liquid, the working fluid, that boils at a lower temperature than water. The two liquids are kept completely separate through the use of a heat exchanger used to transfer heat energy from the geothermal water to the working fluid. When heated, the working fluid vaporizes into gas

[16] Republic of Kenya. 2010. *Updated Least Cost Power Development Plan 2011-2030,* p. 89

[17] Republic of Kenya. 2010. *Updated Least Cost Power Development Plan 2011-2030,* p. 139

[18] http://www1.eere.energy.gov/geothermal/powerplants.html, accessed 22.01.2013

and (like steam) the force of the expanding gas turns the turbines that power the generators.[19]

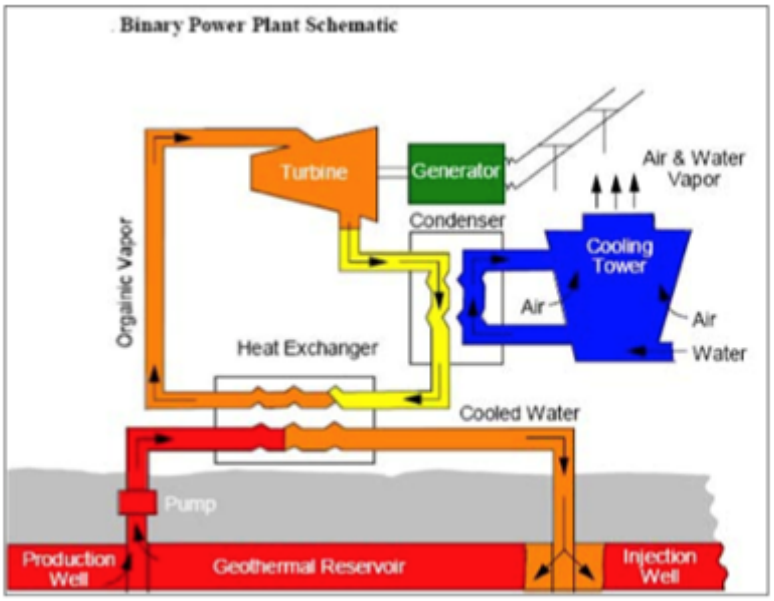

Figure 5: Binary power plant[20]

The implementation of geothermal 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) or the addition of capacity to an existing power plant (capacity addition). The renewable energy generation units will be connected and supply electricity to the Kenyan national electricity grid whereby the generated electricity will substitute electricity generated by power plants connected to the grid.

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

The following table shows the typical information that a CPA will need to provide:

Table 4: Required technical parameter

	Type I: Geothermal power plant/unit (Greenfield)	**Type II: Geothermal power plant/unit (Capacity addition)**
Overall plant	Plant type	Plant type
	Installed capacity (MW)	Installed capacity (MW) of capacity addition
		Installed capacity (MW) of existing plant
	Plant load factor (%) and plant losses	Plant load factor (%) and plant losses
	Energy yield on an annual basis for the first 20 years of operation or the duration of the PPA (MWh)	Energy yield on an annual basis for the first 20 years of operation or the duration of the PPA. (MWh)
		Historic average annual electricity generation (MWh)
	Equipment lifetime	Equipment lifetime
	Certification	Certification
Turbine	Turbine Type	Turbine Type

[19] Republic of Kenya. 2010. *Updated Least Cost Power Development Plan 2011-2030,* p. 89

[20] Republic of Kenya. 2010. *Updated Least Cost Power Development Plan 2011-2030,* p. 90

	Steam pressure / temp	Steam pressure / temp
Generator	Generator type	Generator type
	No. of units	No. of units
	Capacity (kVA)	Capacity (kVA)
	Output voltage	Output voltage
Transformer[21]	No. of units	No. of units
	Type	Type
	Primary voltage	Primary voltage
	Secondary voltage	Secondary voltage

In line with the above description and information, the following technical information will be provided by specific CPAs that will be included in the PoA:

- The installed capacity
- Technical specifications of the equipment that will be installed
- Lifetime of the installed equipment
- Plant load factor, including the relevant losses internal consumption, and net electricity supply to the grid
- Details about the electricity collection and transmission infrastructure
- Details about the metering system

In line with the *Feed in tariff policy's 2nd revision of 2012* set up by the Ministry of Energy of Kenya, the maximum installed capacity for a single grid connection point for the geothermal power projects will be 70 MW.[22]

In addition to the geothermal power plant equipment the CPAs will require additional equipment for the collection of the electricity generated and connection to the Kenyan electricity grid. An electrical network will be installed to collect the electricity, including transformers to change the voltage of the electricity and to minimize the electrical losses. Electricity will be transformed to the required connection voltage at the Point of Utility Connection (PuC) to the national electricity grid.

The installation of a metering system is required for electricity sales and to determine the amount of certified emission reductions (CERs). The metering system will have a main and a back up meter, whereby the first one will be owned and maintained by the CPA implementing entity and the latter under the responsibility of Kenya Power.

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

[21] In case of capacity addition, the CME shall provide information if the existing transformer will be used or if the capacity addition will involve the implementation of additional transformers.

[22] http://www.energy.go.ke/downloads/FiT%20Policy%202012.pdf

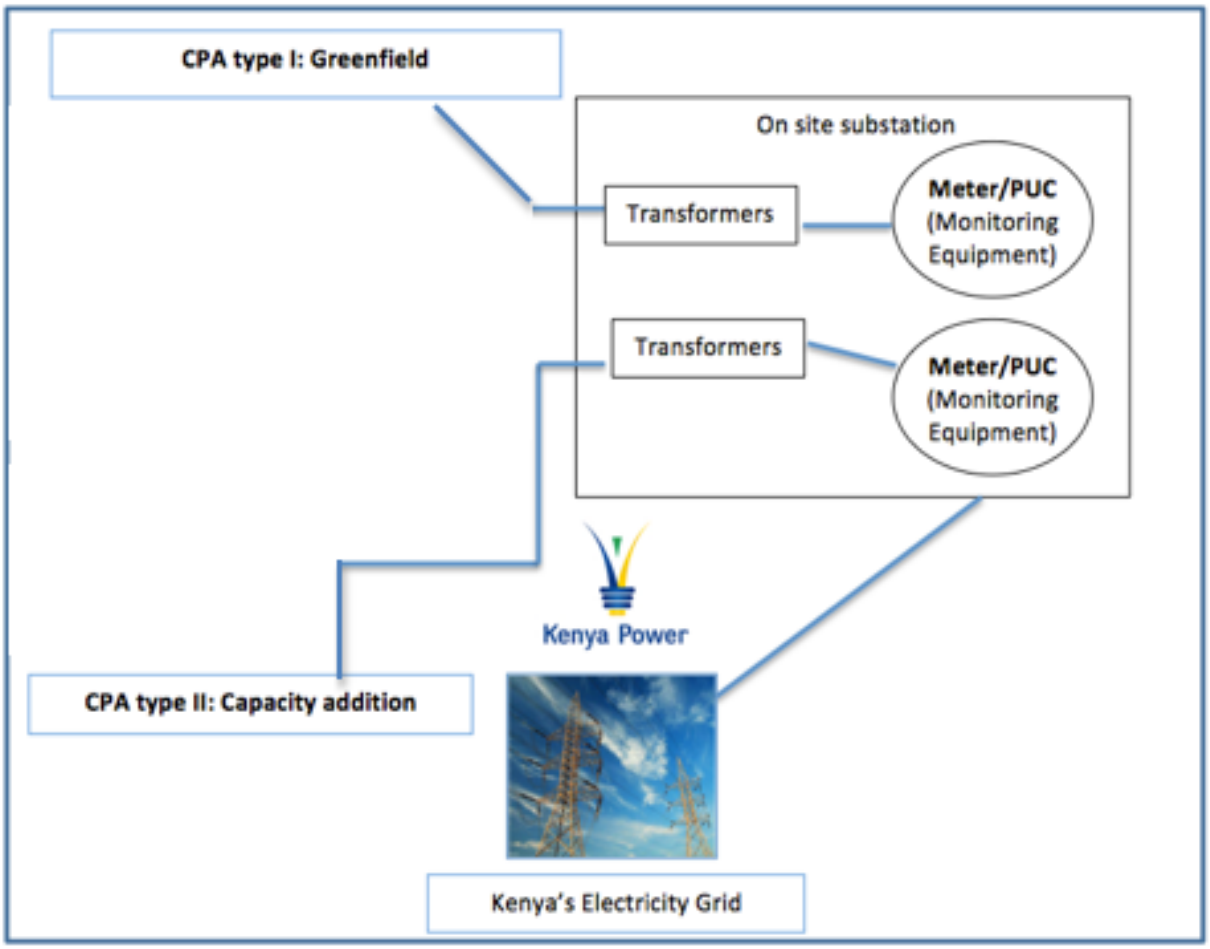

Figure 6: Location of the metering system

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

Detailed information about the exact technology and measure applied by the individual CPAs will be provided in section A 5. of the CPA-DD. The section will also include a description of how environmentally safe and sound technology and know-how is being applied by the specific CPA *inter alia* technology transfer to the host party for application in the CPA.

A.7 Public funding of PoA

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

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

As outlined in the standard for *Demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities* CDM-EB 65 -A03-STAN, version

04.0 (EB 87, Annex 03), additionality shall be demonstrated by establishing that in the absence of CDM PoA, none of the implemented CPAs would occur.

For PoAs that consist of one or more large-scale projects, CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large-scale methodologies applied to the CPAs.

As per the applied methodology ACM0002 (version 16.0), *the additionality of the project activity shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality".* Therefore, eligibility criteria are being formulated in accordance with the steps outlined in the *"Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0) as outlined below have been applied:

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

Sub-step 1a: Define alternatives to the project activity:
The following are identified the alternatives to the project activity:

- Alternative 1: The project activity not undertaken as a CDM project activity
- Alternative 2: Electricity delivered to the Kenyan national 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.

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

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful due to the fact that article 36 of the *Energy Act of 2006* only allow the revocation of already issued generation licenses in case of non-compliance of the licensee or on application of the licensee. The addition of new generation capacity can be considered lawful since article 28 of the *Energy Act of 2006* allows the application for new generation capacity

Since Alternative 1 describes the addition of grid connected geothermal power capacity to the Kenyan grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the *Energy Act of 2006* allows the implementation of geothermal power plants.

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

As per the *Tool for the demonstration and assessment of additionality* (version 07.0.0), the project participant has opted to apply step 2: Investment analysis to further evidence the additionality of each CPA.

The standard for *demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities* CDM- EB65-A03-STAN, version 04.0 (EB 87 Annex 03), indicates that when investment analysis is used for the demonstration of additionality, there are two options to meet the above requirements:

"(i) One option is to conduct an investment analysis to each CPA. In this case, the CME shall define the input parameters that will be used in the investment analysis in the PoA-DD, together with a description of how the values for these parameters will be obtained for each CPA. The additionality of each CPA shall then be assessed by using the actual values, applicable to the CPA at the time of inclusion, in the investment analysis conducted for the purpose of demonstrating the additionality of the CPA."

"(ii) Another option is not to conduct an investment analysis to each CPA but to define technical and economic criteria for the inclusion of the CPA in the PoA-DD. In this case, the CME shall determine, through the application of an investment analysis, a range of values for each input parameter which qualify a CPA for inclusion in the PoA. At the time of inclusion of a CPA, the CME shall assess whether the actual values, applicable to the CPA at the time of inclusion, fall within the range that was specified in the PoA-DD."

The project participant opts to apply option (i) – accordingly the following sources of evidence are being objective and credible to be used as evidence in the investment analysis:

- Documentation that has been prepared by an experienced third party
- Documentation that has been approved or issued by Kenyan governmental authorities
- Documentation that carries an official signature from the CPA implementing entity, CME or project participant[23]
- Documentation that has been submitted to or received from financing institutions like banks and equity providers
- Documentation submitted for official purposes such as documents submitted to Kenyan authorities.

Step 2: Investment analysis

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

Sub-step 2a: Determine appropriate analysis method
The *Tool for the demonstration and assessment of additionality* (version 07.0.0), provides three methods for carrying out investment analysis:

1. Simple cost analysis (Option I),
2. Investment comparison analysis (Option II)
3. Benchmark analysis (Option III).

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

In line with ACM0002 (version 16.0), the baseline scenario for the project activities is the supply of electricity from a grid. Therefore, the baseline scenario does not necessarily require investment and is outside the control of the project developers. Option III, benchmark analysis is selected as the appropriate analysis method for the CPAs.

[23] As documentation with an official signature from the CPA implementing entity, CME or project participant may not be sufficiently objective on its own for some cases, so those will only be valid for the following criteria:

- Double counting. Criteria 2a to 2d. The nature of these criteria can only be evidenced by signed confirmations from the CME and the CPA implementing entity. However, the veracity of those are easily demonstrable by the DOE.
- Investment decision date. Criterion 14c. The investment decision is taken by the project developer and therefore its proof is normally based on Board Resolution or Board Minutes. However, this decision can be backed up by independent third party studies such as energy resource assessments.
- Stakeholder consultation. Criterion 7a. When the stakeholder consultation is hold strictly for CDM purposes, the consultation and its reports are normally taken by the CME and therefore it must be accepted. Signed participation lists and pictures should support those reports.
- ODA diversion. Criteria 7b. When there is no use public funding by the project developer, its non- existence can only be evidence by a signed confirmation by the project developer.
- The agreement between the CME and the CPA for participation in the PoA is a legally binding document and therefore it can be used for confirmation purposes.

It is the understanding of the CME that those specific evidence for the eligibility criteria do not go against any of the CDM rules on third party evidence.

Sub-step 2b: Option III. Apply benchmark analysis
In line with paragraph 9 and 16 of the *Methodological tool: Investment analysis (v 06.0)*, CPAs will use one of the following two benchmark indicators:

- Option (a) Post-tax nominal Weighted Average Cost of Capital (WACC)
- Option (b) Post-tax nominal Return on Equity

The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR. The post-tax, nominal Weighted Average Cost of Capital (WACC) is an appropriate benchmark because post-tax WACC is the minimum acceptable rate of return at which a company yields returns for both debt and equity investors.

The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.

For CPAs applying option (a) as benchmark indicator, the following formula will be used to determine the post-tax nominal:

WACC: $WACC = r_e * W_e + r_d * W_d * (1 - T_c)$

Where:

WACC:	Weighted Average Cost of Capital
r_e	Cost of equity (-)
W_d:	Percentage of financing that is debt (-)
W_e:	Percentage of financing that is equity (-)
r_d:	Cost of debt (-)
T_c:	Corporate tax rate (-)

The values of w_d and w_e will be determined and evidenced at the CPA inclusion stage.

The default value for the cost of equity financing (r_e) is provided as a real term, post-tax value in the *Methodological tool Investment analysis (v 06.0).* Therefore, the following step will be undertaken to convert the value to a nominal, post-tax value:

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

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

The Return on Equity (provided in real terms) will be based on the default value as provided in the latest version of the *Methodological tool Investment analysis (v 06.0)*, for Group 1 projects located in Kenya – therefore the following equation applies:

$$\text{Nominal rate} = (1 + 14.55\%) \times (1 + \text{inflation}) - 1$$

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

- The inflation forecast provided by the Central Bank of Kenya for the duration of the CPA crediting period.
- The target inflation of the Central Bank of Kenya.
- The average forecasted inflation rate for Kenya published by the IMF or the World Bank for the next five years after start of the CPA.

As per the *Tool for the demonstration and assessment of additionality* (version 07.0.0) and the *Methodological tool Investment analysis (v 06.0)*, cost of debt financing (r_d) will be based on the estimates of the cost of debt financing and required return on debt capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on

bankers views.

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

The Return on Equity will be based on the default value as provided in the latest version of the *Methodological tool Investment analysis (v 06.0)* for Group 1 projects located in Kenya.

The default value is provided as a real term, post-tax value therefore, the following procedure is followed to convert the value to a nominal, post-tax value:

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

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

The Return on Equity (provided in real terms) will be based on the default value as provided in the latest version of the *Methodological tool Investment analysis (v 06.0)* for Group 1 projects located in Kenya – therefore the following equation applies:

$$\text{Nominal rate} = (1 + 14.55\%) \times (1 + \text{inflation}) - 1$$

The inflation will be based on:

- The inflation forecast provided by the Central Bank of Kenya for the duration of the CPA crediting period
- The target inflation of the Central Bank of Kenya
- The average forecasted inflation rate for Kenya published by the IMF or the World Bank for the next five years after start of the CPA.

Sub-step 2c: Calculation and comparison of financial indicators
After determination and calculation of the benchmark, the CPA will determine the post-tax Project IRR or the post-tax Equity IRR, as applicable. In line with the *Methodological tool Investment analysis (v 06.0),* all values used in the investment analysis will be applicable at the time of the investment decision. The time of the investment decision will be either the date on which the expected plant load factor has become available to the board based on which the board has decided to proceed with the drilling of exploration wells, or the date on which the board has decided to proceed with the drilling of production wells based on the resource results of the exploration wells, which is considered as significant commitment towards the implementation of the project.

In line with paragraph 6 of the *Methodological tool Investment analysis (v 06.0)*, both project IRR and equity IRR calculations should reflect the period of expected operation of the underlying project activity. The period of the investment analysis shall thus be determined in accordance with the PPA duration stipulated in the Feed-in-tariff policy or the Power Purchase Agreement (PPA) but carried out for at least 10 years. In case the technical lifetime of a project exceed the PPA duration, a fair value shall be determined and included in the final year of the cash flow analysis.

As required per option (i) of The standard for *demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities* CDM-EB 65-A03-STAN, version 04.0 (EB 87, Annex 03), each CPA will consider the following parameters when calculating the financial indicators as outlined in the tables 5-10 below:

As outlined earlier, the following sources will thereby be valid to determine input values for the below outlined parameter:

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

CAPEX items are all project costs that occur before commercial operation of a power plant and are therefore capitalized by debt and equity.

Table 5: CAPEX input parameter - Project Development

CAPEX Item **Project Development costs**	**Description**
Consulting costs	Consulting costs can for instance be costs for pre- and full feasibility studies, EIA studies, financial and legal advisory
Exploration risk insurance	Exploration risk insurance will include all costs related to the insurance of the drilling phase
Permits and licensing	Costs of permitting and licensing does for instance include EIA license costs, Geothermal resource licensing costs, Development, Construction and Generation permits
Land acquisition	Land acquisition costs account for costs of acquiring land required for the construction and operation of the power plant
Initial land access fee during exploration	Fees related to access and use of land prior to land acquisition or lease.
Administration costs	Administration costs include all costs related to all managerial and administrative costs occurring during the development and construction phase
Community development projects	Costs related to financial contributions to community projects as agreed with the community surrounding the power plant, e.g. schools, housing, hospitals.

Table 6: CAPEX input parameter - Equipment costs

CAPEX Item **Equipment costs**	**Description**
Initial civil works (exploration access roads etc)	Costs for Civil works costs, e.g. roads, well-pads if not included in EPC costs
Soil improvement, piling etc	Costs for s soil improvement and piling if not included in EPC costs
EPC (Plant)	EPC costs, e.g. for power plant
Drilling	Cost for drilling of exploration, production and re-injection wells
Interconnection	Costs of grid connection, if not included in EPC costs
Steam gathering system	Costs of steam gathering systems, e.g. steam pipes and plant interface if not included in EPC costs
Other equipment costs	Applicable equipment costs not included in any of the named equipment cost

	parameters

Table 7: CAPEX input parameter - Other costs

CAPEX Item	Description
Other costs	
Project management	Costs of project management during the construction phase
Contingency (DEV+EQU+PM)	Contingency costs applicable to development, equipment and project management costs. Contingency costs are typically up to 15% of total CAPEX.
Interest during construction	Interest during construction costs (IDC) are charged by the lending institution for debt interest accrued during the construction period.
Commitment fees	Commitment fees are typically being charged by the lending institution on non-withdrawn loan amount.
Front end fees	Front-end fees are typically charged by the lending institution as a fee for arranging debt finance
Debt Service Reserve Account (DSRA)	The establishment of a debt service reserve account during construction is typically required by the lending institution.
Working capital	Working capital costs are usually being capitalized to assure liquidity during the initial project phases and can potentially also include cash used to pay up-front VAT.

Table 8: OPEX input parameter

OPEX	
Geothermal license	Costs of geothermal license includes license fees to be paid to the MoE&P during the operational phase
Land leasing fees	Costs of land lease include costs for leasing land required for the operation of the power plant in case the land has not been acquired
Plant variable O&M expense	Variable costs of plant O&M, commonly provided in USD/kWh
Plant fixed O&M expense	Fixed costs of plant O&M, commonly provided in USD/MW
Make-up wells	Annual costs for make up wells, commonly provided in USD/MWh.
Royalty	Royalty costs to be paid to the MoE&P during the operational period
Community costs	Costs related to financial commitments made to the community residing nearby the power plant, during the power plant operational period

Table 9: Economic / financial input parameter

Economic / financial data	
Inflation rates	Inflation rates are being applied to escalate cost items over time. Different inflation rates

	will be used according to origin of cost items, e.g. USD costs will use USD inflation rates, KES costs will use KES inflation, EUR cost items will apply EUR inflation etc.
Exchange rates	Exchange rates will be used to translate costs items of different origin to one common currency applied in the financial model.
Corporate tax	Applicable corporate tax rate will be applied to income before tax
Equipment lifetime	Equipment lifetime will be utilized to calculate project fair value at the end of the modeling period
Debt/equity gearing	Applicable debt/equity gearing will be applied to calculate Equity IRR
Interest rates	Interest rates applicable to debt finance will be considered
Grace period	Grace period on debt principals payments will be considered
Loan tenor	Loan tenor applicable to debt finance will be considered

Table 10: PPA input parameter

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

Sub-step 2d: Sensitivity analysis
In order to show that the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions, a -10%/+10% sensitivity analysis was carried out on the following parameters:

- Electricity generation
- Operating costs
- Investment costs
- Tariff

Step 4: Common practice analysis
In accordance with the *Tool for the demonstration and assessment of additionality* (version 07.0.0) and the *methodological tool: Common Practice* (EB 84 Annex 7, version 03.1), a common practice analysis will be conducted for every CPA to be included to the PoA, as per the following steps:

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

Step 2: identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:
(a)The projects are located in the applicable geographical area;

(b) The projects apply the same measure as the proposed project activity;

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number $N_{all.}$

Step 4: within similar projects identified in Step 3, identify those that apply technologies that are different to the technology applied in the proposed project activity. Note their number N_{diff}.

Step 5: calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

The proposed project activity is a "common practice" within a sector in the applicable geographical area if the factor F is greater than 0.2 and $N_{all}-N_{diff}$ is greater than 3.

If a CPA fulfils all requirements of step 1,2 and 4 of the *Tool for the demonstration and assessment of additionality* (version 07.0.0) the CPA is considered additional.

In addition to the requirements set out in the latest approved version of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 04.0), the applied methodology ACM0002 (version 16.0), para. 68 requires the definition of eligibility criteria as per economic and technical parameters outlined in the methodology:

- Technical and economic parameters that are technology specific (e.g. ranges of load factors, sizes of installation, wind speed) have been included as eligibility criteria that specify the technology/measure including the level and type of service, performance specifications including compliance with testing/certifications (para 18c of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programmes of Activities,* version 04.0).

- Parameters reflecting the investment climate have been included as conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality (para 15 (a i) of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programmes of Activities,* version 04.0).

- Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA) have been included as conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality (para 15 (a i) of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programmes of Activities,* version 04.0).

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

The applicable methodology ACM0002 (version 16.0) states, *CPAs are regarded to be of the same type if they are similar with regard to the demonstration of additionality, emission reduction calculations and monitoring.*

Accordingly, the PoA will involve two CPA types:

- CPA – Type I: Geothermal power plant/unit (Greenfield)
- CPA – Type II: Geothermal power plant/unit (Capacity addition)

The following eligibility criteria have been formulated for each of type of CPA based on the requirements outlined in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* CDM-EB 65-A03-STAN, version 04.0 (EB 87, Annex 03) as per the requirements outlined in section B1. of the PoA-DD.

CPA TYPE I: Geothermal power plant/unit (Greenfield)

Topic	Eligibility criteria	Documentary/Evidence
1. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA **(a)**	The geographic boundary of the CPA is located in the geographical boundary of the PoA as indicated in section A.5. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description and or correspondence with entities of the Kenyan Government.	Verifiable evidence are either: – EIA report – Prefeasibility Study/Feasibility study/Technical description – Governmental letters
2a) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CPA implementing entity will confirm that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.	Verifiable evidence are either: – Signed confirmation by CPA implementing entity – CPA PoA participation agreement
2b) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by a signed confirmation letter from the CME. Every CPA will furthermore have a unique identification number.	Verifiable evidence are either: – Signed confirmation letter from the CME and CDM website check – CPA-DD
2c) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user	The CPA will provide a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical	Verifiable evidence are either: – Project map – EIA report

locations (e.g. programme logo) **(b)**	description report, EIA report, or other relevant documentation.	– Prefeasibility Study/Feasibility study/Technical description
2d) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM projects within the geographical boundary. This will be evidenced by a signed confirmation letter from the CME.	– Signed confirmation letter from the CME and CDM website check
3a) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The CPA will involve the implementation of a Greenfield geothermal power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
3b) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The generator technology shall be certified to IEC 60034-1 and the turbine to IEC 60045-1 standards. This will be evidenced by the IEC certificates. If at the time of the inclusion of the CPA, the certificates are not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.	Verifiable evidence are either: – Certification certificate – CPA PoA participation agreement – Signed letter by the CPA implementing entity
3c) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The installed capacity of the CPA will be minimal 35 MW and not more than 70 MW per grid connection point. This is in line with the revised *Feed-in-tariff policy* of 2012. The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report

3d) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The CPA will have a net load factor below or equal to 98%.[24] The top range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a geothermal project can be developed. This figure is also confirmed by the 2011 report by the International Energy Agency.[25]	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report
4. Conditions to check the start date of the CPA through documentary evidence **(d)**	The start of the CPA occurs after 23/05/2013, when MPG submitted CDM Prior Consideration. This will be evidenced by the exploration well-drilling contract or any other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 23/05/2013.	Verifiable evidence are either: – Contract with the drilling company – Substantial agreement e.g. lending agreement – UNFCCC website to show PoA start date
5. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs **(e)**	The CPA will confirm its compliance with the applicability of ACM0002, (version 16.0) in section D.2 of the specific CPA-DD	See evidence required as per section D.2 of the specific CPA-DD.
6. The conditions that ensure that the CPA meets the requirements pertaining to the demonstration of additionality **(f)**	The CPA will proven to be additional by being eligible to criteria 12-16.	– See verifiable evidence for eligibility criteria 12-16
7a.) The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis **(g)**	An Environmental Impact Assessment shall be carried out on the CPA level in line with Kenyan regulations as outlined in section E.1 of the PoA-DD. A local stakeholder consultation is carried out in accordance with CDM requirements and (if available) DNA requirements on PoA level for the whole concession area. Therefore no additional CDM stakeholder consultation will have to be carried out on CPA level. However, additional stakeholder consultations might have to be carried out for each CPA as part of the EIA process.	Sections C of the CPA-DD and section F of the PoA DD Verifiable evidence are either: – PoA Stakeholder consultation report – EIA report

[24] This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[25] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7

7b.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has not received funding from Annex I parties, it will confirm so by issuing a signed confirmation letter.	Verifiable evidence are either: – Signed confirmation letter by the CPA implementing entity
7c.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has received funding from Annex I parties, a letter will be provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.	Verifiable evidence are either: – ODA declaration letter
8. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation) **(i)**	The CPA will be connected to the Kenyan electricity grid. This will be evidenced through the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
9. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities" **(j)**	The *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities* (version 05.0), mentions that sampling requirements outlined in the applicable methodology are precedent. Sampling will therefore be carried out in line with ACM0002 (version 16.0)	Sampling will be carried out as per the applied methodology ACM0002 (version 16.0). Verifiable evidence: – Section B.3 of the PoA-DD – CME Manual
10. Where applicable, the conditions that ensure that every CPA meets the small-scale or microscale threshold and remains within those thresholds throughout the crediting period of the CPA. However, for a CPA that consists of only units that qualify as 'microscale CDM units' as defined in the methodological tool "Demonstration of additionality of microscale project activities", this condition is not required **(k)**	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology ACM0002 (version 16.0). Therefore no small- or micro-scale threshold shall be applied.	See methodology section D.2 of the specific CPA-DD
11. Where applicable, the requirements for the debundling check, in case	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology	See methodology section D.2 of the specific CPA-DD

the CPA belongs to small-scale or microscale project categories. However, if a CPA solely consists of 'microscale CDM units', the requirement regarding debundling is not applicable (l)	ACM0002 (version 16.0). Therefore no debundling shall be applied.	

