**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 03 - in effect as of: 28 July 2006**

## CONTENTS



## Annexes

## SECTION A. General description of project activity

### A.1 Title of the project activity:

>> Optimisation of Kiambere Hydro Power Project

Version 02 completed on January 30, 2008

### A.2. Description of the project activity:

>> The objective of Optimisation of Kiambere Power Project is upgrade the turbines with new runners at the existing Kiambere Power plant instead of conducting the regular maintenance, hence increasing output by 20 MW generating more renewable energy for sale to the Kenya Power and Lighting