Eligibility criteria related to step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Topic	Eligibility criteria	Documentary/Evidence
12a) Identification of alternative scenarios	The CPA will identify that the alternative to the CPA implementation, is that electricity delivered to the Kenyan national 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, or the project activity being undertaken not as a CDM project.	Verifiable evidence: - CPA - DD
12b) Identification of alternative scenarios	The CPA will confirm that both alternatives are consistent with mandatory laws and regulations.	Verifiable evidence: - List of applicable laws

Eligibility criteria related to step 2: CPA investment analysis:

Topic	Eligibility criteria	Documentary/Evidence
13a) Benchmark	The CPA will carry out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet.	Verifiable evidence: - Investment analysis
13b) Benchmark	The CPA will apply (a) the post-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR. This will be evidenced through the investment analysis spread sheet.	Verifiable evidence: - Investment analysis

Topic	Eligibility criteria	Documentary/Evidence
14a) Financial indicator	Without the CER revenue, the CPA will have a less favorable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spreadsheet and the relevant references.	Verifiable evidence: - Investment analysis - Relevant references
14b) Financial indicator	All input values applied in the investment analysis will be applicable at the time of the investment decision.	Verifiable evidence: - Relevant references

	The CME will check whether all the input values are valid at the time of the investment decision.	
14c) Financial indicator	The time of the investment decision will be either the date on which the expected plant load factor has become available to the board based on which the board has decided to proceed with the drilling of exploration wells, or the date on which the board has decided to proceed with the drilling of production wells based on the resource results of the exploration wells, which is considered as significant commitment towards the implementation of the project. This will be evidenced by the resource assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project	Verifiable evidence are either: - CPA implementing entity Board resolution - Drilling contract - Resource assessment study

Sub-step 2d: Sensitivity analysis

Topic	Eligibility criteria	Documentary evidence
15a) Sensitivity analysis	The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis: • Investment cost • Electricity generation • Operating and maintenance cost • Tariff	Verifiable evidence: - Sensitivity analysis
15b) Sensitivity analysis	The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.	Verifiable evidence: - Sensitivity analysis

Step 4: Common practice analysis

Topic	Eligibility criteria	Documentary evidence
16) Common practice analysis	When following steps 1 – 5 of the *methodological tool: Common Practice* (version 03.1), it can be concluded that	Verifiable evidence: - Common practice analysis and applicable

	the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from KPLC, KenGen and/or the Ministry of Energy (MoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.	references

Eligibility criteria derived from clause 68 of the applied methodology ACM0002 (version 16.0):

Topic	Eligibility criteria	Documentary/Evidence
17a) Technical and economic parameters	*Ranges of load factors:* Only CPAs with a net load factor below or equal to 98% will be eligible under the PoA. This top range is based on geothermal projects that have been registered under the CDM and, therefore, provides a realistic maximum load factor, which a geothermal power plant projects can apply. This figure is confirmed by the 2011 report by the International Energy Agency.[26]	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – EIA report and – Investment analysis
17b) Technical and economic parameters	*Sizes of installation:* The CPAs will have an installed capacity from 35 MW of up to 70 MW per grid connection point This is in line with the feed-in policy of the Ministry of Energy.	Verifiable evidence are either: – Feasibility study – EIA report and – Investment analysis
17c) Technical and economic parameters	*Tariffs and PPA:* The CPA will use a non-inflated tariff[27] of not more than 88 USD/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years, or whenever the tariff is updated under the Kenyan FiT policy or other relevant government regulation, whichever occurs first. The PPA will be with Kenya Power since Kenya currently follows a single-buyer market model or with another private consumer through a wheeling agreement.	Verifiable evidence are either: – MoE approval letter – FiT policy and – Investment analysis
17d) Technical and economic parameters	*Depreciation:* The CPA will apply the applicable depreciation rates in the investment	Verifiable evidence: – Investment analysis

[26] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7 This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[27] Base year is 2012, when the most recent FiT policy was updated.

	analysis as provided by the Kenyan regulations with regard depreciation. At the time of writing the PoA DD, the depreciation for energy projects is straight-line depreciation. The applicable depreciation will be updated every two years, or whenever the applicable depreciation rates in Kenya change, whichever occurs earlier.	
17e) Technical and economic parameters	*Taxes:* The CPA will apply a tax rate of 30% in the investment analysis, which is the Kenyan corporate tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years, or whenever the tax regulations in Kenya change, whichever occurs earlier.	Verifiable evidence: – Investment analysis – Corporate tax rate
17f) Technical and economic parameters	*Other parameters determining market circumstances:* Applicable inflation rates will be determined as follows: • The inflation forecast by the central bank of Kenya, European Central Bank, US FED for the duration of the CPA crediting period • The target inflation of the Central Bank of Kenya, European Central Bank, US FED at the time of investment decision • The average forecasted inflation rate for Kenya, EU and USD published by the IMF or the World Bank for the next five years after start of the CPA Applicable exchange rates will be determined as follows: • The applicable exchange rates reported by Kenyan Central Bank on the date of the investment decision will be used.	Verifiable evidence are either: - Central Bank of Kenya - European Central Bank - US FED - World Bank or IMF and - Investment analysis
17g) Technical and economic parameters	*Subsidies or other financial flows* If applicable at the time of investment decision, the CPA will include any relevant subsidies or other financial flows in the investment analysis. The CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	Verifiable evidence: – Investment analysis – CPA confirmation letter

18a) Ranges of costs and revenues	*Capital investment:* Only CPAs applying a CAPEX exceeding 1.9 million USD/MW will be eligible under the PoA. This CAPEX figure has been derived from the 2014 report by Ren21 [28] According to the source, this figure represents the lower bound for CAPEX investment costs of Greenfield geothermal power plants.	Verifiable evidence: – Investment analysis – Applicable references
18b) Ranges of costs and revenues	*Operating & maintenance costs:* Only CPAs applying O&M costs exceeding 100 USD/kW will be eligible under the PoA. This OPEX figure has been derived from the 2012 report by IRENA.[29] According to the source, this figure represents the lower bound for OPEX costs of geothermal power plants.	Verifiable evidence: – Investment analysis – Applicable references
18c) Ranges of costs and revenues	*Electricity revenues:* All revenues from electricity sales as per the applicable tariff will be included in the financial analysis	Verifiable evidence: – Investment analysis – PPA / Tariff letter
18d) Ranges of costs and revenues	*Subsidies or other fiscal incentives:* Any additional subsidies or other types of financial incentives that affect that financial attractiveness of the CPA shall be included in the financial analysis. The CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	Verifiable evidence: – Investment analysis – CPA confirmation letter
18e) Ranges of costs and revenues	*ODA:* If the CPA is supported by ODA finance, it shall include this financing in the investment analysis.	Verifiable evidence are either: – ODA declaration form – CPA confirmation letter and – Investment analysis

CPA TYPE II: Geothermal power plant/unit (Capacity addition)

Topic	Eligibility criteria	Documentary/Evidence

[28] REN21 (2014) Renewables 2014 – Global Status Report

[29] IRENA (2013) *Renewable Energy Generation Cost in 2012: An Overview.* p.74

1. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA **(a)**	The geographic boundary of the CPA is located in the geographical boundary of the PoA as indicated in section A.5. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description and or correspondence with entities of the Kenyan Government.	Verifiable evidence are either: – EIA report – Prefeasibility Study/Feasibility study/Technical description – Governmental letters
2a) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CPA implementing entity will confirm that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.	Verifiable evidence are either: – Signed confirmation by CPA implementing entity – CPA PoA participation agreement
2b) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by a signed confirmation letter from the CME. Every CPA will furthermore have a unique identification number.	Verifiable evidence are either: – Signed confirmation letter from the CME and CDM website check – CPA-DD
2c) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CPA will provide a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.	Verifiable evidence are either: – Project map – EIA report – Prefeasibility Study/Feasibility study/Technical description
2d) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM projects within the geographical boundary. This will be evidenced by a signed confirmation letter from the CME.	– Signed confirmation letter from the CME and CDM website check
3a) The specifications of technology/ measure including the level and type of service, performance specifications including	The CPA will involve the implementation of a capacity addition geothermal power project supplying electricity to the national grid. This will be evidenced by the	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical

compliance with testing/ certifications **(c)**	feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.	description – Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
3b) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The generator technology shall be certified to IEC 60034-1 and the turbine to IEC 60045-1 standards. This will be evidenced by the IEC certificates. If at the time of the inclusion of the CPA, the certificates are not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.	Verifiable evidence are either: – Certification certificate – CPA PoA participation agreement – Signed letter by the CPA implementing entity
3c) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The installed capacity[30] of the CPA will be minimal 35 MW and not more than 70 MW per grid connection point. This is in line with the revised *Feed-in-tariff policy* of 2012. The installed capacity [31] will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report
3d) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The CPA will have a net load factor below or equal to 98%.[32] The top range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a geothermal project can be developed. This figure is also confirmed by the 2011 report by the International Energy Agency.[33]	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report
4. Conditions to check the start date of the CPA through documentary evidence **(d)**	The start of the CPA occurs after 23/05/2013, when MPG submitted CDM Prior Consideration. This will be evidenced by the exploration	Verifiable evidence are either: – Contract with the drilling company

[30] This refers to the capacity of the capacity addition only

[31] This refers to the capacity of the capacity addition only

[32] This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[33] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7

	well-drilling contract or any other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 23/05/2013.	– Substantial agreement e.g. lending agreement – UNFCCC website to show PoA start date
5. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs **(e)**	The CPA will confirm its compliance with the applicability of ACM0002, (version 16.0) in section D.2 of the specific CPA-DD	See evidence required as per section D.2 of the specific CPA-DD
6. The conditions that ensure that the CPA meets the requirements pertaining to the demonstration of additionality **(f)**	The CPA will prove to be additional by being eligible to criteria 12-16.	– See verifiable evidence for eligibility criteria 12-16
7a.) The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis **(g)**	An Environmental Impact Assessment shall be carried out on the CPA level in line with Kenyan regulations as outlined in section E.1 of the PoA-DD. A local stakeholder consultation is carried out in accordance with CDM requirements and (if available) DNA requirements on PoA level for the whole concession area. Therefore no additional CDM stakeholder consultation will have to be carried out on CPA level. However, additional stakeholder consultations might have to be carried out for each CPA as part of the EIA process.	Sections C of the CPA-DD and section F of the PoA DD Verifiable evidence are either: – PoA Stakeholder consultation report – EIA report
7b.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has not received funding from Annex I parties, it will confirmed so by issuing a signed confirmation letter.	Verifiable evidence are either: – Signed confirmation letter by the CPA implementing entity
7c.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has received funding from Annex I parties, a letter will be provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.	Verifiable evidence are either: – ODA declaration letter
8. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms	The CPA will be connected to the Kenyan electricity grid. This will be evidenced through the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description

(e.g. direct installation) **(i)**	study.	– Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
9. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities" **(j)**	The *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities* (version 05.0), mentions that sampling requirements outlined in the applicable methodology are precedent. Sampling will therefore be carried out in line with ACM0002 (version 16.0)	Sampling will be carried out as per the applied methodology ACM0002 (version 16.0). Verifiable evidence: – Section B.3 of the PoA-DD – CME Manual
10. Where applicable, the conditions that ensure that every CPA meets the small-scale or microscale threshold and remains within those thresholds throughout the crediting period of the CPA. However, for a CPA that consists of only units that qualify as 'microscale CDM units' as defined in the methodological tool "Demonstration of additionality of microscale project activities", this condition is not required **(k)**	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology ACM0002 (version 16.0). Therefore no small- or micro-scale threshold shall be applied.	See methodology section D.2 of the specific CPA-DD
11. Where applicable, the requirements for the debundling check, in case the CPA belongs to small-scale or microscale project categories. However, if a CPA solely consists of 'microscale CDM units', the requirement regarding debundling is not applicable (l)	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology ACM0002 (version 16.0). Therefore no debundling shall be applied.	See methodology section D.2 of the specific CPA-DD

Eligibility criteria related to step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Topic	Eligibility criteria	Documentary/Evidence
12a) Identification of alternative scenarios	The CPA will identify that the alternative to the CPA implementation, is that electricity delivered to the Kenyan national grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the	Verifiable evidence: - CPA - DD

	addition of new generation sources, or the project activity being undertaken not as a CDM project.	
12b) Identification of alternative scenarios	The CPA will confirm that both alternatives are consistent with mandatory laws and regulations.	Verifiable evidence: - List of applicable laws

Eligibility criteria related to step 2: CPA investment analysis:

Topic	Eligibility criteria	Documentary/Evidence
13a) Benchmark	The CPA will carry out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet	Verifiable evidence: - Investment analysis
13b) Benchmark	The CPA will apply (a) the post-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR. This will be evidenced through the investment analysis spread sheet.	Verifiable evidence: - Investment analysis

Topic	Eligibility criteria	Documentary/Evidence
14a) Financial indicator	Without the CER revenue, the CPA will have a less favorable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spreadsheet and the relevant references.	Verifiable evidence: - Investment analysis - Relevant references
14b) Financial indicator	All input values applied in the investment analysis will be applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.	Verifiable evidence: - Relevant references
14c) Financial indicator	The time of the investment decision will be either the date on which the expected plant load factor has become available to the board based on which the board has decided to proceed with the drilling of exploration wells, or the date on which the board has decided to proceed with the drilling of production wells based on the resource results of the exploration wells, which is considered as significant commitment towards the implementation of the project. This will be evidenced by the resource assessment report together with a board resolution or by a contract involving the commitment of significant	Verifiable evidence are either: - CPA implementing entity Board resolution - Drilling contract - Resource assessment study

	financial resources towards the implementation of the project	

Sub-step 2d: Sensitivity analysis

Topic	Eligibility criteria	Documentary evidence
15a) Sensitivity analysis	The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis: • Investment cost • Electricity generation • Operating and maintenance cost • Tariff	Verifiable evidence: - Sensitivity analysis
15b) Sensitivity analysis	The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.	Verifiable evidence: - Sensitivity analysis

Step 4: Common practice analysis

Topic	Eligibility criteria	Documentary evidence
16) Common practice analysis	When following steps 1 – 5 of the *methodological tool: Common Practice* (version 03.1), it can be concluded that the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from KPLC, KenGen and/or the Ministry of Energy (MoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.	Verifiable evidence: - Common practice analysis and applicable references

Eligibility criteria derived from clause 68 of the applied methodology ACM0002 (version 16.0):

Topic	Eligibility criteria	Documentary/Evidence
17a) Technical and economic parameters	*Ranges of load factors:* Only CPAs with a net load factor below or equal to 98% will be eligible under the PoA. This top range is based on geothermal projects that have been	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description

	registered under the CDM and, therefore, provides a realistic maximum load factor, which a geothermal power plant projects can apply. This figure is confirmed by the 2011 report by the International Energy Agency.[34]	– EIA report and – Investment analysis
17b) Technical and economic parameters	*Sizes of installation:* The CPAs will have an installed capacity from 35 MW of up to 70 MW per grid connection point This is in line with the feed-in policy of the Ministry of Energy.	Verifiable evidence are either: – Feasibility study – EIA report and – Investment analysis
17c) Technical and economic parameters	*Tariffs and PPA:* The CPA will use a non-inflated tariff[35] of not more than 88 USD/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years, or whenever the tariff is updated under the Kenyan FiT policy or other relevant government regulation, whichever occurs first. The PPA will be with Kenya Power since Kenya currently follows a single-buyer market model or with another private consumer through a wheeling agreement.	Verifiable evidence are either: – MoE approval letter – FiT policy and – Investment analysis
17d) Technical and economic parameters	*Depreciation:* The CPA will apply the applicable depreciation rates in the investment analysis as provided by the Kenyan regulations with regard depreciation. At the time of writing the PoA DD, the depreciation for energy projects is straight-line depreciation. The applicable depreciation will be updated every two years, or whenever the applicable depreciation rates in Kenya change, whichever occurs earlier.	Verifiable evidence: – Investment analysis
17e) Technical and economic parameters	*Taxes:* The CPA will apply a tax rate of 30% in the investment analysis, which is the Kenyan corporate tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years, or whenever the tax regulations in Kenya change, whichever occurs earlier.	Verifiable evidence: – Investment analysis – Corporate tax rate

[34] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7 This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[35] Base year is 2012, when the most recent FiT policy was updated.

17f) Technical and economic parameters	*Other parameters determining market circumstances:* Applicable inflation rates will be determined as follows: • The inflation forecast by the central bank of Kenya, European Central Bank, US FED for the duration of the CPA crediting period • The target inflation of the Central Bank of Kenya, European Central Bank, US FED at the time of investment decision • The average forecasted inflation rate for Kenya, EU and USD published by the IMF or the World Bank for the next five years after start of the CPA Applicable exchange rates will be determined as follows: • The applicable exchange rates reported by Kenyan Central Bank on the date of the investment decision will be used.	Verifiable evidence are either: - Central Bank of Kenya - European Central Bank - US FED - World Bank or IMF and - Investment analysis
17g) Technical and economic parameters	*Subsidies or other financial flows* If applicable at the time of investment decision, the CPA will include any relevant subsidies or other financial flows in the investment analysis. The CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	Verifiable evidence: – Investment analysis – CPA confirmation letter

18a) Ranges of costs and revenues	*Capital investment:* Only CPAs applying a CAPEX exceeding 1.9 million USD/MW will be eligible under the PoA. This CAPEX figure has been derived from the 2014 report by Ren21 [36] According to the source, this figure represents the lower bound for CAPEX investment costs of Greenfield geothermal power plants.	Verifiable evidence: – Investment analysis – Applicable references
18b) Ranges of costs and revenues	*Operating & maintenance costs:* Only CPAs applying O&M costs exceeding 100 USD/kW will be eligible under the PoA. This OPEX figure has	Verifiable evidence: – Investment analysis – Applicable references

[36] REN21 (2014) Renewables 2014 – Global Status Report

	been derived from the 2012 report by IRENA.[37] According to the source, this figure represents the lower bound for OPEX costs of geothermal power plants.	
18c) Ranges of costs and revenues	*Electricity revenues:* All revenues from electricity sales as per the applicable tariff will be included in the financial analysis	Verifiable evidence: – Investment analysis – PPA / Tariff letter
18d) Ranges of costs and revenues	*Subsidies or other fiscal incentives:* Any additional subsidies or other types of financial incentives that affect that financial attractiveness of the CPA shall be included in the financial analysis. The CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	Verifiable evidence: – Investment analysis – CPA confirmation letter
18e) Ranges of costs and revenues	*ODA:* If the CPA is supported by ODA finance, it shall include this financing in the investment analysis.	Verifiable evidence are either: – ODA declaration form – CPA confirmation letter and – Investment analysis

B.3. Application of technologies/measures and methodologies

This PoA will include the installation of grid-connected geothermal power generation plants/units. The project activities might either consist of the installation of new geothermal plants sites where no geothermal energy power plant was operated prior to the implementation of the project activity (Greenfield plants), or in a capacity addition of an existing geothermal power plant.

All CPAs implemented under this PoA will apply the approved consolidated baseline and monitoring methodology ACM0002 *"Grid-connected electricity generation from renewable sources"* (version 16.0).

Since the CPAs to be included in the PoA will be large-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each CPA. As per the *Standard for Sampling and surveys for CDM project activities and programmes of activities,* (version 05.0), sampling for CPA monitoring parameters $W_{steam,CO2,y}$ and $W_{steam,CH4,y}$ will be carried out for each CPA as defined in ACM0002 (version 16.0).

An electronic database will be established that contains general information regarding each CPA as well as data and information, which is monitored on a regular basis and which is used to determine emission reductions achieved by the CPA. The database will be accessible at any time for verification.

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

[37] IRENA (2013) *Renewable Energy Generation Cost in 2012: An Overview.* p.74

Completion Date: 12/07/2016
Entity: Marine Power Generation Company Limited (MPG)
Name: Eric M'Barine
Email: eric.mbarine@mpgeneration.com

As shown in appendix 1 to the PoA-DD, the entity is also acting as a CME to the PoA.

SECTION C. Management system

As per the *CDM Project Standard* (version 09.0), paragraph 210, 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 the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities (*version 04.0). The following management system will be implemented by the CME for the inclusion of CPAs.

Definition of roles and responsibilities
A programme officer will be appointed by the CME with working experience in CDM and knowledge of CDM modalities and procedures. The programme officer will have the following responsibilities:

a) Development of the PoA Design Document (CDM-PoA-DD) and CDM Component Project Activity (CPA) Design Documents (CDM-CPA-DD) for CPAs that are developed under the Programme of Activities;
b) Carry out a quality check on CPAs to be included in the Programme of Activities ensure that the CPA meets all the eligibility criteria as formulated in the PoA-DD;
c) Collect and compile supporting evidence that are required for the inclusion and validation of the CPA in the PoA
d) Verify that the CPA has not yet been developed as a single CDM project or been included in another PoA. Collect, compile and store data and information regarding each CPA
e) Preparing the monitoring report and implementation of a monitoring database
f) Obtaining a Letter of Approval for the implementation of the PoA from the host country;
g) Obtaining a Letter of Authorization of the coordination of the PoA from the host country;
h) Liaise with the Designated National Authority (DNA) on matters related to the implementation of the PoA and inclusion of CPAs
i) Act as the focal point with the CDM Executive Board for matters related to the PoA;
j) 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;
k) Coordinate monitoring activities and data management during the lifetime of the PoA;
l) Collect and compile monitoring records from all the CPA entities;
m) Prepare and submit monitoring reports and facilitate the verification of the same;
n) Contract a DOE for validation and verification purposes
o) Training the monitoring personnel
p) Any post-registration changes to the PoA-DD as required

Individual CPAs will be developed and implemented by CPA implementing entities. The CPA implementing entities will be responsible for the operation and maintenance (including calibration) of the power plant and will enter into a power purchase agreement or similar contractual agreement with the electricity off-taker 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 CPA will also be responsible to provide the CME and DOE with required documents and access to sites as needed.

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

a) Implementation of the described CPA

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

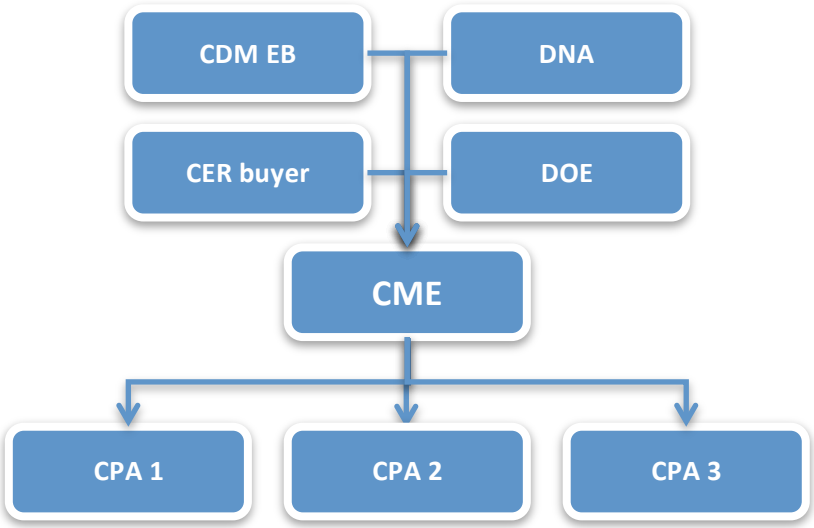

Figure 7: PoA Management structure

Records of arrangements for training and capacity development of personnel:
In order to ensure that CME personnel are able to improve their skills and competencies and retain relevant knowledge given the frequent changes to the CDM rules and requirements, staff will undergo a regular skills assessment (at least once every six months). This will be conducted through an internal review of skills and competency levels and an assessment of any outsourced third parties. All CME staff will be required to complete an evaluation form and present this to their respective managers. Based on the outcomes of an evaluation meeting, appropriate internal and external training sessions will be organized as necessary for the particular personnel requirements.

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

Procedures for technical review of inclusion of CPAs
As part of the responsibilities of the Programme Manager, a technical review of each proposed CPA will be carried out prior to the request for inclusion being sent to the DOE. All supporting evidence stated in the eligibility criteria will be compiled and CPA compliance in accordance with all eligibility requirements as per the PoA-DD will be double-checked. The Programme Manager will also verify the authenticity of the evidence to the eligibility criteria by consulting with national or local authorities when necessary. Finally, the Programme Manager will verify that the CPA has not yet been developed as a single CDM project or been included in another PoA by means of the procedures to avoid double counting described. An internal quality check will be performed by a second CME staff member who has not been directly involved in the development of the CPA-DD.

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:

a) General information about CPA:
    a. CPA Name
    b. Name and contact details of the entity implementing the CPA
    c. Geographical location of the CPA (GPS coordinates)

   d. Technology employed by the CPA and installed capacity
   e. Commissioning date
   f. Start date of the CPA
   g. Crediting period
   h. Start and end date of crediting period
   i. Operational lifetime
   j. Verification status (number of verification and associated monitoring period)
   k. Emission reductions monitored and issued each monitoring period
b) Supporting evidence for each eligibility criterion to demonstrate that the CPA meets all the eligibility criteria for inclusion into the PoA.
c) 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 programme officer appointed by the CME will be responsible for entering, updating and maintaining data and information regarding CPAs into the electronic database.

Procedure to avoid double accounting
The following procedure will be established to avoid double accounting 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:

a) 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.
b) A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project. The check by the CME will be presented in a signed confirmation letter from the CME.
c) The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:
   a. A project area map, including geographic coordinates, provided by the CPA Implementer. This will be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
   b. A check by the CME on the CDM website that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area. The check by the CME will be presented in a signed confirmation letter from the CME.
   c. The Programme Officer will also give a name to the CPA that uniquely identifies the CPA in terms of location, technology and installed capacity.

Measures for continuous improvements of the PoA management system
In the course of the PoA lifetime, it is likely that some of those procedures included in the PoA Management and CPA Inclusion Manual will result in insufficient control of the CME management system. Therefore, the CME will update its processes and procedures with a view to improving them for better management system control. Any such improvements will be incorporated as soon as is reasonably possible and the Manual will be updated accordingly. This may include but is not limited to:

- Improved CME organization and structure
- Better personnel development and training procedures
- Updated document and data management and control processes

- Better internal and external communication

Quality control improvement
The CME shall also continually improve the effectiveness of the quality control system by:

- Communicating to staff the importance of meeting statutory and regulatory requirements
- Ensuring that quality objectives are established and putting in place more stringent procedures as required
- Conducting management reviews
- Ensuring the availability of resources

As the size of the PoA grows with time and the CME structure and functions evolve, the CME may consider to apply more formal quality assurance and control procedures and processes such ISO 9001 and ISO 14064/65 to the PoA management system.

External review and feedback
In order to help achieve continual improvement, information and feedback will be solicited from CPA implementers. To this effect the Programme Manager and the Programme Officer responsible for a CPA will provide to and collect from CPA implementer a CME Assessment Form. The CME Assessment Forms will be circulated to them on an annual basis. Comments received will be taken into account to improve the CME management system.

CME management system improvement plan
A CME management system improvement plan will be developed based on the external inputs received above, CME staff comments and evaluations and the internal review. It will be updated every 12 months, with the details of the actions to improve the management system based on analysis of the feedback received. The plan will include targets for improved performance in the future. A designated CME Programme Manager shall prepare and update the plan. At the end of the first crediting period of the PoA, new CME management processes and procedures that have been adopted will be included in the updated PoA-DD.

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

SECTION D. Duration of PoA

D.1. Start date of PoA

In line with the *Glossary of CDM terms* (version 08) and the *CDM Project Standard* (version 09.0), the start date of the PoA is 23/05/2013 which is the date when the CME has submitted Prior Consideration to the UNFCCC as well as to the Kenyan DNA. The start date of any future CPA is not, or will not be, prior to the start date of the PoA, therefore will not be prior to the commencement of the validation of the PoA.

D.2. Duration of the PoA

The lifetime of the PoA will be 28 years in accordance with the *CDM Project Standard* (version 09.0)

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

As per the *Environmental Management and Coordination Act of 1999*[38] and *the Environmental (Impact Assessment and Audit) Regulations 2003*[39], every CPA will have to carry out an Environment and Social Impact Assessment (ESIA).

Accordingly, the environmental analysis will be undertaken at CPA level.

E.2. Analysis of the environmental impacts

Not relevant since environmental analysis will be carried out on CPA level

E.3. Environmental impact assessment

Not relevant since environmental analysis will be carried out on CPA level

SECTION F. Local stakeholder consultation

F.1. Solicitation of comments from local stakeholders

The concession area granted to MPG to exploit the geothermal resource covers Mlima Panya and Mt Margaret in Nakuru County, Rift Valley region, Kenya. Since the geographical boundary of the PoA only covers the MPG's concessional licence area and all CPAs to be applicable to this PoA will have similar economic, social and environmental impacts on the local stakeholders throughout the concessional area, the CME opted to carry out the CDM stakeholder consultation on PoA level.

Therefore, a CDM local stakeholder consultation meeting was held at the Mwangaza Women's Hall in Maai Mahiu town, Nakuru County, Kenya on 20/03/2012 covering stakeholders from the whole geographical boundary. No national regulations on CDM LSC are and were existent at the time of conducting the CDM LSC. The CME therefore carried out a CDM PoA LSC that was integrated in the stakeholder consultation process required to obtain an Environmental and Social Impact Assessment Licence (ESIA license). The ESIA required LSC process was therefore carried out in accordance with provisions related to stakeholder consultations as per *Environmental Management and Coordination Act of 1999*[40] and *the Environmental (Impact Assessment and Audit) Regulations 2003*[41].

Based on the definition of Stakeholders as given in version 08 of the *Glossary of CDM Terms* the CME identified the following relevant stakeholders:

- Local landowners in the geographical area
- Community leaders and members from the geographical area
- Government departments and agencies (local, district and national)
- Community-based organizations and youth groups

Local landowners
Local landowners are considered as stakeholders because they will be directly affected by the CPA's in terms of environmental, social and economic impacts and benefits.

Community leaders and members from the wider project area
Community leaders and other members of the wider local community are stakeholders because of the direct and indirect environmental, social and economic impacts of the CPAs. This category of

[38] Republic of Kenya. 1999, ACT NO. 8 of 1999 - Environmental Management and Co-ordination Act

[39] Republic of Kenya. 2003. Environmental (Impact Assessment and Audit) Regulations 2003

[40] Republic of Kenya. 1999, ACT NO. 8 of 1999 - Environmental Management and Co-ordination Act

[41] Republic of Kenya. 2003. Environmental (Impact Assessment and Audit) Regulations 2003

stakeholders includes people living in the neighboring areas including pastoralist groups who would be affected by the project due the fact that their activities involve moving from one area to another in search of pasture and water for their animals.

Government departments and agencies (local, district and national)

Local, provincial and national government departments and agencies are considered stakeholders as they will be responsible for ensuring that the project fits within government policies, planning, requirements and regulations, will issue project approvals and will monitor project implementation and operations.

Community-based organizations and youth groups

CBOs and youth groups are important stakeholders in their role as civil society actors who are able to represent those community members and interests that may otherwise be marginalized to ensure the project contributes to sustainable development.

How stakeholder comments were invited

The CME organized a stakeholder consultation meeting on 20/03/2012 at the Mwangaza Women's Hall in Maai Mahiu town, Nakuru County, Kenya. Maai Mahiu was selected as being the most central location for stakeholders coming from all over the geographical boundary. The purpose of the meeting was to introduce the stakeholders to the CME, CPA technologies, the Environmental Impact Assessment (EIA) process and to brief participants on carbon credits and the project's eligibility to participate in the CDM, and to receive stakeholder comments on such.

Relevant stakeholders were invited to participate through personal invitation letters distributed in advance through the office of the Senior District Officer (DO) Naivasha. Some stakeholders were also invited through word of mouth. Questionnaires were distributed among stakeholders in order to receive further comments at the conclusion of the consultation meeting.

A total of 121 people attended the local stakeholder consultation meeting. These included local government officials (Ministry of Energy, senior district officials responsible for administration, development, livestock, gender and environment from Naivasha, Narok North, Narok Central and Maai Mahiu), chiefs, sub-chiefs and councilors representing Longonot, Kajiado, Ewaso, Ngong, Nakuru, Naivasha, Suswa and Maai Mahiu locations, community members and local land owners, local business people, CBOs and youth group members.

The meeting was conducted mostly in Swahili and English and began at 10:00 with a word of prayer followed by introductions facilitated by the District Officer for Maai Mahiu, who chaired the meeting until the arrival of the Senior District Officer for Naivasha.

The projects to be included to the PoA and the applicable EIA process were introduced by the CME who indicated that they welcomed all community comments and questions. The EIA consultants then further elaborated on the project and the EIA process and noted that geothermal power is one of the sectors of focus of the government to increase clean electricity generation capacity in the country. A technical description of the geothermal technology was provided and some of the development benefits were summarized.

The EIA process was then presented in detail, including the importance of the process in identifying both positive and negative impacts and mitigation measures for the latter. The process will take into account environmental, economic and social considerations. Community feedback and consent to proceed with the project is one important aspect of the EIA procedures. Once the EIA report for the first CPA is completed, reviewed by relevant agencies and stakeholders and approved, an EIA licence would be issued. The same applies to all future CPAs.

The National Environment Management Authority (NEMA) representative affirmed the process as outlined by the EIA consultants and noted that geothermal project development normally has three main phases, the impacts of each of which would be considered:

- Exploration

- Drilling/field development
- Power plan construction and operations

The NEMA officer and EIA consultants also outlined some of the potential negative impacts of the project that would need to be mitigated:

- Drilling effluent
- Hydrogen sulfide and CO_2 emissions from project operations
- Risk of a wellhead blowout due to improper design
- Presence of steam piping hindering human and animal passage
- Use of water for drilling and cooling
- Emissions of steam and heat at the power plant site
- Noise during construction and operations

NEMA emphasized that the project must show how it contributes to sustainable development in Kenya and both NEMA and the EIA consultant stressed the importance of public participation in the EIA process and invited comments and cooperation from the community.

The floor was then opened for questions and comments from stakeholders, a summary of which is provided below.

Following the question and answer session on the project and the EIA process, the carbon credit consultants presented on the issue of climate change, the Kyoto Protocol, the Clean Development Mechanism (CDM) and the fact that the project would apply for carbon credits based on certain eligibility criteria. The role of the Designated National Authority (DNA) and the requirement that the project must meet host country sustainable development criteria were also noted. Lastly, the modalities of carbon trading were explained.

Meeting participants were then given the opportunity to make comments and ask questions regarding carbon credits and how the project might benefit from such, an overview of which is provided below.

The local stakeholder consultation was closed at 14:00 with a word of thanks and prayer. Participants were invited to complete the EIA and carbon consultant evaluation forms provided and were offered lunch and compensation for transport fare.

As part of the ongoing site reconnaissance, exploration and Environment Impact Assessment (EIA) processes, further stakeholder consultations will be held in the geographical for each CPA to be implemented.

In accordance with article 77 of the *CDM Project Standard* (EB 82, Annex 13, version 09.0), the CME has requested the DNA to forward any additional comments from relevant stakeholders. At the time of request for registration, no additional comments had been received.

F.2. Summary of comments received

Stakeholders were given an opportunity to provide comments at the meeting as well as before and after via face-to-face meetings with the project proponents, local government officials and the EIA consultants. Comments received by stakeholders were positive as affirmed by the completed evaluation forms and related mostly to the more general aspects of the project with a few questions specific to the carbon credit component. A summary of the main comments and questions as well as an explanation of how the project proponents are taking due account of comments received is provided below:

<u>Summary of questions on the project benefits</u>

- Stakeholders indicated that the CPAs should benefit local residents. Specific suggestions included the planting of trees, construction of hospital and schools and provision of water to

local communities. It was also requested that the project should employ people from the local area and work with community leaders to recruit local people. Community shareholding in the project should also be considered. In order to ensure that promises of benefits are not forgotten during project implementation (as has happened with other projects), stakeholders suggested that a formal agreement be signed between the community and the project developer with lawyers involved to advise both parties. There was debate as to whether such an agreement should be signed before exploration begins or after project viability is confirmed.

- It was noted that both farmers and pastoralists live around the project area and that therefore both should be taken into account in project implementation. Questions were raised on the specific benefits for the pastoralist communities living in and around the project area.

Summary of questions on the EIA and project development process of the first CPA

- Stakeholders requested to be informed of the exact location of the first CPA in order to determine who should be best included in the EIA consultations and interviews. Site-level visits should also be undertaken. Stakeholders also asked that the existing status and next steps in the project development and EIA process be described for the first CPA. Participants requested meeting minutes to be taken and shared to ensure an accurate record of the stakeholder consultation. A community coordination committee could also be set up to work with the project developers.

- Participants also enquired as to why if the project was in a select area, stakeholders from the concession area had been invited to the workshop. On the other hand, some residents of Mai Mahiu town and certain landowners were not invited to participate in the consultation meeting. The community asked to be fully involved and informed at all stages in the project cycle so as to ensure their support and avoid conflict. It was noted that another similar project near Mt Suswa (not part of this PoA) was also planned and that the EIA report for this was not made available and there was concern over the project impacts on conservation areas and natural caves.

Summary of questions on the project impacts

- Stakeholders asked how different impacts could be mitigated. For example, on one of the mountains under investigation by the project there are stones that are used by local residents for construction and sale. Another example is how cattle herds on which pastoralists are dependent might be affected. A third example noted was the presence of gas that might be released during power plant operations. A fourth example raised was the use of water by the project and where this would come from. A fifth example noted that project roads should be well built to avoid dust, accidents and rainwater runoff. Concerns were also stated regarding possible impacts on farmers' livelihoods and on school attendance in case some residents may be asked to relocate due to the project.

Summary of questions on the carbon credits

Stakeholders inquired who will be the owner of the carbon credits. Stakeholders suggested that, if the owner is the CPA, it should consider to allocate five percent of carbon revenues to the local communities. Alternatively the CPA could channel such revenues through the existing Community Development Fund. Stakeholders also asked if carbon credit buyers are buying carbon credits as a result of international penalization. Lastly, participants enquired as to how carbon credits are quantified and how the average person could benefit from carbon credits.

F.3. Report on consideration of comments received

Summary of comments on the project benefits

- The project proponent noted that this meeting was the first of many as part of the EIA, stakeholder engagement and project development process and that as such detailed discussions on specific benefits would still need to take place. It was agreed that a memorandum including such information would be useful, but that this should ideally come later as the developer first has to complete exploration and drilling to determine project feasibility. The project developer would be happy to discuss in detail community benefits at the time that it was clear that a power plant would be built. However, due to high investment costs and difficulties with securing project finance the project does not envision offering shareholding to local residents.

- The importance of including pastoral communities was agreed and it was noted that the project proponent ensured that such groups were represented during the stakeholder consultation. However, it was acknowledged that pastoralists may be more at a disadvantage to benefit from the project than settled residents in terms of employment for example due to lack of applicable education and skills. However, the project will try to provide training opportunities for local community members where possible. The project will also work with pastoralist groups to ensure that access to land for animal grazing will still remain available. In the short term, the project will provide some employment opportunities to both pastoralist and resident communities as the EIA consultations will require local guides and interpreters who will be recruited from the local area.

Summary of comments on the EIA and project development process of the first CPA

- The CME described the allocated concession area, the targeted specific project sites at Mlima Panya and Mt Margaret and noted that it was important to consider the wider geographical boundary for all possible impacts and to enable the implementation of mitigation measures if necessary. In terms of the EIA process, it was explained that after interviews a draft approved EIA report would be made available to all stakeholders, announced at the national level and discussed in a subsequent public forum at the local level. The interviews would entail site-level visits and discussions. The completion of the EIA and beginning of more detailed resource exploration activities including drilling were noted as the next steps for project development. At present, the project has only undertaken surface reconnaissance and assessments building on the existing knowledge of the geothermal resource in the area. The importance of meeting minutes was agreed. Local administration officials also indicated their support to help with community coordination activities.

- The project proponent noted that it was aware of the other geothermal project on Mt Suswa but that this was a separate project in a separate concession area, which has been granted to another entity. The Akiira I project (first CPA) will however not have any impact on Mt Suswa or its caves. The reason that a broad geographical distribution of stakeholders were invited to the consultation was because of the presence of pastoralist groups in the wider project area who may be impacted when grazing their livestock and due to the fact that the CME opted for an CDM consultation on PoA level. Even with the broad outreach, it was not possible to include everyone in the first meeting but all relevant stakeholders will have a chance to comment during the EIA process for each specific CPA. This was also the reason to involve community leaders who should have the responsibility of reporting back to their constituents. Once the specific project sites (additional CPAs) are further identified, more detailed discussions would happen with individual and group landowners at that time and they will also be interviewed during the EIA process.

Summary of questions and comments on the project impacts

- It was explained that the EIA would be rigorous and comprehensive and would be required to identify all possible positive and negative impacts of the project during drilling, construction and operations. Thus all issues will be covered by the EIA and where necessary mitigation measures proposed. If NEMA and the community do not feel that the EIA report is satisfactory, the project would not be approved to proceed. The project owner

is well aware of this and hence the needs and concerns of the community will be addressed as the project is developed. Stakeholder livelihoods, land and wellbeing (including education) will be taken into account when preparing the EIA report. Water supply and access will also be one of the issues to be addressed. The specifics of each will be identified and the main objective of the first consultation meeting was to ensure that everyone is informed and on board for information collection and recording.

Summary of questions and comments on the carbon credits

The CME confirmed that as the investor, risk taker and power plant operator, it would own the rights to the carbon credits, subject to approval by the host country authority. All carbon credit revenues would be accounted for as part of general revenues to make the project commercially viable. Any benefits that would be provided by the project to the community would be based on the overall success and profitability of the CPAs. Unfortunately it is not easy for the average person to obtain carbon credits but there are certain existing carbon programmes that interested individuals could join in Kenya, such as tree planting. It was explained that carbon credit buyers are not exactly being penalized but are required to purchase international credits to meet legally binding emission reduction targets if they are not able to reduce their own emissions sufficiently. For electricity generation projects, the principle of carbon credit calculations was explained.

SECTION G. Approval and authorization

The Letter of Approval by the host country's DNA, NEMA, has been granted on the 11/11/2014

PART II. Generic component project activity (CPA)

CPA Type I: Geothermal power plant/unit (Greenfield)

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

The generic component project activity (CPA), which will be implemented under the MPG Geothermal Energy PoA is a grid-connected geothermal power plant/unit implemented at a site where not renewable energy power plant was operated prior the implementation of the CPA (Greenfield activity). The CPA will generate electricity, which will be fed into Kenya's national electricity grid. By replacing fossil fuel based electricity, the CPA will lead to emission reductions.

The CPA is being pursued as a component of the MPG Geothermal Energy PoA with Marine Power Generation Company Limited (MPG) as the CME.

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

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

CPAs included in the PoA will apply the approved consolidated baseline and monitoring methodology ACM0002 *Grid-connected electricity generation from renewable sources* (EB 81, Annex 9, version 16.0).

ACM0002 (version 16.0) also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9, version 05.0)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf)
- *Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf)
- *Combined tool to identify the baseline scenario and demonstrate additionality* (EB 85, Annex 11, version 06.0)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v6.0.pdf)
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* (EB 41, Annex 11, version 02)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v6.0.pdf)
- *Tool to determine the remaining lifetime of equipment* (EB 50, Annex 15, version 01)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf)
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period* (EB 66, Annex 47, version 03.0.1)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf)

The *Tool to determine the remaining lifetime of equipment* (EB 50, Annex 15, version 01) will not be used under this generic CPA because the generic CPA is of the Greenfield type. The *Combined tool to identify the baseline scenario and demonstrate additionality (EB 85, Annex 11,* version 06.0*)* will not be used, since there is no need to use it to describe the baseline scenario. Additionally the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* (EB 41, Annex 11, version 02) will not be applied since the CPAs will not involve on-site fossil fuel consumption.

The *Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0) further requires the application of the *Methodological Tool: Common Practice* (EB 84, Annex 7,

version 03.1) and the *Guidelines on the assessment of investment analysis* which has now been reclassified to a tool "*Methodological tool: Investment analysis (*EB 85, Annex 12, version 06.0*)*

CPAs to be included to this PoA will only apply:

- *Tool to calculate the emission factor for an electricity system* (EB 87 Annex 9, version 05.0) *(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf)*
- *Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0) *(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v6.0.pdf)*
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (EB 66, Annex 47,* version 03.0.1) *(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf)*
- *Methodological Tool: Common practice* (EB 84, Annex 7, version 03.1) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf)
- *Methodological tool: Investment analysis (*EB 85, Annex 12, version 06.0*) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v1.pdf)*

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

The generic CPA meets the applicability criteria listed in the approved consolidated baseline and monitoring methodology ACM0002 (version 16.0) as shown below:

Applicability criteria	**Generic CPA justification**
This methodology is applicable to grid-connected renewable energy power generation project activities that: a) Install a Greenfield power plant b) Involve a capacity addition to (an) existing plant(s) c) Involve a retrofit of (an) existing operating plants/units d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or e) Involve a replacement of (an) existing plant(s)/unit(s).	The generic CPA is a grid connected renewable power generation project activity that falls under option (a) Greenfield power plant Applicable evidence will be either: – Prefeasibility Study/ Feasibility study/Technical description – EIA report – PPA
The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The generic CPA will install geothermal power plant, which are eligible technologies to use under this methodology. Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description – EIA report – PPA
In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and	n/a. The CPA is a Greenfield project.

defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m^2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m^2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m^2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power project.	n/a. CPA involves geothermal technology

In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	n/a. This is a Geothermal power plant
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units.	This project is a geothermal project and does not include fuel switching or biomass. Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description – EIA report
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.	n/a. The CPA is a Greenfield project.

In addition, the CPA meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9, version 05.0) as follows:

This tool may be applied to estimate the	CPAs under the PoA will supply electricity to the

OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	Kenya national grid. Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description – EIA report – PPA/MoE&P letter
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	GEF calculation will not include off-grid capacities. Applicable evidence: – PoA-DD
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project electricity system is located in Kenya. Kenya is not an annex I country. Applicable evidence: – PoA-DD – See: www.unfccc.int
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	n/a. This is a Geothermal plant

The CPA also meets the applicability criteria of the *Tool for the demonstration and assessment of additionality (*EB 70, Annex 8, version 07.0.0) as follows:

Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory.	The applied methodology ACM0002 (version 16.0) requires the application of either the *Tool for the demonstration and assessment of additionality* or the *Combined tool to identify the baseline scenario and demonstrate additionality.* The PP has opted to apply the former. Applicable evidence: – PoA-DD

The CPA also meets the applicability criteria of the *Methodological tool: Investment analysis (*EB 85, Annex 12, version 06.0*)* as follows:

i. This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario.	ii. The applied methodology ACM0002 (version 16.0) uses the investment analysis for the demonstration of additionality and further requires the application of either the *Tool for the demonstration and assessment of additionality* or the *Combined tool to identify the baseline scenario and demonstrate additionality.* The PP has opted to apply the former, thus the Methodological tool: Investment analysis (v.06.0) is applicable. iii. Applicable evidence: – PoA-DD – ACM0002 (v.16.0)
iv. In case the applied approved baseline and monitoring methodology contains requirements for the investment analysis that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	v. For Geothermal projects, the requirements set out in the applied methodology ACM0002 (version 16.0) do not differ from the requirements as per the Methodological tool: Investment analysis (v.06.0): vi. Applicable evidence: – PoA-DD – ACM0002 (v.16.0) – Methodological tool: Investment analysis (v.06.0):

In order to determine the monitoring parameter related to the fraction of non-condensable gases, sampling will be carried out in accordance with ACM0002 (version 16.0) as described in the monitoring plan (section D.7.2) of the CPA-DD. Sampling as per the CDM *Standard for Sampling and surveys for CDM project activities and programmes of activities* (version 05.0) is not required as the guidance outlined in the methodology has precedence to the procedures outlined in the standard.

B.3. Sources and GHGs

Source		Gas	Included	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal	CO_2	Yes	Main emission source
		CH_4	Yes	Minor emission source
		N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	n/a. CPA will not involve on-site fossil fuel consumption
		CH_4	No	n/a. CPA will not involve on-site fossil fuel consumption
		N_2O	No	n/a. CPA will not involve on-site fossil fuel consumption
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	n/a. CPA is a geothermal plant
		CH_4	No	n/a. CPA is a geothermal plant
		N_2O	No	n/a. CPA is a geothermal plant

The figure below presents a flow diagram physically delineating the project boundary of a typical geothermal energy CPA.[42]

[42] The figure is just an illustration of a typical geothermal project in Kenya and does not necessarily represent a specific CPA.

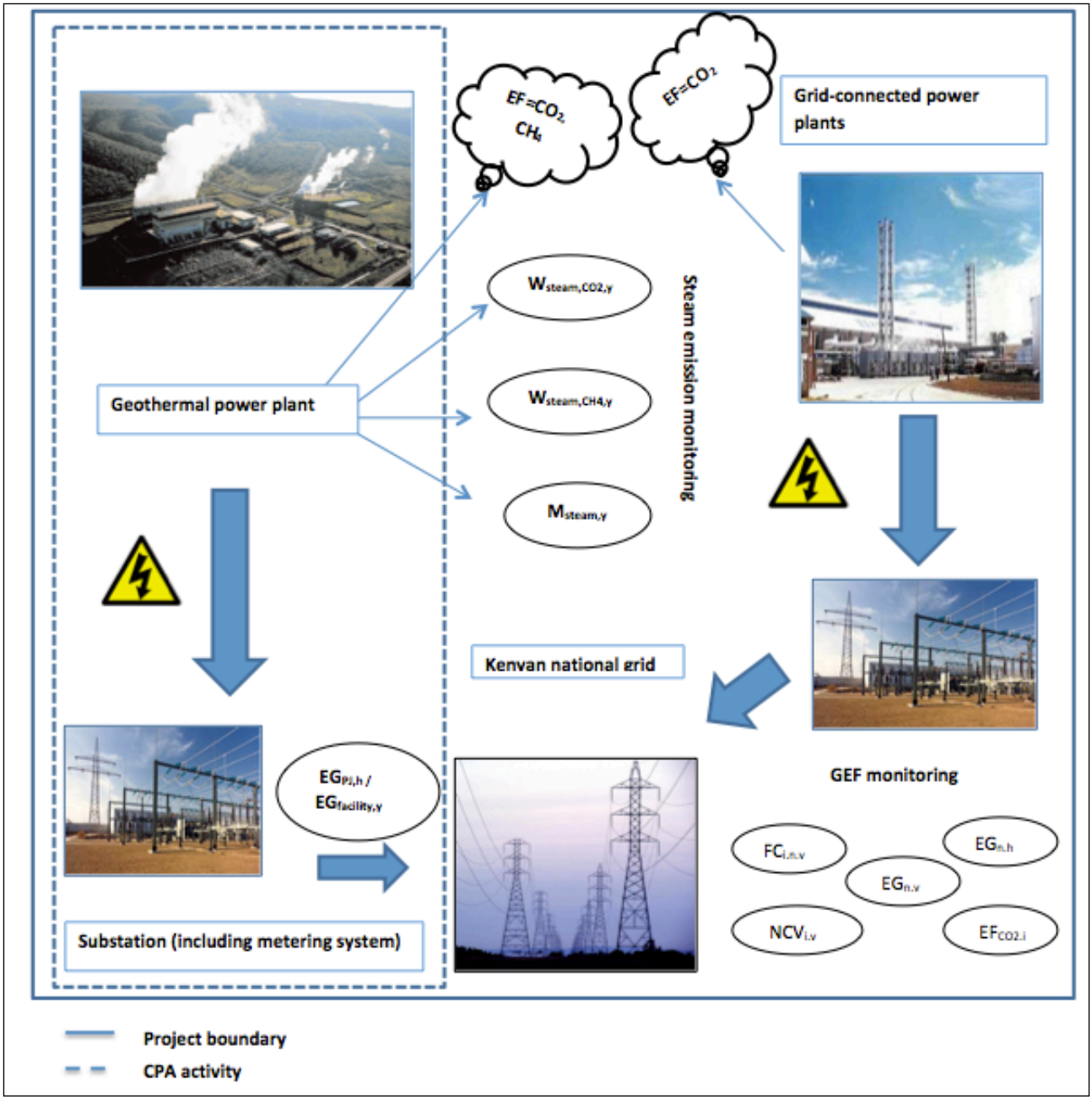

Figure 8: Flow Chart diagram

B.4. Description of baseline scenario

In accordance with approved consolidated baseline methodology ACM0002 (version 16.0) *Grid-connected electricity generation from renewable sources*, the baseline scenario for the installation of new grid-connected renewable power plant/units 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, as reflected in the combined margin (CM) calculations described in the "Tool to calculated the emission factor for an electricity system".*

Therefore, the baseline can be described as follows:

The Kenyan power sector policies and regulations[43]

[43] The energy sector policy documents can be accessed at http://www.energy.go.ke/index.html; Website accessed on 25 May 2015

The power sector falls under the Ministry of Energy (MoE) and is regulated by the Energy Regulatory Commission (ERC). The latter regulates the entire energy sector having replaced the Energy Regulatory Board (ERB) after repeal of the *Electric Power Act 1997* and consequent enactment of the *Energy Act 2006.* ERC is empowered to set, review and adjust tariffs for all persons who transmit or distribute electrical energy for sale and to ensure competition in the power sub-sector, where this is feasible, such as in the generation function. ERC seeks to protect consumer interests, guarantee economic and financial viability of sub-sector utilities, and enhance the confidence of consumers, investors and lenders in the Kenyan power sub-sector.

In October 2004, the Ministry of Energy (MoE) outlined the National Energy Policy in the Sessional Paper No. 4 of 2004 on Energy. Key elements of the National Energy Policy include:

- The establishment of a single independent energy regulator with adequate mandate to regulate all sector entities;
- The establishment of the Rural Electrification Authority to take over rural electrification functions from the Ministry of Energy;
- The establishment of a state-owned Geothermal Development Company (GDC) to be in charge of geothermal resource assessments and sell steam to power generation companies;
- Privatisation of KenGen over time starting with an initial public offering (IPO) of 30% of its equity through the Nairobi Stock Exchange;
- Direct sale of bulk power from power generation companies to bulk consumers, via the transmission network;
- Transfer of rural electrification assets to licensed distributors;
- Privatisation or concessioning of isolated power stations;
- Unbundling of Kenya Power and Lighting Company (KPLC)[44] into a state-owned transmission company and a private sector owned distribution company; and
- Creation of a domestic power pool with a provision for wholesale and retail markets.

The *Energy Act of 2006* (a consolidation of the *Electric Power Act 1997* and the *Petroleum Act 2000)* has set out the national policies and strategies for short to long-term energy development. The broad objective of the Energy Act is to ensure the provision of adequate, quality, cost-effective, affordable supply of energy while encouraging environmental conservation. The policy has identified a number of key challenges, including:

- Upgrading and expanding the current energy infrastructure;
- Promoting energy efficiency and conservation;
- Protection of environment;
- Mobilizing requisite financial resources;
- Ensuring security of supply through diversification of sources and mixes in a cost effective manner;
- Increasing accessibility of energy services to all segments of the population including rural electrification;
- Enhancing legal regulatory and institutional frameworks to create consumer and investor confidence;
- Enhancing and achieving economic competitiveness;

In 2008, the Ministry of Energy introduced a *Feed-in-Tariffs Policy on Wind, Biomass and Small-Hydro Resource Generated Electricity* in order to further spur the development of electricity generation projects from renewable sources in the country. The Feed-in-Tariffs Policy was previously revised in January 2010 to also include feed-in-tariffs for electricity generated from geothermal, biogas and solar projects. In December 2012 the MoE published the 2nd revision of the Feed-in-Tariff policy, which is currently in place.
Since the announcement of the Feed-in-Tariffs Policy in 2008, only one project has been

[44] Also know as Kenya Power (KP)

successfully developed under the policy, the Imenti Tea 0.3 MW small-hydro project.

Key players in the Kenyan power sector[45]

The key oversight agencies in the power sub-sector of Kenya are the Ministry of Energy (MoE) and the Energy Regulatory Commission (ERC). The Ministry of Energy is in charge of making and articulating energy policies to create an enabling environment for efficient operation and growth of the power sector, overseeing implementation of the rural electrification program and facilitating the mobilization of resources for investment in the sector. The Energy Regulatory Commission (ERC) was established under Section 4 of the Energy Act (2006) as a body corporate and as a successor to the Electricity Regulatory Board (ERB). It is responsible for regulation of the power subsector. The Energy Tribunal is an independent legal entity and was set up to arbitrate disputes in the sector.

An overview of the entities and structures of the Kenyan electricity sectors is shown below:

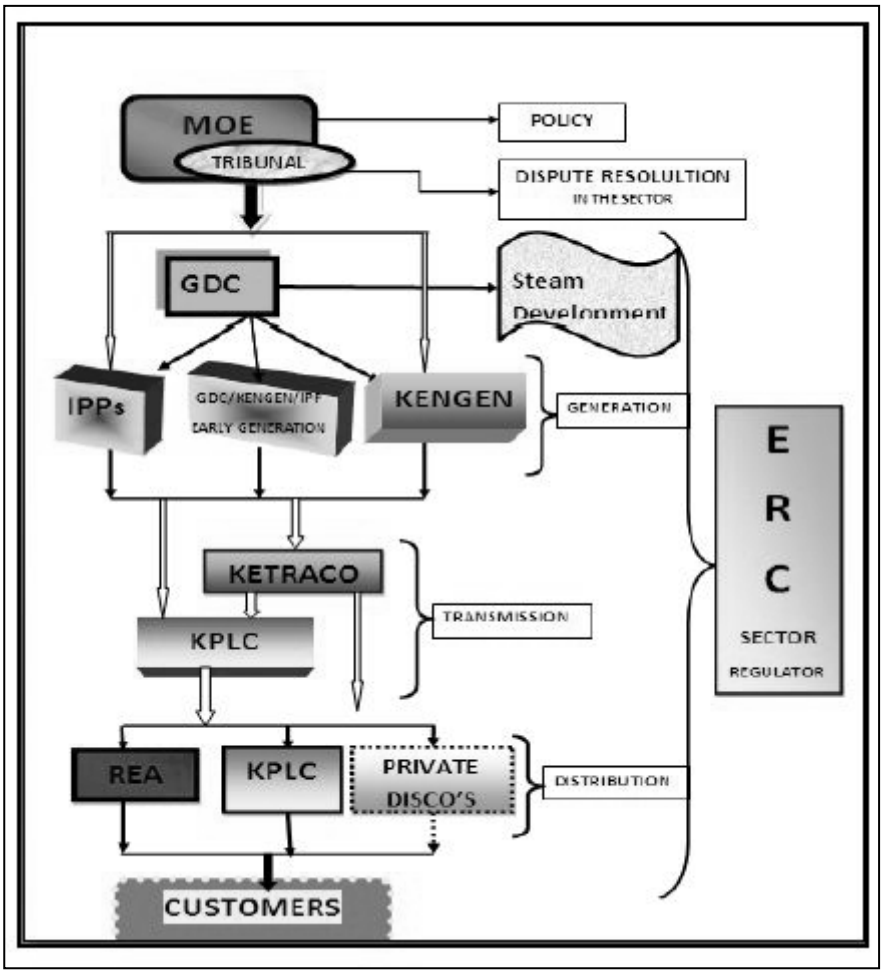

Figure 9: Structure of the Kenyan electricity sector

Generation

The Kenya Electricity Generating Company (KenGen) is a public company that is listed on the Nairobi Stock Exchange, whose main shareholder is the Government of Kenya with a 70% shareholding. KenGen is the biggest generation company with a total installed capacity of 1,229.16

[45] For further information, please see http://www.energy.go.ke/index.html and http://www.erc.go.ke/; Websites accessed on 25 May 2015

MW as per 30 June 2013.[46]

The first Independent Power Producer (IPP) developments occurred on the heels of the *Electric Power Act* 1997, opening up the generation sector to private investment. At the time, there was an increase in power demand, hydrological conditions were becoming unfavourable and public funds to build power plants were insufficient and the sector was dominated by hydropower. All economically viable hydro sites had, however, been largely exploited and diversification became necessary both for drought mitigation and to meet growing demand.

Geothermal Development Company (GDC)[47], established in 2008, is a fully owned Government Special Purpose Vehicle (SPV) intended to undertake surface exploration of geothermal fields, undertake exploratory, appraisal and production drilling develop and manage proven steam fields and enter into steam sales agreements with investors in geothermal power. The GDC is not generating electricity itself but undertakes geothermal resource exploration and production and sells steam to generation companies.

As per 30 June 2013, the total installed capacity of power plants connected to the Kenyan national grid reached 1,740.36 MW. The grid-connected power plants consist of a mix of generation sources, including hydro, thermal and geothermal. An overview of all the power plants connected to the Kenyan grid as per 30 June 2013 is given in Appendix 7 KenGen is the biggest generator with an installed capacity of 1,229.16 MW. Independent Power Producers (IPP) have installed 391.2 MW and temporary emergency capacity installed by Aggreko currently contributes 120 MW.[48]

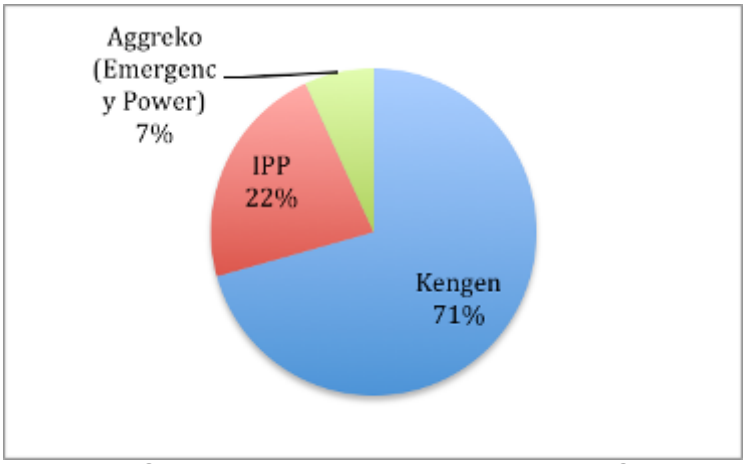

Figure 10: Generators connected to the Kenyan Grid June 2013

Table 11 below gives an overview of the installed capacity in Kenya, which has increased by approximately 34.47% over the last 6 years.[49]

Table 11: Installed capacity 2008-2013 (MW)[50]

	2008	2009	2010	2011	2012	2013
Hydro	737.25	737.25	757.85	763.15	812.2	816.35
Thermal	427	427.3	466	581.01	639.98	642.5
Geothermal	128	163	198	198	209.50	250.21
Biomass	2	2	26	26	26	26

[46] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[47] http://www.gdc.co.ke/

[48] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[49] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[50] Kenya Power and Lighting Company Annual Report & Financial Statements 2008 - 2013

Wind	0.35	0.35	5.45	5.1	5.1	5.3
Total	**1,294.6**	**1,329.9**	**1,453.3**	**1,573.26**	**1,692.78**	**1,740.36**

The thermal power plants connected to the national grid are powered by various fuels such as diesel, kerosene and heavy fuel oil (HFO), which have to be imported. An overview of grid-connected, fossil fuel based power plants is given in Table 12 below.

Table 12: Fossil fuel based power plants[51]

Power Plant	Ownership	Fuel Type
Kipevu I Diesel	KenGen	HFO
Kipevu / Embakasi GT1	KenGen	Kerosene
Kipevu / Embakasi GT2	KenGen	Kerosene
Kipevu III Diesel	KenGen	HFO
Tsavo Diesel	IPP	HFO
Iberafrica	IPP	HFO
Iberafrica 2 (Additional 52.5 MW)	IPP	HFO
Aggreko Embakasi 6	EPP	AGO
Aggreko Embakasi 7	EPP	AGO
Aggreko Muhoroni	EPP	AGO
Rabai Power	IPP	AGO

Table 13 below shows the generated electricity by the different generation sources as recorded in the year July 2012 – June 2013.[52]

Table 13: Electricity generation sources for the year July 2012 - June 2013 (GWh)[53]

Technology	Generation (GWh)	%
Hydro	4,299	53.80%
Thermal	2,007	25.12%
Geothermal	1,600	20.02%
Biomass	71	0.89%
Wind	14	0.17%
Total	**7,991**	**100.00%**

Electricity generation from hydro sources accounted for approximately 53.8% of total electricity generation, followed by thermal (25.12%) and geothermal (20.02%). Biomass and wind capacities have only a minor share in the power sector by now.

[51] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[52] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[53] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

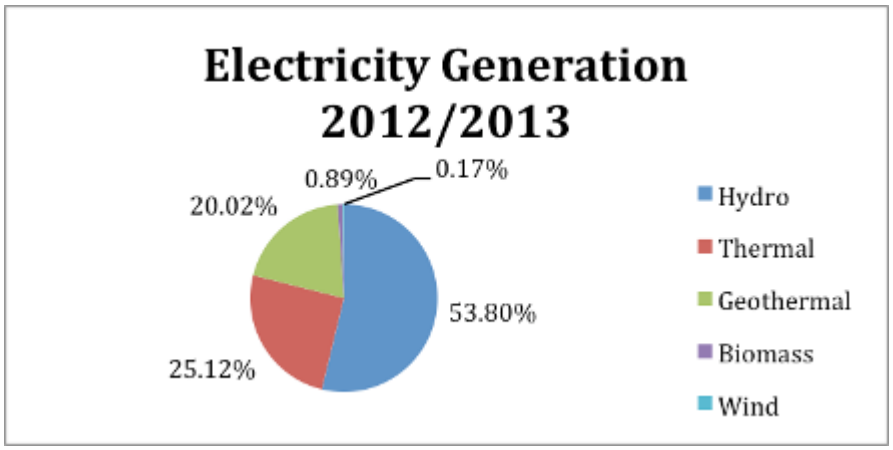

Figure 11: Electricity generated 2012/2013 by source

In the medium term, Kenya is expected to increase its generation capacity to 6,762 MW by 2017. Several power generation projects are at various stages of development by KenGen and Independent Power Producers (IPPs). See figure 12 for an overview of the planned additions of new generation sources.[54]

[54] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

Planned generation projects (2014–2017)

Year	Name	Type	Added capacity MW	Cumulative total system capacity (MW)
2014	Kindaruma upgrade	Hydopower	24	
	Thika diesel	Diesel	87	
	OrPower 4	Geothermal	16	
	Olkaria IV unit 1	Geothermal	70	
	Triumph Power	Diesel	80	
	Gulf Power	Diesel	83	
	Olkaria IV unit2	Geothermal	70	
	Olkaria I unit 4	Geothermal	70	
	Olkaria wellheads	Geothermal	40	
	Agreko	Emergency Diesel	-90	2,114
2015	Menengai modular units	Geothermal	90	
	Menengai wellheads	Geothermal	50	
	Olkaria I unit 5	Geothermal	70	
	Olkaria wellheads	Geothermal	30	
	Ngong I phase II	Wind	6.8	
	Ngong II	Wind	13.6	
	Kwale Sugar	Cogeneration	18	
	Mombasa gas turbines	Natural Gas	700	
	Aelous	Wind	60	3,152
2016	Menengai	Geothermal	100	
	Silali I	Geothermal	150	
	Isiolo	Wind	100	
	MSD KenGen (fuel switch)	Diesel	-175	
	MSD IPP (fuel switch)	Diesel	-175	
	Mombasa LNG (fuel switch)	Natural Gas	350	
	Coal	Coal	960	
	Lake Turkana	Wind	150	
	Lake Turkana	Wind	150	
	Kipeto	Wind	100	
	Prunus	Wind	50	
	Suswa	Geothermal	35	
	Olkaria unit 6	Geothermal	70	5,017
	Menengai	Geothermal	400	
2017	Olkaria VI	Geothermal	140	
	Baringo	Geothermal	140	
	Suswa	Geothermal	35	
	Silali II	Geothermal	70	
	Coal	Coal	960	6,762

Figure 12: Planned grid capacity additions until 2017

A more long-term view of the development of electricity generation capacity in the country is given in the *Updated Least Cost Power Development Plan for the Study Period 2011-2031.* According to the plan, Kenya's peak demand will be between 12,738 and 22,985 MW in 2031, which means that the current peak load is expected to grow 12 times. Candidate generation resources considered in the system expansion plan include geothermal, hydro, wind, coal, oil fired plants and nuclear power plants. More detailed information on the long-term plans is given in Appendix 7 of this document.

Transmission and Distribution

The Kenya Power and Lighting Company (KPLC) is the sole off-taker and distribution company supplying all consumers/costumers connected to the grid. It is further responsible for electricity transmission through all existing transmission and distribution systems in Kenya. The transmission system comprises 220kV, 132kV and 66kV transmission lines. KPLC is a listed company on the Nairobi Stock Exchange with the ownership structure being 50.1% by the National Social Security Fund (NSSF) and the Government of Kenya whereas the private shareholders own 49.9%.

Kenya Electricity Transmission Company (KETRACO)[55] was incorporated in December 2008 as a State Corporation, 100% owned by the Government of Kenya. The Mandate of the KETRACO is to

[55] http://www.ketraco.co.ke/; Accessed on 25 May 2015

plan, design, construct, own, operate and maintain new high voltage (132kV and above) electricity transmission infrastructure that will form the backbone of the National Transmission Grid & regional inter-connections. It is expected that this will also facilitate evolution of an open- access- system in the country.

The Rural Electrification Authority (REA)[56] is charged with the mandate of implementing the Rural Electrification Programme and came into operation in July 2007. The objective of the rural electrification programme, which is financed by the Government, is to provide electricity in areas that are far from the national electricity grid, and where electricity supply projects are not commercially viable.

B.5. Demonstration of eligibility for a generic CPA

The following eligibility criteria have been formulated for each of type of CPA based on the requirements outlined in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programmes of Activities* CDM-EB65-A03-STAN, version 04.0 (EB 87, Annex 03) as per the requirements outlined in section B1. of the PoA-DD.

CPA TYPE I: Geothermal power plant/unit (Greenfield)

Topic	Eligibility criteria	Documentary/Evidence
1. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA **(a)**	The geographic boundary of the CPA is located in the geographical boundary of the PoA as indicated in section A.5. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description and or correspondence with entities of the Kenyan Government.	Verifiable evidence are either: – EIA report – Prefeasibility Study/Feasibility study/Technical description – Governmental letters
2a) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CPA implementing entity will confirm that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.	Verifiable evidence are either: – Signed confirmation by CPA implementing entity – CPA PoA participation agreement
2b) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by a signed confirmation letter from the CME.	Verifiable evidence are either: – Signed confirmation letter from the CME and CDM website check – CPA-DD

[56] http://www.rea.co.ke/; Accessed on 25 May 2015

	Every CPA will furthermore have a unique identification number.	
2c) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CPA will provide a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.	Verifiable evidence are either: – Project map – EIA report – Prefeasibility Study/Feasibility study/Technical description
2d) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM projects within the geographical boundary. This will be evidenced by a signed confirmation letter from the CME.	– Signed confirmation letter from the CME and CDM website check
3a) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The CPA will involve the implementation of a Greenfield geothermal power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
3b) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The generator technology shall be certified to IEC 60034-1 and the turbine to IEC 60045-1 standards. This will be evidenced by the IEC certificates. If at the time of the inclusion of the CPA, the certificates are not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.	Verifiable evidence are either: – Certification certificate – CPA PoA participation agreement – Signed letter by the CPA implementing entity
3c) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The installed capacity of the CPA will be minimal 35 MW and not more than 70 MW per grid connection point. This is in line with the revised *Feed-in-tariff policy* of 2012. The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report

	study/technical description or Power Purchase Agreement (PPA) or EIA report.	
3d) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The CPA will have a net load factor below or equal to 98%.[57] The top range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a geothermal project can be developed. This figure is also confirmed by the 2011 report by the International Energy Agency.[58]	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report
4. Conditions to check the start date of the CPA through documentary evidence **(d)**	The start of the CPA occurs after 23/05/2013, when MPG submitted CDM Prior Consideration. This will be evidenced by the exploration well-drilling contract or any other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 23/05/2013.	Verifiable evidence are either: – Contract with the drilling company – Substantial agreement e.g. lending agreement – UNFCCC website to show PoA start date
5. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs **(e)**	The CPA will confirm its compliance with the applicability of ACM0002, (version 16.0) in section D.2 of the specific CPA-DD	See evidence required as per section D.2 of the specific CPA-DD
6. The conditions that ensure that the CPA meets the requirements pertaining to the demonstration of additionality **(f)**	The CPA will prove to be additional by being eligible to criteria 12-16.	– See verifiable evidence for eligibility criteria 12-16
7a.) The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis **(g)**	An Environmental Impact Assessment shall be carried out on the CPA level in line with Kenyan regulations as outlined in section E.1 of the PoA-DD. A local stakeholder consultation is carried out in accordance with CDM requirements and (if available) DNA requirements on PoA level for the whole concession area. Therefore no additional CDM stakeholder consultation will have to be carried out on CPA level. However, additional stakeholder consultations might have to be	Sections C of the CPA-DD and section F of the PoA DD Verifiable evidence are either: – PoA Stakeholder consultation report – EIA report

[57] This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[58] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7

	carried out for each CPA as part of the EIA process.	
7b.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has not received funding from Annex I parties, it will confirm so by issuing a signed confirmation letter.	Verifiable evidence are either: – Signed confirmation letter by the CPA implementing entity
7c.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has received funding from Annex I parties, a letter will be provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.	Verifiable evidence are either: – ODA declaration letter
8. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation) **(i)**	The CPA will be connected to the Kenyan electricity grid. This will be evidenced through the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
9. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities" **(j)**	The *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities* (version 05.0), mentions that sampling requirements outlined in the applicable methodology are precedent. Sampling will therefore be carried out in line with ACM0002 (version 16.0)	Sampling will be carried out as per the applied methodology ACM0002 (version 16.0). Verifiable evidence: – Section B.3 of the PoA-DD – CME Manual
10. Where applicable, the conditions that ensure that every CPA meets the smallscale or microscale threshold and remains within those thresholds throughout the crediting period of the CPA. However, for a CPA that consists of only units that qualify as 'microscale CDM units' as defined in the methodological tool "Demonstration of additionality of microscale project activities", this condition is not required **(k)**	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology ACM0002 (version 16.0). Therefore no small- or micro-scale threshold shall be applied.	See methodology section D.2 of the specific CPA-DD

11. Where applicable, the requirements for the debundling check, in case the CPA belongs to small-scale or microscale project categories. However, if a CPA solely consists of 'microscale CDM units', the requirement regarding debundling is not applicable **(I)**	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology ACM0002 (version 16.0). Therefore no debundling shall be applied.	See methodology section D.2 of the specific CPA-DD

Eligibility criteria related to step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Topic	Eligibility criteria	Documentary/Evidence
12a) Identification of alternative scenarios	The CPA will identify that the alternative to the CPA implementation, is that electricity delivered to the Kenyan national 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, or the project activity being undertaken not as a CDM project.	Verifiable evidence: - CPA - DD
12b) Identification of alternative scenarios	The CPA will confirm that both alternatives are consistent with mandatory laws and regulations.	Verifiable evidence: - List of applicable laws

Eligibility criteria related to step 2: CPA investment analysis:

Topic	Eligibility criteria	Documentary/Evidence
13a) Benchmark	The CPA will carry out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet	Verifiable evidence: - Investment analysis
13b) Benchmark	The CPA will apply (a) the post-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR. This will be evidenced through the investment analysis spread sheet.	Verifiable evidence: - Investment analysis

Topic	Eligibility criteria	Documentary/Evidence
14a) Financial indicator	Without the CER revenue, the CPA will have a less favorable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spreadsheet and the relevant references.	Verifiable evidence: - Investment analysis - Relevant references

14b) Financial indicator	All input values applied in the investment analysis will be applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.	Verifiable evidence: - Relevant references
14c) Financial indicator	The time of the investment decision will be either the date on which the expected plant load factor has become available to the board based on which the board has decided to proceed with the drilling of exploration wells, or the date on which the board has decided to proceed with the drilling of production wells based on the resource results of the exploration wells, which is considered as significant commitment towards the implementation of the project. This will be evidenced by the resource assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project	Verifiable evidence are either: - CPA implementing entity Board resolution - Drilling contract - Resource assessment study

Sub-step 2d: Sensitivity analysis

Topic	Eligibility criteria	Documentary evidence
15a) Sensitivity analysis	The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis: • Investment cost • Electricity generation • Operating and maintenance cost • Tariff	Verifiable evidence: - Sensitivity analysis
15b) Sensitivity analysis	The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.	Verifiable evidence: - Sensitivity analysis

Step 4: Common practice analysis

Topic	Eligibility criteria	Documentary evidence

16) Common practice analysis	When following steps 1 – 5 of the *methodological tool: Common Practice* (version 03.1), it can be concluded that the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from KPLC, KenGen and/or the Ministry of Energy (MoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.	Verifiable evidence: - Common practice analysis and applicable references

Eligibility criteria derived from clause 68 of the applied methodology ACM0002 (version 16.0):

Topic	Eligibility criteria	Documentary/Evidence
17a) Technical and economic parameters	*Ranges of load factors:* Only CPAs with a net load factor below or equal to 98% will be eligible under the PoA. This top range is based on geothermal projects that have been registered under the CDM and, therefore, provides a realistic maximum load factor, which a geothermal power plant projects can apply. This figure is confirmed by the 2011 report by the International Energy Agency.[59]	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – EIA report and – Investment analysis
17b) Technical and economic parameters	*Sizes of installation:* The CPAs will have an installed capacity from 35 MW of up to 70 MW per grid connection point This is in line with the feed-in policy of the Ministry of Energy.	Verifiable evidence are either: – Feasibility study – EIA report and – Investment analysis
17c) Technical and economic parameters	*Tariffs and PPA:* The CPA will use a non-inflated tariff[60] of not more than 88 USD/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years, or whenever the tariff is updated under the Kenyan FiT policy or other relevant government regulation, whichever occurs first. The PPA will be with Kenya Power since Kenya currently follows a single-buyer market model or with another private consumer through a wheeling agreement.	Verifiable evidence are either: – MoE approval letter – FiT policy and – Investment analysis

[59] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7 This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[60] Base year is 2012, when the most recent FiT policy was updated.

17d) Technical and economic parameters	*Depreciation:* The CPA will apply the applicable depreciation rates in the investment analysis as provided by the Kenyan regulations with regard depreciation. At the time of writing the PoA DD, the depreciation for energy projects is straight-line depreciation. The applicable depreciation will be updated every two years, or whenever the applicable depreciation rates in Kenya change, whichever occurs earlier.	Verifiable evidence: – Investment analysis
17e) Technical and economic parameters	*Taxes:* The CPA will apply a tax rate of 30% in the investment analysis, which is the Kenyan corporate tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years, or whenever the tax regulations in Kenya change, whichever occurs earlier.	Verifiable evidence: – Investment analysis – Corporate tax rate
17f) Technical and economic parameters	*Other parameters determining market circumstances:* Applicable inflation rates will be determined as follows: • The inflation forecast by the central bank of Kenya, European Central Bank, US FED for the duration of the CPA crediting period • The target inflation of the Central Bank of Kenya, European Central Bank, US FED at the time of investment decision • The average forecasted inflation rate for Kenya, EU and USD published by the IMF or the World Bank for the next five years after start of the CPA Applicable exchange rates will be determined as follows: • The applicable exchange rates reported by Kenyan Central Bank on the date of the investment decision will be used.	Verifiable evidence are either: - Central Bank of Kenya - European Central Bank - US FED - World Bank or IMF and - Investment analysis
17g) Technical and economic parameters	*Subsidies or other financial flows* If applicable at the time of investment decision, the CPA will include any relevant subsidies or other financial flows in the investment analysis. The	Verifiable evidence: – Investment analysis – CPA confirmation letter

	CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	

18a) Ranges of costs and revenues	*Capital investment:* Only CPAs applying a CAPEX exceeding 1.9 million USD/MW will be eligible under the PoA. This CAPEX figure has been derived from the 2014 report by Ren21 [61] According to the source, this figure represents the lower bound for CAPEX investment costs of Greenfield geothermal power plants.	Verifiable evidence: – Investment analysis – Applicable references
18b) Ranges of costs and revenues	*Operating & maintenance costs:* Only CPAs applying O&M costs exceeding 100 USD/kW will be eligible under the PoA. This OPEX figure has been derived from the 2012 report by IRENA.[62] According to the source, this figure represents the lower bound for OPEX costs of geothermal power plants.	Verifiable evidence: – Investment analysis – Applicable references
18c) Ranges of costs and revenues	*Electricity revenues:* All revenues from electricity sales as per the applicable tariff will be included in the financial analysis	Verifiable evidence: – Investment analysis – PPA / Tariff letter
18d) Ranges of costs and revenues	*Subsidies or other fiscal incentives:* Any additional subsidies or other types of financial incentives that affect that financial attractiveness of the CPA shall be included in the financial analysis. The CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	Verifiable evidence: – Investment analysis – CPA confirmation letter
18e) Ranges of costs and revenues	*ODA:* If the CPA is supported by ODA finance, it shall include this financing in the investment analysis.	Verifiable evidence are either: – ODA declaration form – CPA confirmation letter and – Investment analysis

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

B.6.1. Explanation of methodological choices

[61] REN21 (2014) Renewables 2014 – Global Status Report

[62] IRENA (2013) *Renewable Energy Generation Cost in 2012: An Overview.* p.74

The PoA will include geothermal energy projects 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* (EB 87, Annex 9, version 05.0).

Project emissions

The emissions shall be accounted for, by using **(equation 1)** from ACM0002 (version 16.0):

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

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

Project Emissions from Fossil Fuel Combustion ($PE_{FF,y}$)

No on-site fossil fuel consumption will take place.

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

$PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 (version 16.0), as follows:

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

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$w_{steam,CO2,y}$	=	Average mass fraction of CO_2 in the produced steam in year *y* (tCO_2/t steam)
$w_{stean,CH4,y}$	=	Average mass fraction of CH_4 in the produced steam in year *y* (tCH_4/t steam)
GWP_{CH4}	=	Global warming potential of CH_4 valid for the relevant commitment period ($tCO_2e/tCH4$)
$M_{steam,y}$	=	Quantity of steam produced in year *y* (t steam/yr)

According to the methodology, the default value for GWP_{CH4} is used, which is 25 tCO_2e/CH_4.

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

Not applicable. The PoA will only involve geothermal technology.

Baseline Emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The baseline emissions are to be calculated as follows **(equation 7 of ACM0002, v.16.0)**:

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

Where:

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

Calculation of $EG_{PJ,y}$

The project activity is the installation of a new grid-connected renewable power plant-unit at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore $EG_{PJ,y}$ is calculated as per **(equation 8 of ACM0002, v.16.0)**:.

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

Where:

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

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

The emission factor is 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* (EB 87, Annex 9, version 05.0)

The procedures applied to calculate the grid emission factor for Kenyan electricity system are described as below. The procedures to calculate the GEF will be updated after every seven years of the duration of the PoA.

Step 1. Identify the relevant electric power system

For determining the grid emission factor, the project activity has identified the Kenyan national grid as the relevant project electricity system. The identification of the Kenyan national electricity grid as the relevant project electricity system is based on the following arguments:

- The Kenyan DNA has not published a delineation of the project electricity system and connected electricity systems.

- There are no connected electricity systems because: The Uganda – Kenya transmission line (Lessos –Musaga line) has a capacity of 64 MW. While the Kenyan grid system has an installed capacity of 1,740.36, the Uganda grid has an installed capacity of 837 MW. This is

based on a UNECA (2014) report, which states the Ugandan grid capacity to be 822 MW. [63] The report states that 822 MW consists among other plants of small hydro power plants with a total capacity of 50 MW. A 2014 report published by the Ugandan electricity market regulator ERA however mentions that the total capacity of small hydro power plants in the country stands at 65 MW.[64] The additional small hydro-power capacity of 15 MW, which is not reflected in the UNECA report, is therefore added to the 822 MW stated by UNECA. This leads to a total grid capacity of 837 MW. Following the argument in the *Tool to calculate the emission factor for an electricity system* version 05.0, the transmission capacity of the transmission line that is connecting the electricity systems (i.e. Lessos Musaga line) is less than 10 per cent of the installed capacity of the Ugandan grid system (Uganda grid system has a smaller capacity than the Kenyan grid system) i.e. (64/837) = 7.65%. Furthermore the latest annual reports and statements published by Kenya Power for the period ending June 2013[65] shows that imports to Uganda, were 30 GWh in comparison with a total electricity generation of 7,586.4 GWh. This is approximately 0.47% of the generated electricity in the Kenyan grid system and therefore can be considered as insignificant. According to the same Kenya Power Report, Kenya exported 1 GWh hours of electricity in the year 2012- 2013 to Tanzania. This is also very insignificant compared with the total Kenya electricity generation of 7,991 GWh. There is a line connecting Kenya to Tanzania, however the amount of electricity imported to the Kenyan electricity system is "insignificant" as shown above. (see Updated Least Cost Power Development Plan. Study Period 2011- 2031, p. 45) The Tanzania-Kenya line is furthermore not to be considered a transmission line per se since it connects power to one customer.

- Finally, Kenya does not have a layered dispatch system and the country has only one grid system that serves the entire country. Therefore, and in line with the *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9, version 05.0), the national grid definition is used by default since there are no regional grids.

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

The project activity has selected Option I, only grid power plants were included in the calculation.

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

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

- Simple OM
- Simple adjusted OM
- Dispatch data analysis OM
- 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.[66]

The Dispatch Data Analysis OM method was used to calculate the operating margin because hourly dispatch data is available.

[63] UNECA (2014). Energy Access and Security in Eastern Africa, p. 50

[64] http://www.era.or.ug/index.php/2013-12-14-14-58-04/sector-reports p.8

[65] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[66] As shown in table 11, low-cost/must-run power plants (i.e. hydro power plants and geothermal power plants) generated > 50% during the last 5 years

In terms of data vintage, the projects under this PoA will use the *ex post* data vintage for carrying out the Dispatch Data Analysis and will update the operating margin emission factor annually during monitoring using data for the year in which the project activity displaces grid electricity.

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

The dispatch data analysis OM emission factor ($EF_{grid,OM\text{-}DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour *h* where the project is displacing grid electricity. **(Equation 12)** of the *Tool to calculate the emission factor for an electricity system* (v.5.0) as shown below is used:

$$EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \times EF_{EL,DD,h}}{EG_{PJ,y}} \quad \textbf{(12)}$$

Where:

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

Since hourly fuel consumption data is not available, the hourly emission factor ($EF_{EL,DD,h}$) is calculated based on the energy efficiency of the grid power unit and type of fuel used using **(equation 14)** of the *Tool to calculate the emission factor for an electricity system* (v.5.0) as shown below:

$$EF_{EL,DD,h} = \frac{\sum_n EG_{n,h} \times EF_{EL,n,y}}{\sum_n EG_{n,h}} \quad \textbf{(14)}$$

Where:

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

Determination of $EF_{,EL,n,y}$

Since annual data on fuel consumption and electricity generation is available, Option A1 i.e. (**equation 14**)[67] of the *Tool to calculate the emission factor for an electricity system* (v.5.0), was used to calculate the CO_2 emission factor for each grid power unit *n* at the top of the dispatch ($EF_{,EL,n,y}$) as shown below:

$$EF_{EL,n,y} = \frac{\sum_i FC_{i,n,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{n,y}} \quad \textbf{(14)}$$

[67] In equation 2, *m* has been replaced by *n,* in order to reflect that $EF_{EI,n,y}$ is being calculated rather than $EF_{EI,m,y}$

Where:

$EF_{EL,n,y}$	=	CO_2 emission factor of power unit *n* in year *y* (tCO_2/MWh)
$FC_{i,n,y}$	=	Amount of fuel type *i* consumed by power unit *n* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)
$EG_{n,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *n* in year *y* (MWh)
n	=	Grid power units in the top of the dispatch (as defined below)
i	=	All fuel types combusted in power unit *n* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

The group of power units in the top of the dispatch is selected based on the merit order that Kenya Power and Lighting Company (KPLC) provides on a monthly basis. KPLC determines the merit order using the cost of buying electricity from the different power plants in the previous month.

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

For the calculation of the build margin (BM) emission factor, Option 2 data vintage was chosen where for the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as per Option 1 described in *Tool to calculate the emission factor for an electricity system* (v.5.0). For the third crediting period, the build margin emission factor calculated for the second crediting period should be used

During the first crediting period, the BM will therefore be updated annually.

The sample group of power units *m* used to calculate the build margin was determined as per the following procedure:

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. $SET_{\geq 20\%}$ does not include power units, which started to supply electricity to the grid more than 10 years ago thus steps (d), (e) and (f) are ignored.

The build margin emission factor is calculated using **(equation 15)** of the *Tool to calculate the emission factor for an electricity system*, as shown below:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(15)}$$

Where:

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

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) was determined as per the guidance in step 4 (a) for the simple OM, using **equation (4)** of the *Tool to calculate the emission factor for an electricity system* (v5.0) 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.

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}} \quad \textbf{(4)}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel *i* in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	The power units included in the build margin
i	=	All fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 5

Step 6: Calculate the Combined Margin

Option A i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated using **(equation 16)** of the *Tool to calculate the emission factor for an electricity system* (v.5.0), as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \textbf{(16)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,CM,y}$	=	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
W_{OM}	=	Weighting of operating margin emissions factor (%)
W_{BM}	=	Weighting of build margin emissions factor (%)

In accordance with *Tool to calculate the emission factor for an electricity system* (v.5.0), during the first crediting period, the following default values will be used for W_{OM} and W_{BM}:

W_{OM} = 0.5
W_{BM} = 0.5

In accordance with the *Tool to calculate the emission factor for an electricity system* (v.5.0), during the 2nd and the 3rd crediting period, the following values will be used:

W_{OM} = 0.25
W_{BM} = 0.75

Emission reductions

In line with ACM0002 (version 16.0) the emission reductions are calculated using **(equation 13)** as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	=	Emission reductions in year *y* (tCO_2e/yr)
BE_y	=	Baseline Emissions in year *y* (tCO_2/yr)

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

B.6.2. Data and parameters fixed ex-ante

Data / Parameter:	The percentage share of total installed capacity of the specific technology
Data unit:	%
Description:	The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country
Source of data:	National statistics or other official data
Value(s) applied:	To be specified in the Specific CPA-DD
Choice of data or Measurement methods and procedures:	National statistics or other official data
Purpose of data	-
Additional comment:	-

Data / Parameter:	The total installed capacity of the technology
Data unit:	MW`
Description:	The total installed capacity of the technology in the host country
Source of data:	National statistics or other official data
Value(s) applied:	To be specified in the Specific CPA-DD
Choice of data or Measurement methods and procedures:	National statistics or other official data
Purpose of data	-
Additional comment:	-

B.6.3. Ex-ante calculations of emission reductions

Project emissions
These emissions shall be accounted for, by using the following equation from ACM0002 (version 16.0):

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

Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$) $PE_{GP,y}$ will be calculated using equation (2) in ACM0002 (version 16.0), as follows:

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

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}	25	tCO_2e/tCH_4	Default value
$M_{Steam,y}$	[insert value]	[insert unit]	[insert source]
$PE_{GP,y}$	[insert value]	[insert unit]	[insert source]

Total Project Emission for the project activity equal $PE_{GP,y}$ since the CPA will not involve on-site fossil fuel consumption:

$PE_y = PE_{GP,y}$ =[insert value]

Baseline Emissions

The baseline emissions are to be calculated as follows:

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

$EG_{PJ,y}$ equals [insert number] MWh and $EF_{grid,CM,y}$ equals [insert number] tCO_2/MWh. Therefore BE_y equals [insert number] tCO_2.

Calculation of $EG_{PJ,y}$

For a new grid-connected geothermal power plant/units at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore $EG_{PJ,y}$ is calculated as per equation 8 of ACM0002 (version 16.0).

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

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

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

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

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

$EF_{grid,BM,y}$ and $EF_{grid,OM,y}$ will be updated every year on CPA level.

Values to determine $EF_{grid,CM,y}$

$EF_{grid,BM,y}$	=	[insert value] tCO_2/MWh
w_{BM}	=	0.50
$EF_{grid,OM-DD,y}$	=	[insert value] tCO_2/MWh
w_{OM}	=	0.50

Therefore:

$EF_{grid,CM,y}$ = [insert value]tCO_2/MWh

BE_y = [insert value]* [insert value]= [insert value] tCO_2/year

Leakage emissions

No leakage emissions are considered In accordance with ACM0002 (version 16.0)

Emission reductions

$$\mathrm{ER_y} = \mathrm{BE_y} - \mathrm{PE_y}$$

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_y] = [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

Parameter to monitor CPA's electricity generation

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data:	Main and backup metering equipment installed at the CPA site in line with the provisions of the Power Purchase Agreement between the CPA implementing entity and KPLC and the latest available Kenya Electricity Grid Code at the time of CPA inclusion (currently March 2008 Edition). This parameter should be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. In case it is calculated then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The net quantity of electricity generated is metered on site using the main metering system, which will be verified by a back up metering system. The main and back up metering system will be owned by the CPA implementing entity and KPLC respectively. The main and back-up metering requirements according to the Kenya Electricity Grid Code will be met and the equipment will comply with international standards. As per the requirements of the Kenyan *Electricity Grid Code*[68] *th*e accuracy class of the meter is 0.2 for the active meter and 0.5 for the reactive meter. As stated in the Kenyan Electricity Grid Code this meter class allows a level of accuracy of +/-0.5% for the active meter and +/- 1.0% for the reactive meter. The testing/recalibration of both meters will be carried out in accordance with the PPA. The measurement data shall be stored for at least two years after the respective crediting period. All data shall be transferred to the meter data buffer and to the SCADA systems of both KPLC and the CPA implementing entity.
Monitoring frequency:	The quantity of electricity supplied to the grid will be measured continuously and recorded monthly. The basic measurement period shall be carried out in line with PPA. The metering system shall be read monthly on the last day of each month (or such other day as may be agreed upon by the parties) for the purpose of determining the net electrical output of the plant since the preceding reading. The CPA implementing entity shall read the Metering System by reading the log in the SCADA system and taking the kWh meter position on the first day of the calendar month at 0:00 midnight. KPLC shall verify the same through their SCADA system.

[68] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

QA/QC procedures:	The measurement results will be cross checked with records for sold electricity (i.e. invoices to KPLC). In case of any difference, the lower value of both the invoice and the meter reading value will be used for the purpose of calculating the emission reductions. Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 61036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS). The method of calibration and frequency of tests shall be agreed between CPA implementing entity and KPLC based on requirements outlined in the Kenyan Grid Code and or the PPA.
Purpose of data	Calculation of baseline emissions
Additional comment:	-

Parameter to monitor CPA's electricity grid emission factor

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	t CO_2/MWh
Description:	Combined Margin Grid Emission factor of an electricity system
Source of data:	*Tool to calculate the emission factor for an electricity system* version 05.0
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The combined margin grid emission factor will be calculated using the Dispatch Data Analysis OM approach. Therefore annual recalculation of the OM emission factor during the credit period of each CPA will be required. The combined margin grid emission factor is calculated as the weighted average of the operating margin and the build margin. In accordance with the *Tool to calculate the emission factor of an electricity system* version 05.0, the default values below shall be applied. First Crediting Period: W_{OM} = 0.50 W_{BM} = 0.25 Subsequent crediting periods: W_{OM} = 0.25 W_{BM} = 0.75
Monitoring frequency:	Annual
QA/QC procedures:	The combined margin grid emission factor will be calculated annually in accordance with the description outlined in sections D.6.1. and D.7.2 of the CPA-DD.
Purpose of data	Calculation of baseline emissions
Additional comment:	N/A

Parameter to monitor CPA's project emissions

Data / Parameter:	$w_{steam,CO2,y}$
Data unit:	tCO_2/t steam
Description:	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data:	Measurement at CPA 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/or at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. H_2S and CO_2 dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane
Monitoring frequency:	Monitoring frequency must be at least every 3 months and more frequently, if necessary.
QA/QC procedures:	Equipment accuracy level and calibration frequency as well as any other applicable QA/QC procedures will be in line with ASTM Standard Practice E1675
Purpose of data	Calculation of project emissions
Additional comment:	-

Data / Parameter:	$w_{steam,CH4,y}$
Data unit:	tCH_4/t steam
Description:	Average mass fraction of methane in the produced steam in year *y*
Source of data:	Measurement at CPA 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/or at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. H_2S and CO_2 dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane
Monitoring frequency:	Monitoring frequency must be at least every 3 months and more frequently, if necessary.
QA/QC procedures:	Equipment accuracy level and calibration frequency as well as any other applicable QA/QC procedures will be in line with ASTM Standard Practice E1675
Purpose of data	Calculation of project emissions
Additional comment:	-

Data / Parameter:	$M_{steam,y}$
Data unit:	t steam/yr
Description:	Quantity of steam produced in year *y*
Source of data:	Measurement at CPA site
Value(s) applied	To be reported in 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:	Metering will be done continuously and recorded daily
QA/QC procedures:	Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. Data is metered continuously and recorded daily. Data will furthermore be aggregated to hourly and daily figures. Data will be checked for consistency by the CME. 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. If data is missing the following applies: If less than 30 consecutive days of data are missing: 1. Count for missing/incomplete hour *h* the number of consecutive days (d) for which data is missing. 2. Calculate the average steam generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing. (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm) If for more than 30 consecutive days are missing: 1. Use data for the same date/hour from the previous year 2. If such data is not available, use the average from the same date/hour from year -2 and year -3 3. If such data is not available apply the highest value measured for the power plant.
Purpose of data	Calculation of project emissions
Additional comment:	-

Parameters to monitor GEF OM

Data / Parameter:	**$EG_{PJ,h}$**
Data unit:	MWh
Description:	Electricity displaced by the project activity in hour h of year y
Source of data:	Main and backup metering equipment installed at the CPA site in line with the provisions of the Power Purchase Agreement and the latest available Kenya Electricity Grid Code at the time of CPA inclusion (currently March 2008 Edition). This parameter should be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. In case it is calculated then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid
Value(s) applied	To be reported in the specific CPA-DD

Measurement methods and procedures:	The net quantity of electricity generated is metered on site using the main metering system, which will be verified by a back up metering system. The main and back up metering system will be owned by the CPA implementing entity and KPLC respectively. The main and back-up metering requirements according to the Kenya Electricity Grid Code will be met and the equipment will comply with international standards. As per the requirements of the *Kenyan Electricity Grid Code,* version March 2008[69], the accuracy class of the meter is 0.2 for the active meter and 0.5 for the reactive meter. As per the Kenyan Electricity Grid Code this allows a level of accuracy of +/-0.5% for the active meter and +/- 1.0% for the reactive meter The testing/recalibration of both meters will be carried out in accordance with the PPA. The testing/recalibration of both meters will be in accordance with the PPA. The measurement data shall be stored for at least two years after the respective crediting period. All data shall be transferred to the meter data buffer and to the SCADA systems of both KPLC and the CPA implementing entity.
Monitoring frequency:	The quantity of electricity supplied to the grid will be measured continuously and recorded monthly. The basic measurement period shall be carried out in line with PPA. The metering system shall be read monthly on the last day of each month (or such other day as may be agreed upon by the parties) for the purpose of determining the net electrical output of the plant since the preceding reading. The CPA implementing entity shall read the Metering System by reading the log in the SCADA system and taking the kWh meter position on the first day of the calendar month at 0:00 midnight. KPLC shall verify the same through their SCADA system.
QA/QC procedures:	The measurement results will be cross checked with records for sold electricity (i.e. invoices to KPLC). In case of any difference, the most lower value of both the invoice and the meter reading value will be used for the purpose of calculating the emission reductions. Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 61036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS). The method of calibration and frequency of tests shall be agreed between CPA implementing entity and KPLC based on requirements outlined in the Kenyan Grid Code and or the PPA.
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation OM emission factor.

Data / Parameter:	**$EG_{PJ,y}$**
Data unit:	MWh
Description:	Electricity displaced by the project activity in year y

[69] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

Source of data:	Main and backup metering equipment installed at the CPA site in line with the provisions of the Power Purchase Agreement and the latest available Kenya Electricity Grid Code at the time of CPA inclusion (currently March 2008 Edition). This parameter should be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. In case it is calculated then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The net quantity of electricity generated is metered on site using the main metering system, which will be verified by a back up metering system. The main and back up metering system will be owned by the CPA implementing entity and KPLC respectively. The main and back-up metering requirements according to the Kenya Electricity Grid Code will be met and the equipment will comply with international standards. As per the requirements of the *Kenyan Electricity Grid Code,* version March 2008[70]*,* the accuracy class of the meter is 0.2 for the active meter and 0.5 for the reactive meter. As per the Kenyan Electricity Grid Code this allows a level of accuracy of +/-0.5% for the active meter and +/- 1.0% for the reactive meter The testing/recalibration of both meters will be carried out in accordance with the PPA. The measurement data shall be stored for at least two years after the respective crediting period. All data shall be transferred to the meter data buffer and to the SCADA systems of both KPLC and the CPA implementing entity.
Monitoring frequency:	The quantity of electricity supplied to the grid will be measured continuously and recorded monthly. The basic measurement period shall be carried out in line with PPA. The metering system shall be read monthly on the last day of each month (or such other day as may be agreed upon by the parties) for the purpose of determining the net electrical output of the plant since the preceding reading. The CPA implementing entity shall read the Metering System by reading the log in the SCADA system and taking the kWh meter position on the first day of the calendar month at 0:00 midnight. KPLC shall verify the same through their SCADA system.
QA/QC procedures:	The measurement results will be cross checked with records for sold electricity (i.e. invoices to KPLC). In case of any difference, the lower value of both the invoice and the meter reading value will be used for the purpose of calculating the emission reductions. Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 61036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS). The method of calibration and frequency of tests shall be agreed between CPA implementing entity and KPLC based on requirements outlined in the Kenyan Grid Code and or the PPA.
Purpose of data	Calculation of baseline emissions

[70] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

Additional comment:	Used for calculation of OM emission factor.

Data / Parameter:	**$EG_{n,h}$**
Data unit:	MWh
Description:	Net electricity generated by power plant/unit *n* in hour *h*
Source of data:	Kenya Power and Lighting Company
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	Data are obtained directly from KPLC, which is the utility in charge of electricity distribution in the country.
Monitoring frequency:	The data will be collected from KPLC on a half-yearly basis and aggregated on an annual basis.
QA/QC procedures:	As a general quality check on the hourly data provided by KPLC, the CME will screen the data for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below: If power plant *n* is a fossil fuel power plant, missing hourly generation data will be set at 0. If power plant *n* is a renewable energy power plant, the following steps will be taken: If less than 30 consecutive days of data are missing: 1. Count for missing hour *h* the number of consecutive days (*d)* for which data is missing. 2. Calculate the average electricity generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing. (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm) If for power plant *n* more than 30 consecutive days are missing: 1. Use data for the same date/hour from the previous year 2. If such data is not available, use the average from the same date/hour from year -2 and year - 3 3. If such data is not available apply 0 MWh
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of OM emission factor.

Data / Parameter:	**$EG_{n,y}$**
Data unit:	MWh
Description:	Net electricity generated by power plant / unit *n* in year *y*
Source of data:	Kenya Power and Lighting Company
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	Data are obtained directly from KPLC, which is the utility in charge of electricity distribution in the country.
Monitoring frequency:	The data will be collected from KPLC on a half-yearly basis and aggregated on an annual basis.

<table>
<tr><td>QA/QC procedures:</td><td>As a general quality check on the hourly data provided by KPLC, the CME will screen the data for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below:

If power plant n is a fossil fuel power plant, missing hourly generation data will be set at 0.

If power plant n is a renewable energy power plant, the following steps will be taken:

If less than 30 consecutive days of data are missing:
1. Count for missing hour h the number of consecutive days (d) for which data is missing.
2. Calculate the average electricity generation for hour h for the period ±d immediately before and after the day(s) for which the data is missing.
(e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days d equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

If for power plant n more than 30 consecutive days are missing:
1. Use data for the same date/hour from the previous year
2. If such data is not available, use the average from the same date/hour from year -2 and year - 3
3. If such data is not available apply 0 MWh

As a subsequent quality check, the CME will compare the yearly electricity generation data calculated from the hourly data with the yearly electricity generation data reported in the KPLC annual report. The following allowable differences were defined:

<table>
<tr><th>Annual Electricity generation by Power Plant (MWh)</th><th>Maximum allowable difference between KPLC official values and calculated values</th></tr>
<tr><td>< 50,000 MWh</td><td>±7.5%</td></tr>
<tr><td>50,000 – 250,000 MWh</td><td>±5.0%</td></tr>
<tr><td>250,000 – 500,000 MWh</td><td>±2.5%</td></tr>
<tr><td>> 500,000 MWh</td><td>±1.5%</td></tr>
</table>
For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is smaller than the allowable difference the annual electricity generation calculated based on the hourly data will be used.

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is larger than the allowable difference then:

• If the power plant n is a renewable energy power plant => the higher value will be used.
• If the power plant n is a fossil fuel power plant => the lower value will be used.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment:</td><td>Used for calculation of OM emission factor.</td></tr>
</table>

Data / Parameter:	$FC_{i,n,y}$
Data unit:	Mass or volume unit
Description:	Amount of fuel type *i* consumed by power plant/unit *n* in year *y*
Source of data:	Specific Fuel Consumption (kg/kWh) data will be obtained from *Schedule of Tariffs, 2013*[71] which is published by the Energy Regulatory Commission, or any update thereof. Electricity generation data will be obtained from the Kenya Power and Lighting Company and will be processed as described above in the table for $EG_{n,y}$
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The Specific Fuel Consumption data published by the Energy Regulatory Commission are used to calculate the fuel charges on the electricity bills of the consumers. The specific fuel consumption data are provided in kg/kWh. The data will be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant ($EG_{n,y}$).
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	KPLC uses the fuel consumption data to calculate the fuel charge on the electricity bill of the consumers. Therefore, the values they use follow the highest standards.
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of OM emission factor

Parameters to monitor GEF OM and BM

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/kg
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	No data on NCV is available from power generation plants or regional default values. Therefore IPCC default values have been applied. Annual monitoring will be done by cross-checking if there are values provided for the relevant power plants, or regional or national average default values, or an updated version of the IPCC guidelines.
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	-.
Purpose of data	Calculation of baseline emissions
Additional comment:	Use for calculation of OM and BM emission factor.

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

[71] Energy Regulatory Commission. 2013. Approval of *Schedule of Tariffs set by the Energy Regulatory Commission for Supply of Electrical Energy by the Kenya Power and Lighting Company Limited pursuant to section 45 of the Energy Act, 2006.*

Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	No data on EF_{CO2} is available from power generation plants or regional default values. Therefore IPCC default values have been applied. Annual monitoring will be done by cross-checking if there are values provided for the relevant power plants, or regional or national average default values, or an updated version of the IPCC guidelines.
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	-
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of OM and BM emission factor.

Parameter to monitor GEF BM

Data / Parameter:	**$EG_{m,y}$**
Data unit:	MWh
Description:	Net electricity generated by power plant / unit *m* in year *y*
Source of data:	Kenya Power and Lighting Company
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	Data are obtained directly from KPLC, which is the utility in charge of electricity distribution in the country.
Monitoring frequency:	The data will be collected from KPLC on a half-yearly basis and aggregated on an annual basis.

<table>
<tr><td>QA/QC procedures:</td><td>As a general quality check on the hourly data provided by KPLC, the CME will screen the data for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below:

If power plant m is a fossil fuel power plant, missing hourly generation data will be set at 0.

If power plant m is a renewable energy power plant, the following steps will be taken:

If less than 30 consecutive days of data are missing:
1. Count for missing hour h the number of consecutive days (d) for which data is missing.
2. Calculate the average electricity generation for hour h for the period ±d immediately before and after the day(s) for which the data is missing.
(e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days d equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

If for power plant n more than 30 consecutive days are missing:
1. Use data for the same date/hour from the previous year
2. If such data is not available, use the average from the same date/hour from year -2 and year - 3
3. If such data is not available apply 0 MWh

As a subsequent quality check, the CME will compare the yearly electricity generation data calculated from the hourly data with the yearly electricity generation data reported in the KPLC annual report. The following allowable differences were defined:

<table>
<tr><th>Annual Electricity generation by Power Plant (MWh)</th><th>Maximum allowable difference between KPLC official values and calculated values</th></tr>
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For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is smaller than the allowable difference the annual electricity generation calculated based on the hourly data will be used.

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is larger than the allowable difference then:

• If the power plant m is a renewable energy power plant => the higher value will be used.
• If the power plant m is a fossil fuel power plant => the lower value will be used.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment:</td><td>Used for calculation of BM emission factor.</td></tr>
</table>

Data / Parameter:	$FC_{i,m,y}$
Data unit:	Mass or volume unit
Description:	Amount of fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data:	Specific Fuel Consumption (kg/kWh) data will be obtained from *Schedule of Tariffs, 2013*[72] which is published by the Energy Regulatory Commission, or any update thereof. Electricity generation data will be obtained from the Kenya Power and Lighting Company and will be processed as described above in the table for $EG_{m,y}$
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The Specific Fuel Consumption data published by the Energy Regulatory Commission are used to calculate the fuel charges on the electricity bills of the consumers. The specific fuel consumption data are provided in kg/kWh. The data will be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant ($EG_{m,y}$).
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	KPLC uses the fuel consumption data to calculate the fuel charge on the electricity bill of the consumers. Therefore, the values they use follow the highest standards.
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of BM emission factor.

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

In order to enable verification of emission reductions the CPA must carry out credible, transparent and adequate data measurement, collection and quality assurance/quality control procedures. Therefore, the following monitoring procedures and responsibilities will apply:

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

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the CPA
- Continuous measurement of steam produced by the geothermal wells
- Measurement of parameters related to CO_2 and CH_4 emissions in geothermal steam
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, according to appropriate standards or manufacturer specifications.
- Calibration and maintenance of steam measuring equipment, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPA's monitoring responsibilities as described above. Each month/quarter, the CPA will submit monthly electricity generation records and steam measurement data to the CME accompanied by the respective copy of records/invoices for sold electricity and steam measurement evidence.

[72] Energy Regulatory Commission. 2013. Approval of *Schedule of Tariffs set by the Energy Regulatory Commission for Supply of Electrical Energy by the Kenya Power and Lighting Company Limited pursuant to section 45 of the Energy Act, 2006.*

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

The CME, through its programme officer, will be responsible for the following:

- Training of CPAs staff on CDM monitoring requirements
- Collection of monitored data by the CPA
- Collection of data related to the re-calculation of operating margin and build margin for annual recalculation of the combined margin of the grid emission factor.
- Collection of data related to geothermal steam and its fraction of CO_2 and CH_4 and annual calculation and calculation of the resulting annual project emissions.
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored electricity with a copy of invoices and the proof of payment of those invoices
- Crosscheck of measured steam data with measurement evidence.
- Confirm that the CPA has operated the metering system and steam measurement equipment in line with relevant regulations
- Preparation of monitoring report

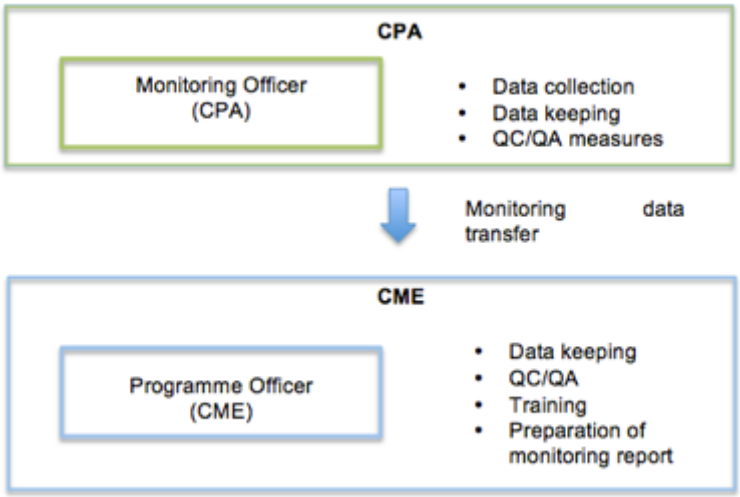

Figure 13: Monitoring organization

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 by the CPA and the CME.

All measurements should be conducted with the calibrated measurement equipment according to relevant industry standards.

Parameters monitored

The CME will 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. The grid emission factor will be calculated annually and be used for the calculation of the baseline emissions achieved by each CPA connected to the electricity system.

Other parameters included in section B.7.1 will be measured by the CPA implementing entity, recorded electronically, and provided to the CME. Based on the data measured and provided by the CPA, the CME will calculate the project emissions of each CPA. Thereafter, the CME will calculate the annual emission reductions achieved.

Table 14: Monitoring responsibilities

Monitoring parameter	Entity responsible for measurement/collection	Entity responsible for processing and QA/QC
$EG_{facility,y}$, $EG_{PJ,y,}$ and $EG_{PJ,h}$	CPA implementing entity	CME
$EF_{grid,CM,y}$	CME	CME
$FC_{i,n,y}$ and $FC_{i,m,y}$	CME	CME
$EG_{n,y}$, $EG_{n,h}$ and $EG_{m,y}$	CME	CME
$NCV_{i,y}$	CME	CME
$EF_{CO2i,y}$	CME	CME
$w_{steam,CO2,y}$	CPA implementing entity	CME
$w_{steam,CH4,y}$	CPA implementing entity	CME
$M_{steam,y}$	CPA implementing entity	CME

Additionally the CME will be responsible to collect the merit order of the power plants connected to the grid in order to be able to update the grid emission factor:

Table 15: Additional data collection

Description	Merit Order
Data recording	The merit order is determined by KPLC on a monthly basis based on the cost of electricity from the different power plants in the previous months. The merit order is used to determine the power plants in the top of the dispatch in step 4 of the *Tool to calculate the emission factor for an electricity system*
Data collection	Merit order data will be collected by the CME on a yearly basis.
Data management and archiving	Data regarding the merit order will be organized annually and stored in a centralized database.
Quality Assurance and Quality Control	Data regarding the merit order will be checked in terms of logic (cheap sources should rank higher in the merit order) and consistency. If merit order data are missing for a particular month, data from the previous month will be used.

Electricity metering

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standard and the *Kenya Electricity Grid Code.* Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 1036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS).

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

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

The CPA will further be responsible for the procurement, installation, testing and commissioning of the back-up meter. KPLC will however be responsible for the operation and maintenance of the back-up meter. The back-up meter will only be used against the data provide by the CPA entity's main-meter and the CPA will usually not have access to that data.

Both meters will be installed at that Point of Utility Connection (PuC), which defines the commercial boundary between the licensee and the customer.

QA/QC

The main-meter readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to KPLC and the proof of payment of those invoices. If there is a difference

between the values, the lower value will be used.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. According to *Kenyan Electricity Grid Code (version March 2008)*[73], the accuracy class of the meter and its maximum interval between calibrations are the following:

Table 16: Applicable accuracies

Maximum allowable overall error (±%)		**Minimum acceptable class of components**	**Meter clock error (seconds) in reference to EAST**
active	reactive		
0.5	1.0	0.2 CT/VT/Meter Wh 0.5 Meter varh	±5

As per the Kenyan Electricity Grid Code, for the active metering a meter of accuracy class 0.2 has to be installed. As per the Kenyan Electricity Grid Code, this refers to an allowable accuracy of +/- 0.5% for the meter which meters active power. For the reactive metering a meter of accuracy class of 0.5 has to be installed. As per the Kenyan Electricity Grid Code, this refers to an allowable accuracy of +/- 1.0% for the meter which meters reactive power.

The testing/recalibration period will be in line with the Power Purchase agreement (PPA).

Emergency procedure:
In case there is disagreement between KPLC and the CPA implementing entity with regard to the meter readings because the readings of the main meter and the back-up meter are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 10 above then the main meter and the back-up meter shall both be tested. Should the main-meter be found to have a level of inaccuracy beyond the tolerance as described above, then the main-meter shall be recalibrated and the electricity output will be based on the readings registered by the back-up meter from the date of the last previous test of the main-meter.

Should both the back-up meter and the main-meter be found to have a level of inaccuracy falling outside the maximum tolerance level then each of the main-meter and the back-up meter shall be recalibrated and the electricity output shall be recalculated as follows (starting with step 1 if applicable):

1. The average monthly data for the plant from the same month in the prior contract Year, reasonably adjusted for the particular billing period by any relevant available data affecting plant generation regarding resource availability, hours of operation, time of operation of generators, and/or native self-use of power output (collectively “Operating Variations”)
2. The average monthly electricity generation during the previous six (6) billing periods prior to meter failure (or fewer months of the Plant is less than six months from the Full Commercial Operation Date), as adjusted or normalized for outages or Operating Variations.

In cases where one meter breaks down, then the readings of the other meter will be applied in the emission reduction calculations. If both meters break down, then the electricity generation value for that period will be assumed to be zero as a conservative approach.

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

Steam measurement
The steam quantity discharged from the geothermal wells should be measured with a venture flow

[73] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

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

Steam meters will be installed to continuously measure the quantity of steam produced during the year in the production wells. The meters will have the integration and their readings will be relayed and be displayed in the SCADA. Daily log will be kept electronically. At the end of each month, the records will be retrieved and submitted to the CME.

QA/QC
Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. Data is read continuously and logged. Data will furthermore be aggregated to hourly and daily figures. Data will be checked for consistency by the CME. 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.

Emergency procedure:
If data is missing the following applies:

If less than 30 consecutive days of data are missing:

1. Count for missing/incomplete hour *h* the number of consecutive days (d) for which data is missing.
2. Calculate the average steam generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing. (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

If for more than 30 consecutive days are missing:
1. Use data for the same date/hour from the previous year
2. If such data is not available, use the average from the same date/hour from year -2 and year -3
3. If such data is not available apply the highest value measured for the power plant.

Non-Condensable gases (NCGs)
The fraction of non-condensable gases will be monitored through sampling. Non-condensable gases sampling should be carried out in production wells and/or at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. H_2S and CO_2 dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane. The sampling team will be trained on how to take the samples. At the end of each sampling period, the records will be submitted to the CME.

QA/QC
Equipment accuracy level and calibration frequency as well as any other applicable QA/QC procedures will be in line with ASTM Standard Practice E1675

Emergency procedure:
In line with ASTM Standard Practice E1675

Grid emission factor – Operating and Combined Margin

The CME will annually monitor the parameters required to recalculate the Combined Margin Emission Factor. This is because the grid emission factor will be calculated using the Dispatch Data Analysis OM approach. Therefore annual recalculation of the OM emission factor during the credit period of each CPA will be required. The CME will furthermore annually calculate the BM emission factor. The CME will therefore annually collect the latest data available from the relevant entities (KPLC, IPCC, ERC) and will furthermore make sure the latest values available are used for default values, i.e. EF_{CO2}, NCV.

The CME will carry out the QA/QC procedures as described in the tables above. For $EG_{n,h}$, $EG_{n,y}$ and $EG_{m,y}$ the following will apply:

The hourly data provided by KPLC, will be screened by the CME for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below:

- If power plant *n* is a fossil fuel power plant, missing hourly generation data will be set at 0.

- If power plant *n* is a renewable energy power plant, the following steps will be taken:

- If less than 30 consecutive days of data are missing:
  1. Count for missing hour *h* the number of consecutive days (*d)* for which data is missing.
  2. Calculate the average electricity generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing.
  (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

  If for power plant *n* more than 30 consecutive days are missing:
  1. Use data for the same date/hour from the previous year
  2. If such data is not available, use the average from the same date/hour from year - 2 and year - 3
  3. If such data is not available apply 0 MWh

As a subsequent quality check in order to apply the most accurate value for $EG_{m,y}$ and $EG_{n,y}$, the CME will compare the yearly electricity generation data calculated from the hourly data with the yearly electricity generation data reported in the KPLC annual report. The following allowable differences were defined:

Table 17: Allowed deviations

Annual Electricity generation by Power Plant (MWh)	Maximum allowable difference between KPLC official values and calculated values
< 50,000 MWh	±7.5%
50,000 – 250,000 MWh	±5.0%
250,000 – 500,000 MWh	±2.5%
> 500,000 MWh	±1.5%

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is smaller than the allowable difference the annual electricity generation calculated based on the hourly data will be used.

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is larger than the allowable difference, then:

- If the power plant *m/n* is a renewable energy power plant => the higher value will be used.
- If the power plant *m/n* is a fossil fuel power plant => the lower value will be used.

Emergency procedures
N/a

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

The database contains the following information:

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

Training
Before the implementation of a CPA, 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
- Measurement procedures of monitoring parameters
- QA/QC procedures
- Monitoring report template
- Preparation for verification

Questions and answers

PART II. Generic component project activity (CPA)

CPA Type II: Geothermal power plant/unit (Capacity Addition)

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

The generic component project activity (CPA), which will be implemented under the MPG Geothermal Energy PoA is a grid-connected geothermal power plant/unit implemented as a capacity addition to an existing geothermal power plant/unit (capacity addition). The CPA will generate electricity, which will be fed into Kenya's national electricity grid. By replacing fossil fuel based electricity, the CPA will lead to emission reductions.

The CPA is being pursued as a component of the MPG Geothermal Energy PoA with Marine Power Generation Company Limited as the CME.

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

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

CPAs included in the PoA will apply the approved consolidated baseline and monitoring methodology ACM0002 *Grid-connected electricity generation from renewable sources* (version 16.0)

ACM0002 (version 16.0) also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9, version 05.0)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf)
- *Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0)
- *(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf)*
- *Combined tool to identify the baseline scenario and demonstrate additionality* (EB 85, Annex 11, version 06.0)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v6.0.pdf)
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* (EB 41, Annex 11, version 02)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v6.0.pdf)
- *Tool to determine the remaining lifetime of equipment* (EB 50, Annex 15, version 01)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf)
- *Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period* (EB 66, Annex 47, version 03.0.1)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf)

The *Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0) further requires the application of the *Methodological Tool: Common Practice* (EB 84, Annex 7, version 03.1) and the *Guidelines on the assessment of investment analysis* which has now been reclassified to a tool *Methodological tool: Investment analysis (*EB 85, Annex 12, version 06.0*)*

CPAs to be included to this PoA will only apply:

- *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9, version 05.0)
  (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf)

- *Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0) *(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v6.0.pdf)*
- *Tool to determine the remaining lifetime of equipment* (EB 50, Annex 15, version 01) *(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf)*
- A*ssessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period* (EB 66, Annex 47, version 03.0.1) *(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf)*
- *Methodological Tool: Common Practice* (EB 84, Annex 7, version 03.1) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-24-v1.pdf)
- *Methodological tool: Investment analysis (*EB 85, Annex 12, version 06.0*) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v1.pdf)*

The *Combined tool to identify the baseline scenario and demonstrate additionality (EB 85, Annex 11*, version 06.0) will not be used, since there is no need to use it to describe the baseline scenario. Additionally the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* (EB 41, Annex 11, version 02) will not be applied since the CPAs will not involve on-site fossil fuel consumption.

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

The generic CPA meets the applicability criteria listed in the approved consolidated baseline and monitoring methodology ACM0002 (version 16.0) as shown below:

Applicability criteria	**Generic CPA justification**
This methodology is applicable to grid-connected renewable energy power generation project activities that: a) Install a Greenfield power plant b) Involve a capacity addition to (an) existing plant(s) c) Involve a retrofit of (an) existing operating plants/units d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or e) Involve a replacement of (an) existing plant(s)/unit(s).	The generic CPA is a grid connected renewable power generation project activity that falls under option (b) capacity addition Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description – EIA report – PPA / MoE&P letter
The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The generic CPA will install geothermal power plant, which are eligible technologies to use under this methodology. Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description – EIA report – PPA/ MoE&P letter
In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the	No capacity addition will take place within 5 years after the implementation of the existing plant. Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description

calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	– EIA report – PPA/ MoE&P letter
In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m^2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m^2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m^2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be: a. Lower than or equal to 15 MW; and b. Less than 10 per cent of the total installed capacity of integrated hydro power	n/a. CPA involves geothermal technology

project.	
In the case of integrated hydro power projects, project proponent shall: (a) Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project activity.	n/a. This is a Geothermal power plant
The methodology is not applicable to: (a) Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; (b) Biomass fired power plants/units.	This project is a geothermal project and does not include fuel switching or biomass. Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description – EIA report
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.	The most plausible baseline scenario is the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance Applicable evidence: – PoA-DD

In addition, the CPA meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9, version 05.0) as follows:

This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	CPAs under the PoA will supply electricity to the Kenya national grid. Applicable evidence will be either: – Prefeasibility Study/Feasibility study/Technical description – EIA report – PPA/ MoE&P letter
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	GEF calculation will not include off-grid capacities. Applicable evidence: – PoA-DD
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project electricity system is located in Kenya. Kenya is not an annex I country. Applicable evidence: – PoA-DD – See: www.unfccc.int
Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	n/a. This is a Geothermal plant

The CPA also meets the applicability criteria of the *Tool for the demonstration and assessment of additionality* (EB 70, Annex 8, version 07.0.0) as follows:

Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory.	The applied methodology ACM0002 (version 16.0) requires the application of either the *Tool for the demonstration and assessment of additionality* or the *Combined tool to identify the baseline scenario and demonstrate additionality.* The PP has opted to apply the former. Applicable evidence: – PoA-DD

The CPA also meets the applicability criteria of the *Methodological tool: Investment analysis (*EB 85, Annex 12, version 06.0*)* as follows:

This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario.	The applied methodology ACM0002 (version 16.0) uses the investment analysis for the demonstration of additionality and further requires the application of either the *Tool for the demonstration and assessment of additionality* or the *Combined tool to identify the baseline scenario and demonstrate additionality.* The PP has opted to apply the former, thus the Methodological tool: Investment analysis (v.06.0) is applicable. Applicable evidence: – PoA-DD – ACM0002 (v.16.0)
In case the applied approved baseline and monitoring methodology contains requirements for the investment analysis that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	For Geothermal projects, the requirements set out in the applied methodology ACM0002 (version 16.0) do not differ from the requirements as per the Methodological tool: Investment analysis (v.06.0): Applicable evidence: – PoA-DD – ACM0002 (v.16.0) – Methodological tool: Investment analysis (v.06.0):

The CPA further meets the applicability criteria of the *Tool to determine the remaining lifetime of equipment* (EB 50, Annex 15, version 01) as follows:

The tool provides guidance to determine the remaining lifetime of baseline or project equipment. The tool may, for example, be used for project activities which involve the replacement of existing equipment with new equipment or which retrofit existing equipment as part of energy efficiency improvement activities.	The tool will be applicable to CPAs, which carry out a capacity addition to an existing geothermal power plant/unit. The applicable methodology ACM0002 (v.16.0) requires the application of the *Tool to determine the remaining lifetime of equipment* Applicable evidence: – Prefeasibility Study/Feasibility study/Technical description – EIA report – PPA/ MoE&P letter

In order to determine the monitoring parameter related to the fraction of non-condensable gases, sampling will be carried out in accordance with ACM0002 (version 16.0) as described in the monitoring plan (section D.7.2) of the CPA-DD. section D.7.2. Sampling as per the CDM *Standard for Sampling and surveys for CDM project activities and programmes of activities* (version 05.0) is not required as the guidance outlined in the methodology has precedence to the procedures outlined in the standard.

B.3. Sources and GHGs

Source		Gas	Included	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal	CO_2	Yes	Main emission source
		CH_4	Yes	Minor emission source
		N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	n/a. CPA will not involve on-site fossil fuel consumption
		CH_4	No	n/a. CPA will not involve on-site fossil fuel consumption
		N_2O	No	n/a. CPA will not involve on-site fossil fuel consumption
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	n/a. CPA is a geothermal plant
		CH_4	No	n/a. CPA is a geothermal plant
		N_2O	No	n/a. CPA is a geothermal plant

The figure below presents a flow diagram physically delineating the project boundary of a typical geothermal energy CPA.[74]

[74] The figure is just an illustration of a typical geothermal project in Kenya and does not necessarily represent a specific CPA.

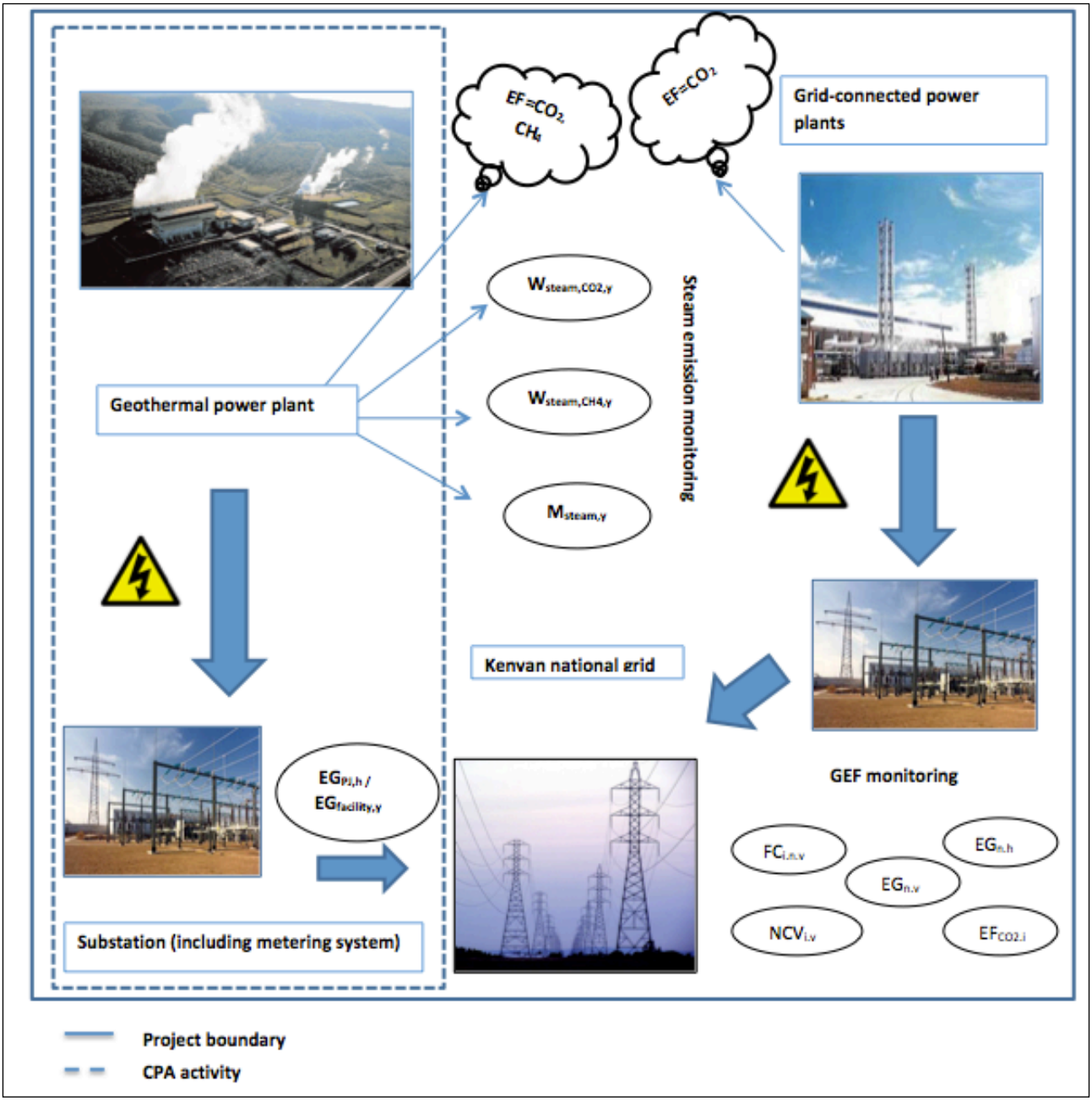

Figure 14: Flow Chart diagram

B.4. Description of baseline scenario

In accordance with approved consolidated baseline methodology ACM0002 (version 16.0) *Grid-connected electricity generation from renewable sources*, the baseline scenario for the installation of new grid-connected renewable power plant/units 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, as reflected in the combined margin (CM) calculations described in the "Tool to calculated the emission factor for an electricity system".*

Therefore, the baseline can be described as follows:

The Kenyan power sector policies and regulations[75]

The power sector falls under the Ministry of Energy (MoE) and is regulated by the Energy Regulatory Commission (ERC). The latter regulates the entire energy sector having replaced the Energy Regulatory Board (ERB) after repeal of the *Electric Power Act 1997* and consequent enactment of the *Energy Act 2006.* ERC is empowered to set, review and adjust tariffs for all persons who transmit or distribute electrical energy for sale and to ensure competition in the power sub-sector, where this is feasible, such as in the generation function. ERC seeks to protect consumer interests, guarantee economic and financial viability of sub-sector utilities, and enhance the confidence of consumers, investors and lenders in the Kenyan power sub-sector.

In October 2004, the Ministry of Energy (MoE) outlined the National Energy Policy in the Sessional Paper No. 4 of 2004 on Energy. Key elements of the National Energy Policy include:

- The establishment of a single independent energy regulator with adequate mandate to regulate all sector entities;
- The establishment of the Rural Electrification Authority to take over rural electrification functions from the Ministry of Energy;
- The establishment of a state-owned Geothermal Development Company (GDC) to be in charge of geothermal resource assessments and sell steam to power generation companies;
- Privatisation of KenGen over time starting with an initial public offering (IPO) of 30% of its equity through the Nairobi Stock Exchange;
- Direct sale of bulk power from power generation companies to bulk consumers, via the transmission network;
- Transfer of rural electrification assets to licensed distributors;
- Privatisation or concessioning of isolated power stations;
- Unbundling of Kenya Power and Lighting Company (KPLC)[76] into a state-owned transmission company and a private sector owned distribution company; and
- Creation of a domestic power pool with a provision for wholesale and retail markets.

The *Energy Act of 2006* (a consolidation of the *Electric Power Act 1997* and the *Petroleum Act 2000)* has set out the national policies and strategies for short to long-term energy development. The broad objective of the Energy Act is to ensure the provision of adequate, quality, cost-effective, affordable supply of energy while encouraging environmental conservation. The policy has identified a number of key challenges, including:

- Upgrading and expanding the current energy infrastructure;
- Promoting energy efficiency and conservation;
- Protection of environment;
- Mobilizing requisite financial resources;
- Ensuring security of supply through diversification of sources and mixes in a cost effective manner;
- Increasing accessibility of energy services to all segments of the population including rural electrification;
- Enhancing legal regulatory and institutional frameworks to create consumer and investor confidence;
- Enhancing and achieving economic competitiveness;

In 2008, the Ministry of Energy introduced a *Feed-in-Tariffs Policy on Wind, Biomass and Small-Hydro Resource Generated Electricity* in order to further spur the development of electricity generation projects from renewable sources in the country. The Feed-in-Tariffs Policy was

[75] The energy sector policy documents can be accessed at http://www.energy.go.ke/index.html; Website accessed on 25 May 2015

[76] Also know as Kenya Power (KP)

previously revised in January 2010 to also include feed-in-tariffs for electricity generated from geothermal, biogas and solar projects. In December 2012 the MoE published the 2nd revision of the Feed-in-Tariff policy, which is currently in place.
Since the announcement of the Feed-in-Tariffs Policy in 2008, only one project has been successfully developed under the policy, the Imenti Tea 0.3 MW small-hydro project.

Key players in the Kenyan power sector[77]

The key oversight agencies in the power sub-sector of Kenya are the Ministry of Energy (MoE) and the Energy Regulatory Commission (ERC). The Ministry of Energy is in charge of making and articulating energy policies to create an enabling environment for efficient operation and growth of the power sector, overseeing implementation of the rural electrification program and facilitating the mobilization of resources for investment in the sector. The Energy Regulatory Commission (ERC) was established under Section 4 of the Energy Act (2006) as a body corporate and as a successor to the Electricity Regulatory Board (ERB). It is responsible for regulation of the power subsector. The Energy Tribunal is an independent legal entity and was set up to arbitrate disputes in the sector.

An overview of the entities and structures of the Kenyan electricity sectors is shown below:

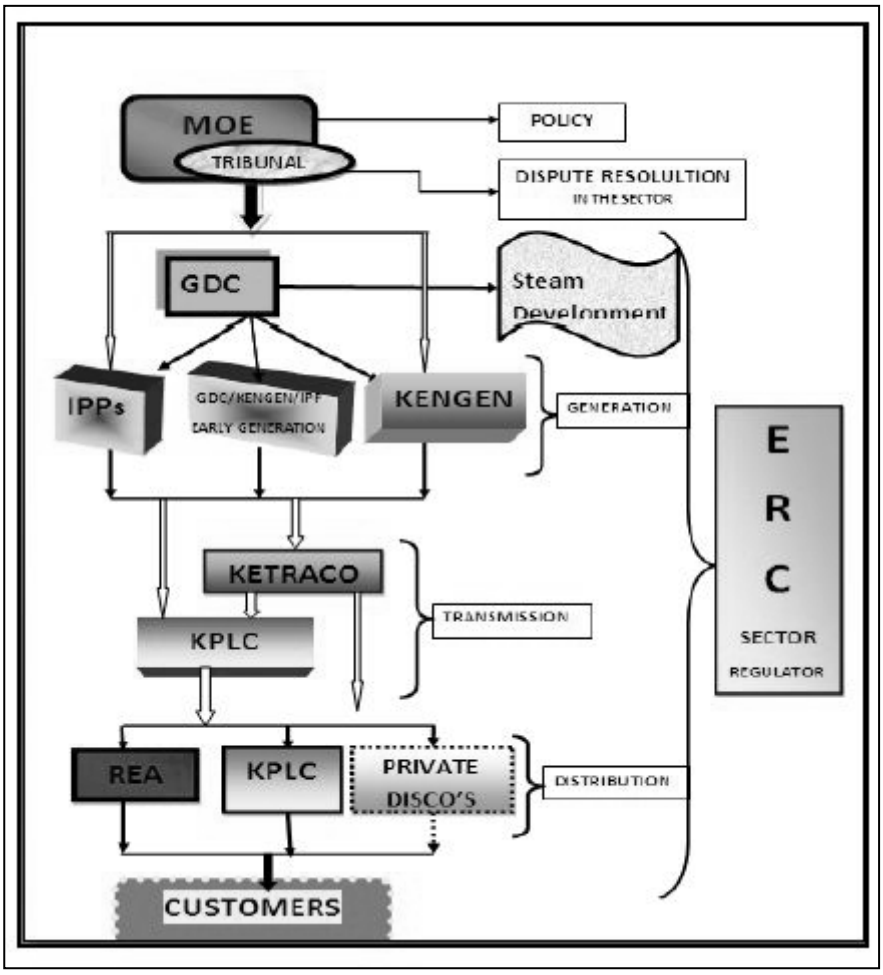

Figure 15: Structure of the Kenyan electricity sector

Generation

The Kenya Electricity Generating Company (KenGen) is a public company that is listed on the

[77] For further information, please see http://www.energy.go.ke/index.html and http://www.erc.go.ke/; Websites accessed on 25 May 2015

Nairobi Stock Exchange, whose main shareholder is the Government of Kenya with a 70% shareholding. KenGen is the biggest generation company with a total installed capacity of 1,229.16 MW as per 30 June 2013.[78]

The first Independent Power Producer (IPP) developments occurred on the heels of the *Electric Power Act* 1997, opening up the generation sector to private investment. At the time, there was an increase in power demand, hydrological conditions were becoming unfavourable and public funds to build power plants were insufficient and the sector was dominated by hydropower. All economically viable hydro sites had, however, been largely exploited and diversification became necessary both for drought mitigation and to meet growing demand.

Geothermal Development Company (GDC)[79], established in 2008, is a fully owned Government Special Purpose Vehicle (SPV) intended to undertake surface exploration of geothermal fields, undertake exploratory, appraisal and production drilling develop and manage proven steam fields and enter into steam sales agreements with investors in geothermal power. The GDC is not generating electricity itself but undertakes geothermal resource exploration and production and sells steam to generation companies.

As per 30 June 2013, the total installed capacity of power plants connected to the Kenyan national grid reached 1,740.36 MW. The grid-connected power plants consist of a mix of generation sources, including hydro, thermal and geothermal. An overview of all the power plants connected to the Kenyan grid as per 30 June 2013 is given in Appendix 7 KenGen is the biggest generator with an installed capacity of 1,229.16 MW. Independent Power Producers (IPP) have installed 391.2 MW and temporary emergency capacity installed by Aggreko currently contributes 120 MW.[80]

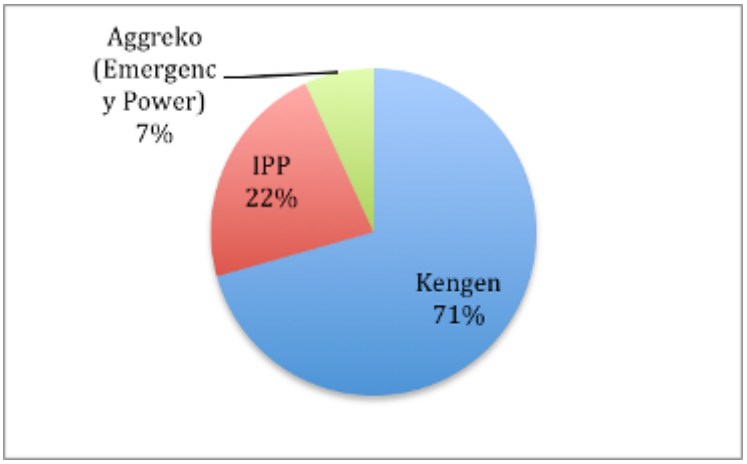

Figure 16: Generators connected to the Kenyan Grid June 2013

Table 18 below gives an overview of the installed capacity in Kenya, which has increased by approximately 34.47% over the last 6 years.[81]

Table 18: Installed capacity 2008-2013 (MW)[82]

	2008	2009	2010	2011	2012	2013
Hydro	737.25	737.25	757.85	763.15	812.2	816.35
Thermal	427	427.3	466	581.01	639.98	642.5

[78] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[79] http://www.gdc.co.ke/

[80] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[81] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[82] Kenya Power and Lighting Company Annual Report & Financial Statements 2008 - 2013

Geothermal	128	163	198	198	209.50	250.21
Biomass	2	2	26	26	26	26
Wind	0.35	0.35	5.45	5.1	5.1	5.3
Total	**1,294.6**	**1,329.9**	**1,453.3**	**1,573.26**	**1,692.78**	**1,740.36**

The thermal power plants connected to the national grid are powered by various fuels such as diesel, kerosene and heavy fuel oil (HFO), which have to be imported. An overview of grid-connected, fossil fuel based power plants is given in Table 19 below.

Table 19: Fossil fuel based power plants[83]

Power Plant	Ownership	Fuel Type
Kipevu I Diesel	KenGen	HFO
Kipevu / Embakasi GT1	KenGen	Kerosene
Kipevu / Embakasi GT2	KenGen	Kerosene
Kipevu III Diesel	KenGen	HFO
Tsavo Diesel	IPP	HFO
Iberafrica	IPP	HFO
Iberafrica 2 (Additional 52.5 MW)	IPP	HFO
Aggreko Embakasi 6	EPP	AGO
Aggreko Embakasi 7	EPP	AGO
Aggreko Muhoroni	EPP	AGO
Rabai Power	IPP	AGO

Table 20 below shows the generated electricity by the different generation sources as recorded in the year July 2012 – June 2013.[84]

Table 20: Electricity generation sources for the year July 2012 - June 2013 (GWh)[85]

Technology	Generation (GWh)	%
Hydro	4,299	53.80%
Thermal	2,007	25.12%
Geothermal	1,600	20.02%
Biomass	71	0.89%
Wind	14	0.17%
Total	**7,991**	**100.00%**

Electricity generation from hydro sources accounted for approximately 53.8% of total electricity generation, followed by thermal (25.12%) and geothermal (20.02%). Biomass and wind capacities have only a minor share in the power sector by now.

[83] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[84] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[85] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

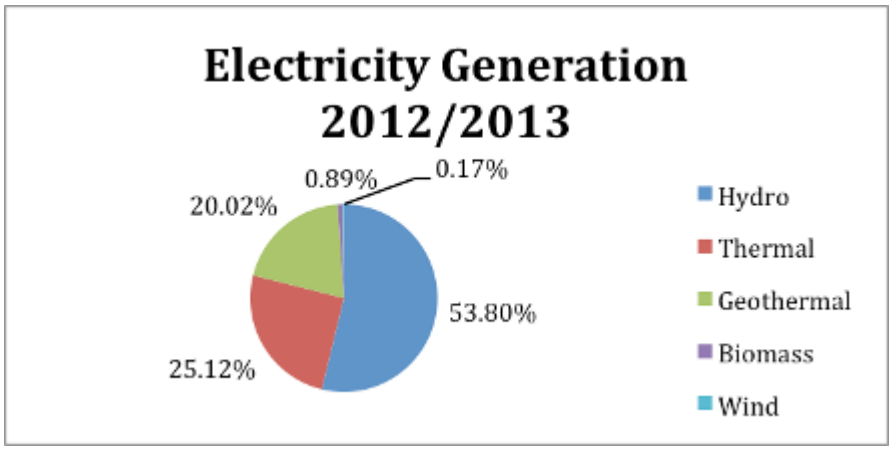

Figure 17: Electricity generated 2012/2013 by source

In the medium term, Kenya is expected to increase its generation capacity to 6,762 MW by 2017. Several power generation projects are at various stages of development by KenGen and Independent Power Producers (IPPs). See Figure 18 for an overview of the planned additions of new generation sources.[86]

[86] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

Planned generation projects (2014–2017)

Year	Name	Type	Added capacity MW	Cumulative total system capacity (MW)
2014	Kindaruma upgrade	Hydopower	24	
	Thika diesel	Diesel	87	
	OrPower 4	Geothermal	16	
	Olkaria IV unit 1	Geothermal	70	
	Triumph Power	Diesel	80	
	Gulf Power	Diesel	83	
	Olkaria IV unit2	Geothermal	70	
	Olkaria I unit 4	Geothermal	70	
	Olkaria wellheads	Geothermal	40	
	Agreko	Emergency Diesel	-90	2,114
2015	Menengai modular units	Geothermal	90	
	Menengai wellheads	Geothermal	50	
	Olkaria I unit 5	Geothermal	70	
	Olkaria wellheads	Geothermal	30	
	Ngong I phase II	Wind	6.8	
	Ngong II	Wind	13.6	
	Kwale Sugar	Cogeneration	18	
	Mombasa gas turbines	Natural Gas	700	
	Aelous	Wind	60	3,152
2016	Menengai	Geothermal	100	
	Silali I	Geothermal	150	
	Isiolo	Wind	100	
	MSD KenGen (fuel switch)	Diesel	-175	
	MSD IPP (fuel switch)	Diesel	-175	
	Mombasa LNG (fuel switch)	Natural Gas	350	
	Coal	Coal	960	
	Lake Turkana	Wind	150	
	Lake Turkana	Wind	150	
	Kipeto	Wind	100	
	Prunus	Wind	50	
	Suswa	Geothermal	35	
	Olkaria unit 6	Geothermal	70	5,017
	Menengai	Geothermal	400	
2017	Olkaria VI	Geothermal	140	
	Baringo	Geothermal	140	
	Suswa	Geothermal	35	
	Silali II	Geothermal	70	
	Coal	Coal	960	6,762

Figure 18: Planned grid capacity additions until 2017

A more long-term view of the development of electricity generation capacity in the country is given in the *Updated Least Cost Power Development Plan for the Study Period 2011-2031.* According to the plan, Kenya's peak demand will be between 12,738 and 22,985 MW in 2031, which means that the current peak load is expected to grow 12 times. Candidate generation resources considered in the system expansion plan include geothermal, hydro, wind, coal, oil fired plants and nuclear power plants. More detailed information on the long-term plans is given in Appendix 7 of this document.

Transmission and Distribution

The Kenya Power and Lighting Company (KPLC) is the sole off-taker and distribution company supplying all consumers/costumers connected to the grid. It is further responsible for electricity transmission through all existing transmission and distribution systems in Kenya. The transmission system comprises 220kV, 132kV and 66kV transmission lines. KPLC is a listed company on the Nairobi Stock Exchange with the ownership structure being 50.1% by the National Social Security Fund (NSSF) and the Government of Kenya whereas the private shareholders own 49.9%.

Kenya Electricity Transmission Company (KETRACO)[87] was incorporated in December 2008 as a State Corporation, 100% owned by the Government of Kenya. The Mandate of the KETRACO is to

[87] http://www.ketraco.co.ke/; Accessed on 25 May 2015

plan, design, construct, own, operate and maintain new high voltage (132kV and above) electricity transmission infrastructure that will form the backbone of the National Transmission Grid & regional inter-connections. It is expected that this will also facilitate evolution of an open- access- system in the country.

The Rural Electrification Authority (REA)[88] is charged with the mandate of implementing the Rural Electrification Programme and came into operation in July 2007. The objective of the rural electrification programme, which is financed by the Government, is to provide electricity in areas that are far from the national electricity grid, and where electricity supply projects are not commercially viable.

B.5. Demonstration of eligibility for a generic CPA

The following eligibility criteria have been formulated for each of type of CPA based on the requirements outlined in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programmes of Activities* CDM- EB65-A03-STAN, version 04.0 (EB 87, Annex 03) as per the requirements outlined in section B1. of the PoA-DD.

CPA TYPE II: Geothermal power plant/unit (Capacity addition)

Topic	Eligibility criteria	Documentary/Evidence
1. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA **(a)**	The geographic boundary of the CPA is located in the geographical boundary of the PoA as indicated in section A.5. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description and or correspondence with entities of the Kenyan Government.	Verifiable evidence are either: – EIA report – Prefeasibility Study/Feasibility study/Technical description – Governmental letters
2a) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CPA implementing entity will confirm that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.	Verifiable evidence are either: – Signed confirmation by CPA implementing entity – CPA PoA participation agreement
2b) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM	Verifiable evidence are either: – Signed confirmation letter from the CME and CDM website

[88] http://www.rea.co.ke/; Accessed on 25 May 2015

	project. This will be evidenced by a signed confirmation letter from the CME. Every CPA will furthermore have a unique identification number.	check – CPA-DD
2c) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CPA will provide a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.	Verifiable evidence are either: – Project map – EIA report – Prefeasibility Study/Feasibility study/Technical description
2d) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo) **(b)**	The CME will check and confirm that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM projects within the geographical boundary. This will be evidenced by a signed confirmation letter from the CME.	– Signed confirmation letter from the CME and CDM website check
3a) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The CPA will involve the implementation of a capacity addition geothermal power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
3b) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The generator technology shall be certified to IEC 60034-1 and the turbine to IEC 60045-1 standards. This will be evidenced by the IEC certificates. If at the time of the inclusion of the CPA, the certificates are not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.	Verifiable evidence are either: – Certification certificate – CPA PoA participation agreement – Signed letter by the CPA implementing entity
3c) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The installed capacity of the CPA will be minimal 35 MW and not more than 70 MW per grid connection point. This is in line with the revised *Feed-in-tariff policy* of 2012. The installed capacity will be	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report

	based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report.	
3d) The specifications of technology/ measure including the level and type of service, performance specifications including compliance with testing/ certifications **(c)**	The CPA will have a net load factor below or equal to 98%.[89] The top range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a geothermal project can be developed. This figure is also confirmed by the 2011 report by the International Energy Agency.[90]	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – PPA / MoE&P letter – EIA report
4. Conditions to check the start date of the CPA through documentary evidence **(d)**	The start of the CPA occurs after 23/05/2013, when MPG submitted CDM Prior Consideration. This will be evidenced by the exploration well-drilling contract or any other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 23/05/2013.	Verifiable evidence are either: – Contract with the drilling company – Substantial agreement e.g. lending agreement – UNFCCC website to show PoA start date
5. Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs **(e)**	The CPA will confirm its compliance with the applicability of ACM0002, (version 16.0) in section D.2 of the specific CPA-DD	See evidence required as per section D.2 of the specific CPA-DD.
6. The conditions that ensure that the CPA meets the requirements pertaining to the demonstration of additionality as specified in section 3.1 above **(f)**	The CPA will prove to be additional by being eligible to criteria 12-16.	– See verifiable evidence for eligibility criteria 12-16
7a.) The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis **(g)**	An Environmental Impact Assessment shall be carried out on the CPA level in line with Kenyan regulations as outlined in section E.1 of the PoA-DD. A local stakeholder consultation is carried out in accordance with	Sections C of the CPA-DD and section F of the PoA DD Verifiable evidence are either: – PoA Stakeholder consultation report – EIA report

[89] This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[90] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7

	CDM requirements and (if available) DNA requirements on PoA level for the whole concession area. Therefore no additional CDM stakeholder consultation will have to be carried out on CPA level. However, additional stakeholder consultations might have to be carried out for each CPA as part of the EIA process.	
7b.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has not received funding from Annex I parties, it will confirm so by issuing a signed confirmation letter.	Verifiable evidence are either: – Signed confirmation letter by the CPA implementing entity
7c.) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance **(h)**	In case the CPA implementing entity has received funding from Annex I parties, a letter will be provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.	Verifiable evidence are either: – ODA declaration letter
8. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation) **(i)**	The CPA will be connected to the Kenyan electricity grid. This will be evidenced through the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – Power Purchase Agreement / MoE&P letter – EIA report – Grid connection study
9. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities" **(j)**	The *Standard for Sampling and Surveys for CDM Project Activities and Programmes of Activities* (version 05.0), mentions that sampling requirements outlined in the applicable methodology are precedent. Sampling will therefore be carried out in line with ACM0002 (version 16.0)	Sampling will be carried out as per the applied methodology ACM0002 (version 16.0). Verifiable evidence: – Section B.3 of the PoA-DD – CME Manual
10. Where applicable, the conditions that ensure that every CPA meets the smallscale or microscale threshold and remains within those thresholds throughout the crediting period of the CPA. However, for a CPA that consists of only units that	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology ACM0002 (version 16.0). Therefore no small- or micro-scale threshold shall be applied.	See methodology section D.2 of the specific CPA-DD

qualify as 'microscale CDM units' as defined in the methodological tool "Demonstration of additionality of microscale project activities", this condition is not required **(k)**		
11. Where applicable, the requirements for the debundling check, in case the CPA belongs to small-scale or microscale project categories. However, if a CPA solely consists of 'microscale CDM units', the requirement regarding debundling is not applicable (l)	This eligibility criterion shall not be applicable as the PoA applies the large-scale methodology ACM0002 (version 16.0). Therefore no debundling shall be applied.	See methodology section D.2 of the specific CPA-DD

Eligibility criteria related to step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Topic	Eligibility criteria	Documentary/Evidence
12a) Identification of alternative scenarios	The CPA will identify that the alternative to the CPA implementation, is that electricity delivered to the Kenyan national 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, or the project activity being undertaken not as a CDM project.	Verifiable evidence: - CPA - DD
12b) Identification of alternative scenarios	The CPA will confirm that both alternatives are consistent with mandatory laws and regulations.	Verifiable evidence: - List of applicable laws

Eligibility criteria related to step 2: CPA investment analysis:

Topic	Eligibility criteria	Documentary/Evidence
13a) Benchmark	The CPA will carry out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet	Verifiable evidence: - Investment analysis
13b) Benchmark	The CPA will apply (a) the post-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR. This will be evidenced through the investment analysis spread sheet.	Verifiable evidence: - Investment analysis

Topic	Eligibility criteria	Documentary/Evidence
14a) Financial indicator	Without the CER revenue, the CPA will have a less favorable Project IRR or Equity IRR, whichever is applicable,	Verifiable evidence: - Investment analysis - Relevant references

	than the benchmark. This will be evidenced in the investment analysis spreadsheet and the relevant references.	
14b) Financial indicator	All input values applied in the investment analysis will be applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.	Verifiable evidence: - Relevant references
14c) Financial indicator	The time of the investment decision will be either the date on which the expected plant load factor has become available to the board based on which the board has decided to proceed with the drilling of exploration wells, or the date on which the board has decided to proceed with the drilling of production wells based on the resource results of the exploration wells, which is considered as significant commitment towards the implementation of the project. This will be evidenced by the resource assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project	Verifiable evidence are either: - CPA implementing entity Board resolution - Drilling contract - Resource assessment study

Sub-step 2d: Sensitivity analysis

Topic	**Eligibility criteria**	**Documentary evidence**
15a) Sensitivity analysis	The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis: • Investment cost • Electricity generation • Operating and maintenance cost • Tariff	Verifiable evidence: - Sensitivity analysis
15b) Sensitivity analysis	The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis	Verifiable evidence: - Sensitivity analysis

	spread sheet and specific CPA-DD.	

Step 4: Common practice analysis

Topic	Eligibility criteria	Documentary evidence
16) Common practice analysis	When following steps 1 – 5 of the *methodological tool: Common Practice* (version 03.1), it can be concluded that the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from KPLC, KenGen and/or the Ministry of Energy (MoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.	Verifiable evidence: - Common practice analysis and applicable references

Eligibility criteria derived from clause 68 of the applied methodology ACM0002 (version 16.0):

Topic	Eligibility criteria	Documentary/Evidence
17a) Technical and economic parameters	*Ranges of load factors:* Only CPAs with a net load factor below or equal to 98% will be eligible under the PoA. This top range is based on geothermal projects that have been registered under the CDM and, therefore, provides a realistic maximum load factor, which a geothermal power plant projects can apply. This figure is confirmed by the 2011 report by the International Energy Agency.[91]	Verifiable evidence are either: – Prefeasibility Study/Feasibility study/Technical description – EIA report and – Investment analysis
17b) Technical and economic parameters	*Sizes of installation:* The CPAs will have an installed capacity from 35 MW of up to 70 MW per grid connection point This is in line with the feed-in policy of the Ministry of Energy.	Verifiable evidence are either: – Feasibility study – EIA report and – Investment analysis
17c) Technical and economic parameters	*Tariffs and PPA:* The CPA will use a non-inflated tariff[92] of not more than 88 USD/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years, or whenever the tariff is updated under the Kenyan FiT policy or other relevant government regulation, whichever	Verifiable evidence are either: – MoE approval letter – FiT policy and – Investment analysis

[91] 'Technology Road Map: Geothermal Heat and Power'. International Energy Agency (2011) p.7 This is in line with other registered CDM projects, e.g. http://cdm.unfccc.int/Projects/DB/DNV-CUK1135673240.22/view and http://cdm.unfccc.int/Projects/DB/RWTUV1252941041.99/view

[92] Base year is 2012, when the most recent FiT policy was updated.

	occurs first. The PPA will be with Kenya Power since Kenya currently follows a single-buyer market model or with another private consumer through a wheeling agreement.	
17d) Technical and economic parameters	*Depreciation:* The CPA will apply the applicable depreciation rates in the investment analysis as provided by the Kenyan regulations with regard depreciation. At the time of writing the PoA DD, the depreciation for energy projects is straight-line depreciation. The applicable depreciation will be updated every two years, or whenever the applicable depreciation rates in Kenya change, whichever occurs earlier.	Verifiable evidence: – Investment analysis
17e) Technical and economic parameters	*Taxes:* The CPA will apply a tax rate of 30% in the investment analysis, which is the Kenyan corporate tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years, or whenever the tax regulations in Kenya change, whichever occurs earlier.	Verifiable evidence: – Investment analysis – Corporate tax rate
17f) Technical and economic parameters	*Other parameters determining market circumstances:* Applicable inflation rates will be determined as follows: • The inflation forecast by the central bank of Kenya, European Central Bank, US FED for the duration of the CPA crediting period • The target inflation of the Central Bank of Kenya, European Central Bank, US FED at the time of investment decision • The average forecasted inflation rate for Kenya, EU and USD published by the IMF or the World Bank for the next five years after start of the CPA Applicable exchange rates will be determined as follows: • The applicable exchange rates reported by Kenyan Central Bank on the date of the investment decision will be used.	Verifiable evidence are either: - Central Bank of Kenya - European Central Bank - US FED - World Bank or IMF and - Investment analysis
17g) Technical and	*Subsidies or other financial flows*	Verifiable evidence:

economic parameters	If applicable at the time of investment decision, the CPA will include any relevant subsidies or other financial flows in the investment analysis. The CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	– Investment analysis – CPA confirmation letter

18a) Ranges of costs and revenues	*Capital investment:* Only CPAs applying a CAPEX exceeding 1.9 million USD/MW will be eligible under the PoA. This CAPEX figure has been derived from the 2014 report by Ren21 [93] According to the source, this figure represents the lower bound for CAPEX investment costs of Greenfield geothermal power plants.	Verifiable evidence: – Investment analysis – Applicable references
18b) Ranges of costs and revenues	*Operating & maintenance costs:* Only CPAs applying O&M costs exceeding 100 USD/kW will be eligible under the PoA. This OPEX figure has been derived from the 2012 report by IRENA.[94] According to the source, this figure represents the lower bound for OPEX costs of geothermal power plants.	Verifiable evidence: – Investment analysis – Applicable references
18c) Ranges of costs and revenues	*Electricity revenues:* All revenues from electricity sales as per the applicable tariff will be included in the financial analysis	Verifiable evidence: – Investment analysis – PPA / Tariff letter
18d) Ranges of costs and revenues	*Subsidies or other fiscal incentives:* Any additional subsidies or other types of financial incentives that affect that financial attractiveness of the CPA shall be included in the financial analysis. The CPA implementing entity will sign a letter that all relevant subsidies have been taken into account.	Verifiable evidence: – Investment analysis – CPA confirmation letter
18e) Ranges of costs and revenues	*ODA:* If the CPA is supported by ODA finance, it shall include this financing in the investment analysis.	Verifiable evidence are either: – ODA declaration form – CPA confirmation letter and – Investment analysis

[93] REN21 (2014) Renewables 2014 – Global Status Report

[94] IRENA (2013) *Renewable Energy Generation Cost in 2012: An Overview.* p.74

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

B.6.1. Explanation of methodological choices

The PoA will include geothermal energy projects activities that are grid-connected geothermal power plant/unit implemented as a capacity addition to an existing geothermal power plant/unit (capacity addition). The baseline scenario is the existing facility that would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$), and electricity delivered to the grid by the added capacity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system (*EB 87, Annex 9, version 05.0). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur.

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 05.0)

Project emissions
The emissions shall be accounted for, by using **(equation 1)** from ACM0002 (version 16.0):

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

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

Project Emissions from Fossil Fuel Combustion ($PE_{FF,y}$)
No on-site fossil fuel consumption will take place.

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

$PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 (version 16.0), as follows:

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

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$w_{steam,CO2,y}$	=	Average mass fraction of CO_2 in the produced steam in year *y* (tCO_2/t steam)

$w_{stean,CH4,y}$ = Average mass fraction of CH_4 in the produced steam in year *y* (tCH_4/t steam)

GWP_{CH4} = Global warming potential of CH_4 valid for the relevant commitment period (tCO_2e/tCH_4)

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

According to the methodology, the default value for GWP_{CH4} is used, 25 tCO_2e/CH_4.

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)
Not applicable. The PoA will only involve geothermal technology.

Baseline Emissions
Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The baseline emissions are to be calculated as follows **(equation 7 of ACM0002 v.16.0)**:

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

Where:

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

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

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

Calculation of $EG_{PJ,y}$
Since the existing power plant and the added capacity apply geothermal power technology, the addition of capacity to an existing unit might impact the electricity generation of the existing unit.

$EG_{PJ,y}$ is therefore calculated as follows **(equation 10)** and **(equation 11)** of ACM0002 (version 16.0):

$$EG_{PJ,y} = EG_{facility,y} – (EG_{historial} + ó_{historical}); \text{ until } DATE_{BaselineRetrofit}$$

and

$$EG_{PJ,y} = 0; \text{ on/after } DATE_{BaselineRetrofit}$$

Where:

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

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

$EG_{historical}$ = Annual average historical net electricity generation delivered to the grid by the existing renewable energy plants/units that was operated at the project site prior to the implementation of the project activity (MWh/yr)

$ó_{historical}$ = Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy power plants/units that was operated at the project site prior to the implementation of the project activity (MWh/yr)

$DATE_{BaselineRetrofit}$ = Point in time when the existing equipment would need to be replaced in the absence of the project activity (date). This only applies to retrofit or replacement projects

In case $EG_{facility,y}$ < (EGhistorical + $ó_{historical}$) in a year then **(equation 12):**

$EG_{PJ,y}=0$

Project participants may choose among the following two time spans of historical data to determine $EG_{historical}$:

(a) The five last calendar years prior to the implementation of the project activity; or
(b) The time period from the calendar year following $DATE_{hist}$, up to the last calendar year prior to the implementation of the project, as long as this time span includes at least five calendar years, where $DATE_{hist}$ is latest point in time between:

(i) The commercial commissioning of the plant/unit;
(ii) If applicable: the last capacity addition to the plant/unit; or
(iii) If applicable: the last retrofit or rehabilitation of the plant/unit.

Calculation of $DATE_{BaselineRetrofit}$

In order to estimate the point in time when the existing equipment would need to be replaced/retrofitted in the absence of the CPA ($DATE_{BaselineRetrofit}$), project participants may take into account the typical average technical lifetime of the type equipment, which shall be determined and documented as per the *Tool to determine the remaining lifetime of equipment (v.01),* as follows:

(a) Use manufacturer's information on the technical lifetime of equipment and compare to the date of first commissioning;
(b) Obtain an expert evaluation;
(c) Use default values.

The selected option will be justified and documented in the specific CPA.

The point in time when the existing equipment would need to be replaced/retrofitted in the absence of the project activity will be chosen in a conservative manner that is, if a range is identified, the earliest date will be chosen

Calculation of $EF_{grid,CM,y}$
The emission factor is 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* (EB 87, Annex 9, version 05.0)

The procedures applied to calculate the grid emission factor for Kenyan electricity system are described as below. The procedures to calculate the GEF will be updated after every seven years of the duration of the PoA.

Step 1. Identify the relevant electric power system
For determining the grid emission factor, the project activity has identified the Kenyan national grid as the relevant project electricity system. The identification of the Kenyan national electricity grid as the relevant project electricity system is based on the following arguments:

- The Kenyan DNA has not published a delineation of the project electricity system and connected electricity systems.

- There are no connected electricity systems because: The Uganda – Kenya transmission line (Lessos –Musaga line) has a capacity of 64 MW. While the Kenyan grid system has an installed capacity of 1,740.36 the Uganda grid has an installed capacity of 837 MW. This is based on a UNECA (2014) report, which states the Ugandan grid capacity to be 822 MW.[95] The report states that 822 MW consists among other plants of small hydro power plants with a total capacity of 50 MW. A 2014 report published by the Ugandan electricity market regulator ERA however mentions that the total capacity of small hydro power plants in the country stands at 65 MW.[96] The additional small hydro-power capacity of 15 MW, which is not reflected in the UNECA report, is therefore added to the 822 MW stated by UNECA. This leads to a total grid capacity of 837 MW. Following the argument in the *Tool to calculate the emission factor for an electricity system,* version *05.0*, the transmission capacity of the transmission line that is connecting the electricity systems (i.e. Lessos Musaga line) is less than 10 per cent of the installed capacity of the Ugandan grid system (Uganda grid system has a smaller capacity than the Kenyan grid system) i.e. (64/837) = 7.65%. Furthermore the latest annual reports and statements published by Kenya Power for the period ending June 2013[97] shows that imports to Uganda, were 30 GWh in comparison with a total electricity generation of 7,586.4 GWh. This is approximately 0.47% of the generated electricity in the Kenyan grid system and therefore can be considered as insignificant.
  According to the same Kenya Power Report, Kenya exported 1 GWh hours of electricity in the year 2012- 2013 to Tanzania. This is also very insignificant compared with the total Kenya electricity generation of 7,991 GWh. There is a line connecting Kenya to Tanzania, however the amount of electricity imported to the Kenyan electricity system is "insignificant" as shown above. (see Updated Least Cost Power Development Plan. Study Period 2011-2031, p. 45) The Tanzania-Kenya line is furthermore not to be considered a transmission line per se since it connects power to one customer.

- Finally, Kenya does not have a layered dispatch system and the country has only one grid system that serves the entire country. Therefore, and in line with the *Tool to calculate the emission factor for an electricity system* (EB 87, Annex 9, version 05.0), the national grid definition is used by default since there are no regional grids.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)
The project activity has selected Option I, only grid power plants were included in the calculation.

Step 3. Select a method to determine the operating margin (OM)
The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

- Simple OM
- Simple adjusted OM
- Dispatch data analysis OM
- 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.[98]

[95] UNECA (2014). Energy Access and Security in Eastern Africa, p. 50

[96] http://www.era.or.ug/index.php/2013-12-14-14-58-04/sector-reports p.8

[97] Kenya Power and Lighting Company (2013) Annual Report & Financial Statements 2012/2013

[98] As shown in table 18, low-cost/must-run power plants (i.e. hydro power plants and geothermal power plants) generated > 50% during the last 5 years

The Dispatch Data Analysis OM method was used to calculate the operating margin because hourly dispatch data is available.

In terms of data vintage, the projects under this PoA will use the *ex post* data vintage for carrying out the Dispatch Data Analysis and will update the operating margin emission factor annually during monitoring using data for the year in which the project activity displaces grid electricity.

Step 4: Calculate the operating margin emission factor according to the selected method
The dispatch data analysis OM emission factor ($EF_{grid,OM\text{-}DD,y}$) is determined based on the grid power units that are actually dispatched at the margin during each hour *h* where the project is displacing grid electricity. **(Equation 12)** of the *Tool to calculate the emission factor for an electricity system* (v.5.0) as shown below is used:

$$EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \times EF_{EL,DD,h}}{EG_{PJ,y}} \quad \textbf{(12)}$$

Where:

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

Since hourly fuel consumption data is not available, the hourly emission factor ($EF_{EL,DD,h}$) is calculated based on the energy efficiency of the grid power unit and type of fuel used using **(equation 14)** of the *Tool to calculate the emission factor for an electricity system* (v.5.0) as shown below:

$$EF_{EL,DD,h} = \frac{\sum_n EG_{n,h} \times EF_{EL,n,y}}{\sum_n EG_{n,h}} \quad \textbf{(14)}$$

Where:

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

Determination of $EF_{EL,n,y}$
Since annual data on fuel consumption and electricity generation is available, Option A1 i.e. (**equation 4**) of the *Tool to calculate the emission factor for an electricity system* (v.5.0), was used to calculate the CO_2 emission factor for each grid power unit *n* at the top of the dispatch ($EF_{EL,n,y}$) as shown below:[99]

[99] In equation 2, *m* has been replaced by *n,* in order to reflect that $EF_{El,n,y}$ is being calculated rather than $EF_{El,m,y}$

$$EF_{EL,n,y} = \frac{\sum_i FC_{i,n,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{n,y}} \quad \textbf{(4)}$$

Where:

$EF_{EL,n,y}$	=	CO_2 emission factor of power unit *n* in year *y* (tCO_2/MWh)
$FC_{i,n,y}$	=	Amount of fuel type *i* consumed by power unit *n* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel type *i* in year *y* (tCO_2/GJ)
$EG_{n,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *n* in year *y* (MWh)
n	=	Grid power units in the top of the dispatch (as defined below)
i	=	All fuel types combusted in power unit *n* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

The group of power units in the top of the dispatch is selected based on the merit order that Kenya Power and Lighting Company (KPLC) provides on a monthly basis. KPLC determines the merit order using the cost of buying electricity from the different power plants in the previous month.

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

For the calculation of the build margin (BM) emission factor, Option 2 data vintage was chosen where for the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as per Option 1 described in *Tool to calculate the emission factor for an electricity system* (v5.0). For the third crediting period, the build margin emission factor calculated for the second crediting period should be used

During the first crediting period, the BM will therefore be updated annually.

The sample group of power units *m* used to calculate the build margin was determined as per the following procedure:

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. $SET_{\geq 20\%}$ does not include power units, which started to supply electricity to the grid more than 10 years ago thus steps (d), (e) and (f) are ignored.

The build margin emission factor is calculated using **(equation 15)** of the *Tool to calculate the emission factor for an electricity system*, as shown below:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(15)}$$

Where:

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

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) was determined as per the guidance in step 4 (a) for the simple OM, using **equation (4)** of the *Tool to calculate the emission factor for an electricity system* (v.5.0) 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.

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}} \quad \textbf{(4)}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fuel *i* in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	The power units included in the build margin
i	=	All fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 5

Step 6: Calculate the Combined Margin

Option A i.e. the weighted average combined margin is used.

The combined margin emissions factor is calculated using **(equation 16)** of the *Tool to calculate the emission factor for an electricity system* (v.5.0) as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \textbf{(16)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,CM,y}$	=	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
W_{OM}	=	Weighting of operating margin emissions factor (%)
W_{BM}	=	Weighting of build margin emissions factor (%)

In accordance with *Tool to calculate the emission factor for an electricity system* (v.5.0), during the first crediting period, the following default values will be used for W_{OM} and W_{BM}:

W_{OM} = 0.5
W_{BM} = 0.5

In accordance with the *Tool to calculate the emission factor for an electricity system* (v.5.0), during the 2nd and the 3rd crediting period, the following values will be used:

W_{OM} = 0.25
W_{BM} = 0.75

Emission reductions

In line with ACM0002 (version 16.0) the emission reductions are calculated using **(equation 13)** as follows:

$$ER_y = BE_y - PE_y$$

Where:

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

BE_y = Baseline Emissions in year y (tCO_2/yr)

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

B.6.2. Data and parameters fixed ex-ante

Data / Parameter:	**$EG_{historical}$**
Data unit:	MWh/yr
Description:	Annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data:	Data will be collected by CPA implementing entity
Value(s) applied:	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures:	Electricity meters
Purpose of data	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**$\sigma_{historical}$**
Data unit:	MWh/yr
Description:	Standard deviation of the annual average historical net electricity generation delivered to the grid by the existing renewable energy plant that was operated at the project site prior to the implementation of the project activity
Source of data:	Calculated from data used to establish $EG_{historical}$
Value(s) applied:	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures:	Parameter to be calculated as the standard deviation of the annual generation data used to calculate *EGhistorical* for retrofit, or rehabilitation or replacement project activities
Purpose of data	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**$DATE_{BaselineRetrofit}$**
Data unit:	Date
Description:	Point in time when the existing equipment would need to be replaced in the absence of the project activity
Source of data:	Data will be determined by CPA implementing entity
Value(s) applied:	To be reported in the specific CPA-DD

Choice of data or Measurement methods and procedures:	As per the *Tool to determine the remaining lifetime of equipment (v.01*), as follows: (a) Use manufacturer's information on the technical lifetime of equipment and compare to the date of first commissioning; (b) Obtain an expert evaluation; (c) Use default values. The selected option will be justified and documented in the specific CPA. The point in time when the existing equipment would need to be replaced/retrofitted in the absence of the project activity will be chosen in a conservative manner that is, if a range is identified, the earliest date will be chosen
Purpose of data	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**$DATE_{hist}$**
Data unit:	Date
Description:	Point in time from which the time span of historical date for retrofit, rehabilitation or replacement project activities may start
Source of data:	Data will be determined by CPA implementing entity
Value(s) applied:	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures:	$DATE_{hist}$ is the latest point in time between: (i) The commercial commissioning of the plant/unit; (ii) If applicable: the last capacity addition to the plant/unit; (iii) If applicable: the last retrofit/rehabilitation of the plant
Purpose of data	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**The percentage share of total installed capacity of the specific technology**
Data unit:	%
Description:	The percentage share of total installed capacity of the specific technology in the total installed grid connected power generation capacity in the host country
Source of data:	National statistics or other official data
Value(s) applied:	To be specified in the Specific CPA-DD
Choice of data or Measurement methods and procedures:	National statistics or other official data
Purpose of data	-
Additional comment:	-

Data / Parameter:	**The total installed capacity of the technology**
Data unit:	MW
Description:	The total installed capacity of the technology in the host country
Source of data:	National statistics or other official data
Value(s) applied:	To be specified in the Specific CPA-DD
Choice of data or Measurement methods and procedures:	National statistics or other official data
Purpose of data	-
Additional comment:	-

B.6.3. Ex-ante calculations of emission reductions

Project emissions
These emissions shall be accounted for, by using the following equation from ACM0002 (version 16.0):

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

Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$) $PE_{GP,y}$ will be calculated using equation (2) in ACM0002 (version 16.0), as follows:

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

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}	25	tCO_2e/tCH_4	Default value
$M_{Steam,y}$	[insert value]	[insert unit]	[insert source]
$PE_{GP,y}$	[insert value]	[insert unit]	[insert source]

Total Project Emission for the project activity equal $PE_{GP,y}$ since the CPA will not involve on-site fossil fuel consumption:

$PE_y = PE_{GP,y}$ =[insert value]

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

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

$EG_{PJ,y}$ equals [insert number] MWh and $EF_{grid,CM,y}$ equals [insert number] tCO_2/MWh. Therefore BE_y equals [insert number] tCO_2.

The addition of a new power plant or unit will affect the electricity generated by the existing plant(s) or unit(s),

$EG_{PJ,y}$ is calculated as per **(equation 10)** and **(equation 11)** of the methodology ACM0002 (v.16.0):

$EG_{PJ,y} = EG_{facility,y} – (EG_{historial} + ó_{historical})$; *until* $DATE_{BaselineRetrofit}$

and

$EG_{PJ,y} = 0$; *on or after* $DATE_{BaselineRetrofit}$

Parameter	Value	Unit	Source
$EG_{facility,y}$	[insert value]	[insert unit]	[insert source]
$EG_{historical}$	[insert value]	[insert value]	[insert value]
$\sigma_{historical}$	[insert value]	[insert value]	[insert value]
$DATE_{BaselineRetrofit}$	[insert value]	[insert value]	[insert value]

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

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

$EF_{grid,BM,y}$ and $EF_{grid,OM,y}$ will be updated every year on CPA level.

Values to determine $EF_{grid,CM,y}$

$EF_{grid,BM,y}$	=	[insert value] tCO_2/MWh
w_{BM}	=	0.50
$EF_{grid,OM-DD,y}$	=	[insert value] tCO_2/MWh
w_{OM}	=	0.50

Therefore:

$EF_{grid,CM,y}$ = [insert value] tCO_2/MWh

BE_y = [insert value]* [insert value] = [insert value] tCO_2/year

Leakage emissions
No leakage emissions are considered in accordance with the ACM0002 (version 16.0)

Emission reductions

$$\mathrm{ER_y} = \mathrm{BE_y} - \mathrm{PE_y}$$

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_y] = [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

Parameter to monitor CPA's electricity generation

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data:	Main and backup metering equipment installed at the CPA site in line with the provisions of the Power Purchase Agreement between the CPA implementing entity and KPLC and the latest available Kenya Electricity Grid Code at the time of CPA inclusion (currently March 2008 Edition). This parameter should be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. In case it is calculated then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The net quantity of electricity generated is metered on site using the main metering system, which will be verified by a back up metering system. The main

	and back up metering system will be owned by the CPA implementing entity and KPLC respectively. The main and back-up metering requirements according to the Kenya Electricity Grid Code will be met and the equipment will comply with international standards. As per the requirements of the Kenyan *Electricity Grid Code*[100] *the* accuracy class of the meter is 0.2 for the active meter and 0.5 for the reactive meter. As stated in the Kenyan Electricity Grid Code this meter class allows a level of accuracy of +/-0.5% for the active meter and +/- 1.0% for the reactive meter. The testing/recalibration of both meters will be carried out in accordance with the PPA. The measurement data shall be stored for at least two years after the respective crediting period. All data shall be transferred to the meter data buffer and to the SCADA systems of both KPLC and the CPA implementing entity.
Monitoring frequency:	The quantity of electricity supplied to the grid will be measured continuously and recorded monthly. The basic measurement period shall be carried out in line with PPA. The metering system shall be read monthly on the last day of each month (or such other day as may be agreed upon by the parties) for the purpose of determining the net electrical output of the plant since the preceding reading. The CPA implementing entity shall read the Metering System by reading the log in the SCADA system and taking the kWh meter position on the first day of the calendar month at 0:00 midnight. KPLC shall verify the same through their SCADA system.
QA/QC procedures:	The measurement results will be cross checked with records for sold electricity (i.e. invoices to KPLC). In case of any difference, the lower value of both the invoice and the meter reading value will be used for the purpose of calculating the emission reductions. Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 61036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS). The method of calibration and frequency of tests shall be agreed between CPA implementing entity and KPLC based on requirements outlined in the Kenyan Grid Code and or the PPA.
Purpose of data	Calculation of baseline emissions
Additional comment:	-

Parameter to monitor CPA's electricity grid emission factor

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	t CO_2/MWh
Description:	Combined Margin Grid Emission factor of an electricity system
Source of data:	*Tool to calculate the emission factor for an electricity system* version 05.0
Value(s) applied	To be reported in the specific CPA-DD

[100] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

Measurement methods and procedures:	The combined margin grid emission factor will be calculated using the Dispatch Data Analysis OM approach. Therefore annual recalculation of the OM emission factor during the credit period of each CPA will be required. The combined margin grid emission factor is calculated as the weighted average of the operating margin and the build margin. In accordance with the *Tool to calculate the emission factor of an electricity system* version 05.0, the default values below shall be applied. First Crediting Period: W_{OM} = 0.50 W_{BM} = 0.25 Subsequent crediting periods: W_{OM} = 0.25 W_{BM} = 0.75
Monitoring frequency:	Annual
QA/QC procedures:	The combined margin grid emission factor will be calculated annually in accordance with the description outlined in sections D.6.1. and D.7.2 of the CPA-DD.
Purpose of data	Calculation of baseline emissions
Additional comment:	N/A

Parameter to monitor CPA's project emissions

Data / Parameter:	$w_{steam,CO2,y}$
Data unit:	tCO_2/t steam
Description:	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data:	Measurement at CPA 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/or at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. H_2S and CO_2 dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane
Monitoring frequency:	Monitoring frequency must be at least every 3 months and more frequently, if necessary.
QA/QC procedures:	Equipment accuracy level and calibration frequency as well as any other applicable QA/QC procedures will be in line with ASTM Standard Practice E1675
Purpose of data	Calculation of project emissions
Additional comment:	-

Data / Parameter:	$w_{steam,CH4,y}$
Data unit:	tCH_4/t steam
Description:	Average mass fraction of methane in the produced steam in year *y*
Source of data:	Measurement at CPA 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/or at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. H_2S and CO_2 dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane
Monitoring frequency:	Monitoring frequency must be at least every 3 months and more frequently, if necessary.
QA/QC procedures:	Equipment accuracy level and calibration frequency as well as any other applicable QA/QC procedures will be in line with ASTM Standard Practice E1675
Purpose of data	Calculation of project emissions
Additional comment:	-

Data / Parameter:	$\mathbf{M_{steam,y}}$
Data unit:	t steam/yr
Description:	Quantity of steam produced in year *y*
Source of data:	Measurement at CPA site
Value(s) applied	To be reported in 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:	Metering will be done continuously and recorded daily

QA/QC procedures:	Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. Data is metered continuously and recorded daily. Data will furthermore be aggregated to hourly and daily figures. Data will be checked for consistency by the CME. 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. If data is missing the following applies: If less than 30 consecutive days of data are missing: 1. Count for missing/incomplete hour *h* the number of consecutive days (d) for which data is missing. 2. Calculate the average steam generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing. (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm) If for more than 30 consecutive days are missing: 1. Use data for the same date/hour from the previous year 2. If such data is not available, use the average from the same date/hour from year -2 and year -3 3. If such data is not available apply the highest value measured for the power plant.
Purpose of data	Calculation of project emissions
Additional comment:	-

Parameters to monitor GEF OM

Data / Parameter:	**$EG_{PJ,h}$**
Data unit:	MWh
Description:	Electricity displaced by the project activity in hour h of year y
Source of data:	Main and backup metering equipment installed at the CPA site in line with the provisions of the Power Purchase Agreement and the latest available Kenya Electricity Grid Code at the time of CPA inclusion (currently March 2008 Edition). This parameter should be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. In case it is calculated then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The net quantity of electricity generated is metered on site using the main metering system, which will be verified by a back up metering system. The main and back up metering system will be owned by the CPA implementing entity and KPLC respectively. The main and back-up metering requirements according to the Kenya Electricity Grid Code will be met and the equipment will comply with international standards.

	As per the requirements of the *Kenyan Electricity Grid Code,* version March 2008[101], the accuracy class of the meter is 0.2 for the active meter and 0.5 for the reactive meter. As per the Kenyan Electricity Grid Code this allows a level of accuracy of +/-0.5% for the active meter and +/- 1.0% for the reactive meter The testing/recalibration of both meters will be carried out in accordance with the PPA. The testing/recalibration of both meters will be in accordance with the PPA. The measurement data shall be stored for at least two years after the respective crediting period. All data shall be transferred to the meter data buffer and to the SCADA systems of both KPLC and the CPA implementing entity.
Monitoring frequency:	The quantity of electricity supplied to the grid will be measured continuously and recorded monthly. The basic measurement period shall be carried out in line with PPA. The metering system shall be read monthly on the last day of each month (or such other day as may be agreed upon by the parties) for the purpose of determining the net electrical output of the plant since the preceding reading. The CPA implementing entity shall read the Metering System by reading the log in the SCADA system and taking the kWh meter position on the first day of the calendar month at 0:00 midnight. KPLC shall verify the same through their SCADA system.
QA/QC procedures:	The measurement results will be cross checked with records for sold electricity (i.e. invoices to KPLC). In case of any difference, the most lower value of both the invoice and the meter reading value will be used for the purpose of calculating the emission reductions. Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 61036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS). The method of calibration and frequency of tests shall be agreed between CPA implementing entity and KPLC based on requirements outlined in the Kenyan Grid Code and or the PPA.
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation OM emission factor.

Data / Parameter:	**$EG_{PJ,y}$**
Data unit:	MWh
Description:	Electricity displaced by the project activity in year y
Source of data:	Main and backup metering equipment installed at the CPA site in line with the provisions of the Power Purchase Agreement and the latest available Kenya Electricity Grid Code at the time of CPA inclusion (currently March 2008 Edition). This parameter should be either monitored using bi-directional energy meter or calculated as difference between (a) the quantity of electricity supplied by the project plant/unit to the grid; and (b) the quantity of electricity the project plant/unit from the grid. In case it is calculated then the following parameters shall be measured: (a) The quantity of electricity supplied by the project plant/unit to the grid; and (b) The quantity of electricity delivered to the project plant/unit from the grid
Value(s) applied	To be reported in the specific CPA-DD

[101] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

Measurement methods and procedures:	The net quantity of electricity generated is metered on site using the main metering system, which will be verified by a back up metering system. The main and back up metering system will be owned by the CPA implementing entity and KPLC respectively. The main and back-up metering requirements according to the Kenya Electricity Grid Code will be met and the equipment will comply with international standards. As per the requirements of the *Kenyan Electricity Grid Code,* version March 2008[102], the accuracy class of the meter is 0.2 for the active meter and 0.5 for the reactive meter. As per the Kenyan Electricity Grid Code this allows a level of accuracy of +/-0.5% for the active meter and +/- 1.0% for the reactive meter The testing/recalibration of both meters will be carried out in accordance with the PPA. The measurement data shall be stored for at least two years after the respective crediting period. All data shall be transferred to the meter data buffer and to the SCADA systems of both KPLC and the CPA implementing entity.
Monitoring frequency:	The quantity of electricity supplied to the grid will be measured continuously and recorded monthly. The basic measurement period shall be carried out in line with PPA. The metering system shall be read monthly on the last day of each month (or such other day as may be agreed upon by the parties) for the purpose of determining the net electrical output of the plant since the preceding reading. The CPA implementing entity shall read the Metering System by reading the log in the SCADA system and taking the kWh meter position on the first day of the calendar month at 0:00 midnight. KPLC shall verify the same through their SCADA system.
QA/QC procedures:	The measurement results will be cross checked with records for sold electricity (i.e. invoices to KPLC). In case of any difference, the lower value of both the invoice and the meter reading value will be used for the purpose of calculating the emission reductions. Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 61036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS). The method of calibration and frequency of tests shall be agreed between CPA implementing entity and KPLC based on requirements outlined in the Kenyan Grid Code and or the PPA.
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of OM emission factor.

Data / Parameter:	**$EG_{n,h}$**
Data unit:	MWh
Description:	Net electricity generated by power plant/unit *n* in hour *h*
Source of data:	Kenya Power and Lighting Company
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	Data are obtained directly from KPLC, which is the utility in charge of electricity distribution in the country.

[102] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

Monitoring frequency:	The data will be collected from KPLC on a half-yearly basis and aggregated on an annual basis.
QA/QC procedures:	As a general quality check on the hourly data provided by KPLC, the CME will screen the data for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below: If power plant *n* is a fossil fuel power plant, missing hourly generation data will be set at 0. If power plant *n* is a renewable energy power plant, the following steps will be taken: If less than 30 consecutive days of data are missing: 1. Count for missing hour *h* the number of consecutive days (*d)* for which data is missing. 2. Calculate the average electricity generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing. (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm) If for power plant *n* more than 30 consecutive days are missing: 1. Use data for the same date/hour from the previous year 2. If such data is not available, use the average from the same date/hour from year -2 and year - 3 3. If such data is not available apply 0 MWh
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of OM emission factor.

Data / Parameter:	**$EG_{n,y}$**
Data unit:	MWh
Description:	Net electricity generated by power plant / unit *n* in year *y*
Source of data:	Kenya Power and Lighting Company
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	Data are obtained directly from KPLC, which is the utility in charge of electricity distribution in the country.
Monitoring frequency:	The data will be collected from KPLC on a half-yearly basis and aggregated on an annual basis.

<table>
<tr><td>QA/QC procedures:</td><td>As a general quality check on the hourly data provided by KPLC, the CME will screen the data for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below:

If power plant n is a fossil fuel power plant, missing hourly generation data will be set at 0.

If power plant n is a renewable energy power plant, the following steps will be taken:

If less than 30 consecutive days of data are missing:
1. Count for missing hour h the number of consecutive days (d) for which data is missing.
2. Calculate the average electricity generation for hour h for the period ±d immediately before and after the day(s) for which the data is missing.
(e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days d equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

If for power plant n more than 30 consecutive days are missing:
1. Use data for the same date/hour from the previous year
2. If such data is not available, use the average from the same date/hour from year -2 and year - 3
3. If such data is not available apply 0 MWh

As a subsequent quality check, the CME will compare the yearly electricity generation data calculated from the hourly data with the yearly electricity generation data reported in the KPLC annual report. The following allowable differences were defined:

<table>
<tr><th>Annual Electricity generation by Power Plant (MWh)</th><th>Maximum allowable difference between KPLC official values and calculated values</th></tr>
<tr><td>< 50,000 MWh</td><td>±7.5%</td></tr>
<tr><td>50,000 – 250,000 MWh</td><td>±5.0%</td></tr>
<tr><td>250,000 – 500,000 MWh</td><td>±2.5%</td></tr>
<tr><td>> 500,000 MWh</td><td>±1.5%</td></tr>
</table>
For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is smaller than the allowable difference the annual electricity generation calculated based on the hourly data will be used.

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is larger than the allowable difference then:

• If the power plant n is a renewable energy power plant => the higher value will be used.
• If the power plant n is a fossil fuel power plant => the lower value will be used.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment:</td><td>Used for calculation of OM emission factor.</td></tr>
</table>

Data / Parameter:	$FC_{i,n,y}$
Data unit:	Mass or volume unit
Description:	Amount of fuel type *i* consumed by power plant/unit *n* in year *y*
Source of data:	Specific Fuel Consumption (kg/kWh) data will be obtained from *Schedule of Tariffs, 2013*[103] which is published by the Energy Regulatory Commission, or any update thereof. Electricity generation data will be obtained from the Kenya Power and Lighting Company and will be processed as described above in the table for $EG_{n,y}$
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The Specific Fuel Consumption data published by the Energy Regulatory Commission are used to calculate the fuel charges on the electricity bills of the consumers. The specific fuel consumption data are provided in kg/kWh. The data will be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant ($EG_{n,y}$).
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	KPLC uses the fuel consumption data to calculate the fuel charge on the electricity bill of the consumers. Therefore, the values they use follow the highest standards.
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of OM emission factor

Parameters to monitor GEF OM and BM

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/kg
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	No data on NCV is available from power generation plants or regional default values. Therefore IPCC default values have been applied. Annual monitoring will be done by cross-checking if there are values provided for the relevant power plants, or regional or national average default values, or an updated version of the IPCC guidelines.
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	-.
Purpose of data	Calculation of baseline emissions
Additional comment:	Use for calculation of OM and BM emission factor.

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

[103] Energy Regulatory Commission. 2013. Approval of *Schedule of Tariffs set by the Energy Regulatory Commission for Supply of Electrical Energy by the Kenya Power and Lighting Company Limited pursuant to section 45 of the Energy Act, 2006.*

Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	No data on EF_{CO2} is available from power generation plants or regional default values. Therefore IPCC default values have been applied. Annual monitoring will be done by cross-checking if there are values provided for the relevant power plants, or regional or national average default values, or an updated version of the IPCC guidelines.
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	-
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of OM and BM emission factor.

Parameter to monitor GEF BM

Data / Parameter:	**$EG_{m,y}$**
Data unit:	MWh
Description:	Net electricity generated by power plant / unit *m* in year *y*
Source of data:	Kenya Power and Lighting Company
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	Data are obtained directly from KPLC, which is the utility in charge of electricity distribution in the country.
Monitoring frequency:	The data will be collected from KPLC on a half-yearly basis and aggregated on an annual basis.

<table>
<tr><td>QA/QC procedures:</td><td>As a general quality check on the hourly data provided by KPLC, the CME will screen the data for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below:

If power plant m is a fossil fuel power plant, missing hourly generation data will be set at 0.

If power plant m is a renewable energy power plant, the following steps will be taken:

If less than 30 consecutive days of data are missing:
1. Count for missing hour h the number of consecutive days (d) for which data is missing.
2. Calculate the average electricity generation for hour h for the period ±d immediately before and after the day(s) for which the data is missing.
(e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days d equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

If for power plant n more than 30 consecutive days are missing:
1. Use data for the same date/hour from the previous year
2. If such data is not available, use the average from the same date/hour from year -2 and year - 3
3. If such data is not available apply 0 MWh

As a subsequent quality check, the CME will compare the yearly electricity generation data calculated from the hourly data with the yearly electricity generation data reported in the KPLC annual report. The following allowable differences were defined:

<table>
<tr><th>Annual Electricity generation by Power Plant (MWh)</th><th>Maximum allowable difference between KPLC official values and calculated values</th></tr>
<tr><td>< 50,000 MWh</td><td>±7.5%</td></tr>
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</table>
For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is smaller than the allowable difference the annual electricity generation calculated based on the hourly data will be used.

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is larger than the allowable difference then:

• If the power plant m is a renewable energy power plant => the higher value will be used.
• If the power plant m is a fossil fuel power plant => the lower value will be used.</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment:</td><td>Used for calculation of BM emission factor.</td></tr>
</table>

Data / Parameter:	$FC_{i,m,y}$
Data unit:	Mass or volume unit
Description:	Amount of fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data:	Specific Fuel Consumption (kg/kWh) data will be obtained from *Schedule of Tariffs, 2013*[104] which is published by the Energy Regulatory Commission, or any update thereof. Electricity generation data will be obtained from the Kenya Power and Lighting Company and will be processed as described above in the table for $EG_{m,y}$
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures:	The Specific Fuel Consumption data published by the Energy Regulatory Commission are used to calculate the fuel charges on the electricity bills of the consumers. The specific fuel consumption data are provided in kg/kWh. The data will be converted to mass unit by multiplying the values in kg/kWh by the annual electricity generation for the power plant ($EG_{m,y}$).
Monitoring frequency:	Annually for the year *y* in which the CPA is displacing grid electricity.
QA/QC procedures:	KPLC uses the fuel consumption data to calculate the fuel charge on the electricity bill of the consumers. Therefore, the values they use follow the highest standards.
Purpose of data	Calculation of baseline emissions
Additional comment:	Used for calculation of BM emission factor.

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

In order to enable verification of emission reductions the CPA must carry out credible, transparent and adequate data measurement, collection and quality assurance/quality control procedures. Therefore, the following monitoring procedures and responsibilities will apply:

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

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the CPA
- Continuous measurement of steam produced by the geothermal wells
- Measurement of parameters related to CO_2 and CH_4 emissions in geothermal steam
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, according to appropriate standards or manufacturer specifications.
- Calibration and maintenance of steam measuring equipment, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPA's monitoring responsibilities as described above. Each month/quarter, the CPA will submit monthly electricity generation records and steam measurement data to the CME accompanied by the respective copy of records/invoices for sold electricity and steam measurement evidence.

[104] Energy Regulatory Commission. 2013. Approval of *Schedule of Tariffs set by the Energy Regulatory Commission for Supply of Electrical Energy by the Kenya Power and Lighting Company Limited pursuant to section 45 of the Energy Act, 2006.*

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

The CME, through its programme officer, will be responsible for the following:

- Training of CPAs staff on CDM monitoring requirements
- Collection of monitored data by the CPA
- Collection of data related to the re-calculation of operating margin and build margin for annual recalculation of the combined margin of the grid emission factor.
- Collection of data related to geothermal steam and its fraction of CO_2 and CH_4 and annual calculation and calculation of the resulting annual project emissions.
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored electricity with a copy of invoices and the proof of payment of those invoices
- Crosscheck of measured steam data with measurement evidence.
- Confirm that the CPA has operated the metering system and steam measurement equipment in line with relevant regulations
- Preparation of monitoring report

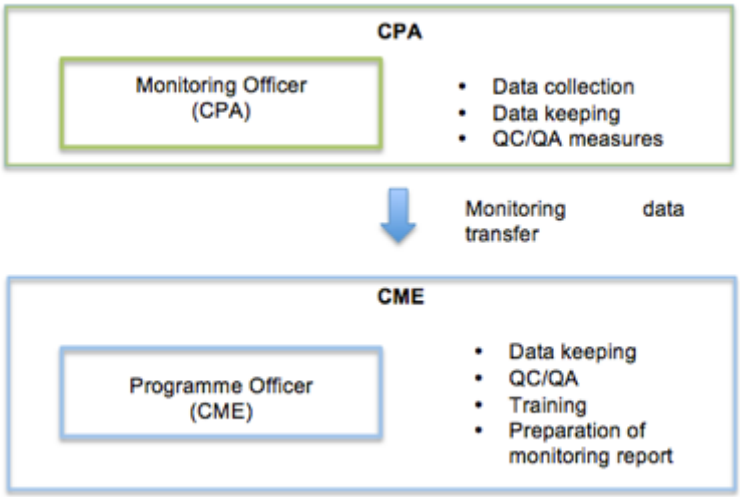

Figure 19: Monitoring organization

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 by the CPA and the CME.

All measurements should be conducted with the calibrated measurement equipment according to relevant industry standards.

Parameters monitored

The CME will 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. The grid emission factor will be calculated annually and be used for the calculation of the baseline emissions achieved by each CPA connected to the electricity system.

Other parameters included in section B.7.1 will be measured by the CPA implementing entity, recorded electronically, and provided to the CME. Based on the data measured and provided by the CPA, the CME will calculate the project emissions of each CPA. Thereafter, the CME will calculate the annual emission reductions achieved.

Table 21: Monitoring responsibilities

Monitoring parameter	Entity responsible for measurement/collection	Entity responsible for processing and QA/QC
$EG_{facility,y}$, $EG_{PJ,y}$ and $EG_{PJ,h}$	CPA implementing entity	CME
$EF_{grid,CM,y}$	CME	CME
$FC_{i,n,y}$ and $FC_{i,m,y}$	CME	CME
$EG_{n,y}$, $EG_{n,h}$ and $EG_{m,y}$	CME	CME
$NCV_{i,y}$	CME	CME
$EF_{CO2i,y}$	CME	CME
$w_{steam,CO2,y}$	CPA implementing entity	CME
$w_{steam,CH4,y}$	CPA implementing entity	CME
$M_{steam,y}$	CPA implementing entity	CME

Additionally the CME will be responsible to collect the merit order of the power plants connected to the grid in order to be able to update the grid emission factor:

Table 22: Additional data collection

Description	Merit Order
Data recording	The merit order is determined by KPLC on a monthly basis based on the cost of electricity from the different power plants in the previous months. The merit order is used to determine the power plants in the top of the dispatch in step 4 of the *Tool to calculate the emission factor for an electricity system*
Data collection	Merit order data will be collected by the CME on a yearly basis.
Data management and archiving	Data regarding the merit order will be organized annually and stored in a centralized database.
Quality Assurance and Quality Control	Data regarding the merit order will be checked in terms of logic (cheap sources should rank higher in the merit order) and consistency. If merit order data are missing for a particular month, data from the previous month will be used.

Electricity metering

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standard and the *Kenya Electricity Grid Code.* Any programmable settings available within a metering installation, data logger or any peripheral device, which may affect the resolution of displayed or stored data, shall meet the relevant requirements of IEC 1036 and shall comply with applicable specifications or guidelines (including any transitional agreements) specified by the Kenya Bureau of Standards (KEBS).

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

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

The CPA will further be responsible for the procurement, installation, testing and commissioning of the back-up meter. KPLC will however be responsible for the operation and maintenance of the back-up meter. The back-up meter will only be used against the data provide by the CPA entity's main-meter and the CPA will usually not have access to that data.

Both meters will be installed at that Point of Utility Connection (PuC), which defines the commercial boundary between the licensee and the customer.

QA/QC

The main-meter readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to KPLC and the proof of payment of those invoices. If there is a difference

between the values, the lower value will be used.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. According to *Kenyan Electricity Grid Code (version March 2008)*[105], the accuracy class of the meter and its maximum interval between calibrations are the following:

Table 23: Applicable accuracies

Maximum allowable overall error (±%)		**Minimum acceptable class of components**	**Meter clock error (seconds) in reference to EAST**
active	reactive		
0.5	1.0	0.2 CT/VT/Meter Wh 0.5 Meter varh	±5

As per the Kenyan Electricity Grid Code, for the active metering a meter of accuracy class 0.2 has to be installed. As per the Kenyan Electricity Grid Code, this refers to an allowable accuracy of +/- 0.5% for the meter which meters active power. For the reactive metering a meter of accuracy class of 0.5 has to be installed. As per the Kenyan Electricity Grid Code, this refers to an allowable accuracy of +/- 1.0% for the meter which meters reactive power.

The testing/recalibration period will be in line with the Power Purchase agreement (PPA).

Emergency procedure:
In case there is disagreement between KPLC and the CPA implementing entity with regard to the meter readings because the readings of the main meter and the back-up meter are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 17 above then the main meter and the back-up meter shall both be tested. Should the main-meter be found to have a level of inaccuracy beyond the tolerance as described above, then the main-meter shall be recalibrated and the electricity output will be based on the readings registered by the back-up meter from the date of the last previous test of the main-meter.

Should both the back-up meter and the main-meter be found to have a level of inaccuracy falling outside the maximum tolerance level then each of the main-meter and the back-up meter shall be recalibrated and the electricity output shall be recalculated as follows (starting with step 1 if applicable):

1. The average monthly data for the plant from the same month in the prior contract Year, reasonably adjusted for the particular billing period by any relevant available data affecting plant generation regarding resource availability, hours of operation, time of operation of generators, and/or native self-use of power output (collectively “Operating Variations”)
2. The average monthly electricity generation during the previous six (6) billing periods prior to meter failure (or fewer months of the Plant is less than six months from the Full Commercial Operation Date), as adjusted or normalized for outages or Operating Variations.

In cases where one meter breaks down, then the readings of the other meter will be applied in the emission reduction calculations. If both meters break down, then the electricity generation value for that period will be assumed to be zero as a conservative approach.

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

Steam measurement
The steam quantity discharged from the geothermal wells should be measured with a venture flow

[105] http://www.erc.go.ke/images/docs/Kenya%20Grid%20Code.pdf

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

Steam meters will be installed to continuously measure the quantity of steam produced during the year in the production wells. The meters will have the integration and their readings will be relayed and be displayed in the SCADA. Daily log will be kept electronically. At the end of each month, the records will be retrieved and submitted to the CME.

QA/QC
Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. Data is read continuously and logged. Data will furthermore be aggregated to hourly and daily figures. Data will be checked for consistency by the CME. 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.

Emergency procedure:
If data is missing the following applies:

If less than 30 consecutive days of data are missing:

1. Count for missing/incomplete hour *h* the number of consecutive days (d) for which data is missing.
2. Calculate the average steam generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing. (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

If for more than 30 consecutive days are missing:
1. Use data for the same date/hour from the previous year
2. If such data is not available, use the average from the same date/hour from year -2 and year -3
3. If such data is not available apply the highest value measured for the power plant.

Non-Condensable gases (NCGs)
The fraction of non-condensable gases will be monitored through sampling. Non-condensable gases sampling should be carried out in production wells and/or at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO_2 and CH_4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. H_2S and CO_2 dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH_4. All alkanes concentrations are reported in terms of methane. The sampling team will be trained on how to take the samples. At the end of each sampling period, the records will be submitted to the CME.

QA/QC
Equipment accuracy level and calibration frequency as well as any other applicable QA/QC procedures will be in line with ASTM Standard Practice E1675

Emergency procedure:
In line with ASTM Standard Practice E1675

Grid emission factor – Operating and Combined Margin

The CME will annually monitor the parameters required to recalculate the Combined Margin Emission Factor. This is because the grid emission factor will be calculated using the Dispatch Data Analysis OM approach. Therefore annual recalculation of the OM emission factor during the credit period of each CPA will be required. The CME will furthermore annually calculate the BM emission factor. The CME will therefore annually collect the latest data available from the relevant entities (KPLC, IPCC, ERC) and will furthermore make sure the latest values available are used for default values, i.e. EF_{CO2}, NCV.

The CME will carry out the QA/QC procedures as described in the tables above. For $EG_{n,h}$, $EG_{n,y}$ and $EG_{m,y}$ the following will apply:

The hourly data provided by KPLC, will be screened by the CME for obvious errors and extreme values. Obvious errors and extreme values will be corrected based on the original generation data. If such data is not available, the procedures for missing data will be applied as described below:

- If power plant *n* is a fossil fuel power plant, missing hourly generation data will be set at 0.

- If power plant *n* is a renewable energy power plant, the following steps will be taken:

- If less than 30 consecutive days of data are missing:
  1. Count for missing hour *h* the number of consecutive days (*d)* for which data is missing.
  2. Calculate the average electricity generation for hour *h* for the period ±d immediately before and after the day(s) for which the data is missing.
  (e.g. if data is missing for hour 3pm on 18 and 19 of August, the number days *d* equals 2 and the electricity generation for the missing data is estimated by taking the average electricity generation from 16, 17 August (-d) and 20, 21 August (+d) for the hour 3pm)

  If for power plant *n* more than 30 consecutive days are missing:
  1. Use data for the same date/hour from the previous year
  2. If such data is not available, use the average from the same date/hour from year - 2 and year - 3
  3. If such data is not available apply 0 MWh

As a subsequent quality check in order to apply the most accurate value for $EG_{n,y}$ and $EG_{n,y}$, the CME will compare the yearly electricity generation data calculated from the hourly data with the yearly electricity generation data reported in the KPLC annual report. The following allowable differences were defined:

Table 24: Allowed deviations

Annual Electricity generation by Power Plant (MWh)	Maximum allowable difference between KPLC official values and calculated values
< 50,000 MWh	±7.5%
50,000 – 250,000 MWh	±5.0%
250,000 – 500,000 MWh	±2.5%
> 500,000 MWh	±1.5%

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is smaller than the allowable difference the annual electricity generation calculated based on the hourly data will be used.

For those cases where the difference between the calculated electricity generation and the electricity generation reported in the KPLC annual report is larger than the allowable difference, then:

- If the power plant *m/n* is a renewable energy power plant => the higher value will be used.
  If the power plant *m/n* is a fossil fuel power plant => the lower value will be used.

Emergency procedures
N/a

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

The database contains the following information:

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

Training
Before the implementation of a CPA, 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
- Measurement procedures of monitoring parameters
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

Appendix 1. Contact information of coordinating/managing entity and responsible person(s)/ entity(ies)

CME and/or responsible person/ entity	☒ CME ☒ Responsible person/ entity for application of the selected methodology(ies) and, where applicable, the selected standardized baseline(s) to the PoA
Organization	Marine Power Generation Company Limited
Street/P.O. Box	74483-00200
Building	-
City	Nairobi
State/Region	Nairobi
Postcode	00200
Country	Kenya
Telephone	+1 9723438656
Fax	-
E-mail	eric.mbarine@mpgeneration.com
Website	-
Contact person	Eric M'Barine
Title	Director
Salutation	Mr
Last name	M'Barine
Middle name	-

Appendix 2. Affirmation regarding public funding

Appendix 3. Applicability of methodology(ies) and standardized baseline(s)

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

Appendix 5. Further background information on the monitoring plan

Appendix 6. Summary of post registration changes

Appendix 7. Additional baseline information

Installed Capacity[106]

Name	*Type*	*Owner*	*Commissioning Date*	*MW*
Mumias Cogeneration	Biomass	Mumias	2005	2.00
Mumias Cogeneration Expansion	Biomass	Mumias	2009	24.00
OrPower4 I	Geothermal	OrPower 4 Inc	2000	13.60
OrPower4 I Expansion	Geothermal	OrPower 4 Inc	2008	39.20
OrPower4 II	Geothermal	OrPower 4 Inc	2013	39.60
Olkaria II - Unit 1+2	Geothermal	Kengen	2003	70.00
Olkaria II - Unit 3	Geothermal	Kengen	2010	35.00
Olkaria I - Unit 1	Geothermal	Kengen	1981	15.00
Olkaria I - Unit 2	Geothermal	Kengen	1982	15.00
Olkaria I - Unit 3	Geothermal	Kengen	1985	15.00
Olkaria Wellhead OW 37	Geothermal	Kengen	2012	5.37
Eburru Hill	Geothermal	Kengen	2012	2.44
Gitaru - Unit 1+2	Hydro	Kengen	1978	145.00
Gitaru - Unit 3	Hydro	Kengen	1999	80.00
Kamburu - Unit 1+2	Hydro	Kengen	1974	62.80
Kamburu - Unit 3	Hydro	Kengen	1976	31.40
Sondu Miriu	Hydro	Kengen	Mar-08	60.00
Turkwel - Unit 1+2	Hydro	Kengen	1991	106.00
Kiambere - Unit 1+2	Hydro	KenGen	1988	144
Kiambere (capacity addition due to retrofit)	Hydro	KenGen	2009	20
Masinga - Unit 1+2	Hydro	Kengen	1981	40.00
Kindaruma - Unit 1+2	Hydro	Kengen	1968	40.00
Kindaruma - Unit 1+2 (retrofit)	Hydro	Kengen	Retrofit 2013	8.00

[106] Data source for each power plant provided in the Grid Emission Factor excel sheet

Kindaruma - Unit 3	Hydro	Kengen	2012	24.00
Mesco	Hydro	Kengen	1919	0.40
Ndula	Hydro	Kengen	1924	2.00
Gogo	Hydro	Kengen	1952	2.00
Sosiani	Hydro	Kengen	1955	0.40
Sagana	Hydro	Kengen	1952	1.50
Wanji	Hydro	Kengen	1955	7.40
Sangoro	Hydro	Kengen	2012	21.15
Tana	Hydro	Kengen	1932/1955 (replacement 2011)	20.00
Imenti Tea Factory	Hydro	KTDA	2010	0.30
Aggrekko Embakasi 6 and 7	Thermal	Aggreko	2011	90.00
Aggreko Muhoroni	Thermal	Aggreko	2011	30.00
Ibera Africa 1	Thermal	Ibera Africa	1997	56.00
Ibera Africa 2 (additional 52.5 MW)	Thermal	Ibera Africa	Jul-09	52.50
Kipevu I Diesel - Unit 1-6	Thermal	Kengen	1999	75.00
Kipvevu III - Unit 1-7	Thermal	Kengen	2011	115.00
Kipevu GT 1/ Embakasi Gas turbine	Thermal	Kengen	1987	30.00
Kipevu GT 2 / Embakasi Gas turbine	Thermal	Kengen	1999	30.00
Rabai Power	Thermal	Rabai Power	Aug-09	90.00
Tsavo	Thermal	Tsavo	2001	74.00
Ngong	Wind	Kengen	Aug-09	5.30
Totals				***1740.36***

Kenya's electricity expansion plans

Kenya is committed to fulfilling Vision 2030. This is a developmental blue print covering the period of 2008 to 2030 with 3 main pillars; economic, social and political development. According to the Vision, the government targets to achieve an economic growth rate of above 10% in the next 10 years. Energy is described as one of the anchors to the pillars. Power demand forecasts are designed to incorporate this vision, and to capture the effects of pertinent development. The forecast predicts that the reference peak demand of 1,227 MW in 2011 will grow to between 12,738 and 22,985 MW in 2031. In order to meet this growing demand, candidate generation resources that have been considered include geothermal, coal, hydro, wind oil fired plants and nuclear power plants. According to the plan, the optimal development program will be dominated by geothermal, nuclear, coal, imports and wind power plants. The system expansion plan over the 30 year plan period indicates that 26% of the total installed capacity will be obtained from geothermal, 19% from nuclear plants, 13% from coals plants and 9% from imports. Wind and hydro plants will provide 9% and 5% respectively while medium speed diesel and gas turbines will provide 9% and 11% of the total capacity respectively. The present value of the total system expansion cost over the period 2011-2031 amounts to USD 41.4 billion. The most attractive supply options according to the plan are the local energy resources, which include geothermal, low grand falls hydro and wind power plants. Gas turbines will be used as capacity additions to geothermal and wind. A detailed overview of the Least Cost Power Development Plan is given below:

Year ending 30th June	Configuration				Indicative Capital Cost (Mln US$)	Type	Added Capacity MW	Total Capacity MW	System Peak MW	Reserve Margin MW	Reserve Margin as % of Peak
2010								1,363	1,227	136	11%
2011	1	×	10	TANA		HYRO	20				
	12	×	10	KIP3	156	MSD	120	1,503	1,302	201	15%
2012	1	×	2.2	EBURRU	8.03	Geothermal	2				
	1	×	5	OLKWH		Geothermal	5				
	2	×	10.3	SANG	78	HYDRO	21	1,531	1,520	11	0.7%
2013	10	×	16	AEOLUS	368	WIND	60				
	5	×	16	TRIUMPH	110	MSD	81				
	5	×	17	GULF	114	MSD	84				
	5	×	17	MELEC	118	MSD	87				
	7	×	5	OLKWH	127	Geothermal	35				
	5	×	16	MUHORONI	110	MSD	80				
	3	×	7	WIN1	15	Ngong 3	21	1,979	1,765	214	12%
2014	2	×	70	OLK4	511	Geothermal	140				
	353	×	0.85	LTWP	538	Turkana	300				
	1	×	-30	KGT1		Gas Turbine	-30				
	1	×	-30	KGT2		Gas Turbine	-30				
	2	×	26	OLK3	131	Geothermal	36				
	5	×	10	OSIWO	115	WIND	50				
	1	×	200	IMPORT		HYDRO	200				
	7	×	5	OLKWH	127	Geothermal	35				
	1	×	32	KIND	115	HYDRO	32				
	2	×	70	OLK1-4&5	511	Geothermal	140	2,852	2,064	788	38%
2015	3	×	-15	OLKI		Geothermal	-45				
	1	X	25	SMHY		Hydro	25				
	2	×	140	GEOT	1022	Geothermal	280				
	1	×	20	ARM		Coal	20	3,132	2,511	621	25%
2016	2	×	200	IMP0RT		IMPORT	400	3,832	2,866	970	34%
	1	×	300	COAL	631.2	COAL	300				
2017	1	×	140	GEOT	511	Geothermal	140				
	2	×	160	MSD	436.48	MSD	320				
	3	×	15	OLK1		Geothermal	45	4,337	3,292	1,045	32%
2018	1	×	300	COAL	631.2	COAL	300				
	1	×	100	WIND	230	WIND	100				
	1	×	60	MUTO	259	HYDRO	60				
	1	×	140	LGF	507	HYDRO	140				
	1	×	140	GEOT	511	Geothermal	140	5,077	3,751	1,326	35%
2019	1	×	200	IMPORT		IMPORT	200				
	1	x	100	WIND	230	WIND	100				
	1	x	16	OLK3	58	Geothermal	16				
	10	×	-5.6	IBR1		MSD	-56				
	1	×	-26	MUMIAS		COGEN	-26				
	2	×	140	GEOT	1022	Geothermal	280	5,591	4,216	1,375	33%
2020	2	×	180	GT-NGAS	270	GT	360				
	1	×	200	IMPORT		IMPORT	200				
	2	×	140	GEOT	1022	Geothermal	280	6,431	4,755	1,676	36%
2021	2	×	140	GEOT	1022	Geothermal	280				
	10	×	-7.4	TSAVO		MSD	-74				
	1	×	300	COAL	631.2	COA	300				
	1	×	180	GT-NGAS	135	L GT	180				
	1	×	100	WIND	230	WIND	100	7,217	5,388	1,829	34%

2022	1	×	1000	NUCL	4055	NUCLEAR	1000	8,217	6,048	2,169	36%
2023	2	×	140	GEOT	1022	Geotherma	280				
	1	×	300	COAL	631.2	I COAL	300				
	1	×	100	WIND	230	WIND	100				
	6	×	-10	KDP1		MSD	-60	8,837	6,784	2,053	31%
2024	1	×	200	IMPORT		IMPOR	200				
	2	×	160	MSD	436.48	T MSD	320				
	1	×	180	GT-NGAS	135	GT	180				
	3	×	140	GEOT	1533	Geothermal	420	9,957	7,608	2,349	31%
2025	3	×	140	GEOT	1533	Geothermal	420				
	2	×	180	GT-NGAS	270	GT	360				
	1	×	160	MSD	218.24	MSD	160				
	2	×	100	WIND	460	WIN	200	11,097	8,528	2,569	30%
2026	2	×	100	WIND	460	WIND	200				
	3	×	140	GEOT	1533	Geotherma	420				
	1	×	1000	NUCL	4055	I	1000				
	2	×	200	IMORT		NUCLEAR	400	13,117	9,556	3,561	37%
2027	3	×	140	GEOT	1533	Geothermal	420				
	1	×	200	IMPORT		IMPORT	200	13,737	10,706	3,031	28%
2028	3	×	140	GEOT	1533	Geotherma	420				
	1	×	200	IMPORT		I IMPORT	200				
	1	×	180	GT-NGAS	135	GT	180				
	3	×	100	WIND	690	WIND	300				
	-4	×	12	ORP4		Geotherma	-48				
	2	×	300	COAL	1262.4	I	600	15,389	11,994	3,395	28%
2029	2	×	180	GT-NGAS	270	GT WIND	360				
	1	×	100	WIND	230	Geotherma	100				
	2	×	-35	OLK2		I	-70				
	3	×	140	GEOT	1533	Geotherma	420				
	1	×	1000	NUCL	4055	I	1000	17,199	13,435	3,764	28%
2030	3	×	140	GEOT	1533	Geothermal	420				
	2	×	300	COAL	1262.4	COA	600				
	2	×	180	GT-NGAS	270	L GT	360				
	2	×	160	MSD	436.48	MSD	320				
	3	×	100	WIND	690	WIND	300	19,199	15,026	4,173	28%
2031	3	×	140	GEOT	1533	Geothermal	420				
	1	×	300	COAL	631.2	COA	300				
	2	×	180	GT-NGAS	270	L GT	360				
	2	×	160	MSD	436.48	MSD	320				
	1	×	1000	NUCL	4055	NUCLEAR	1000	21,599	16,905	4,694	28%

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Document information

Version	*Date*	*Description*
06.0	15 April 2016	Revision to ensure consistency with the "Standard: Applicability of sectoral scopes" (CDM-EB88-A04-STAN) (version 01.0).
05.0	9 March 2015	Revisions to: • Include provisions related to choice of start date of PoA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Add exception for generic CPA where technology is under positive lists; • Editorial improvement.
04.1	5 August 2014	Editorial revision to correct the document information table.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM programme of activities (these instructions supersede the *Guideline: Completing the programme design document form for CDM programme of activities* (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the PoA in B.4 and Appendix 1; • Add general instructions on post-registration changes in paragraph 2 and 3 of general instructions and **Error! Reference source not found.**; • Change the reference number from *F-CDM-PoA-DD* to *CDM-PoA-DD-FORM*; • Editorial improvement.
03.0	3 December 2012	EB 70 Revision to reflect changes to the *Guideline: Completing the programme design document form for CDM programmes of activities* (EB 70, Annex 6)
02.0	13 March 2012	EB 66 Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, annex 12).
01.0	27 July 2007	EB 33, Annex 41 Initial adoption.

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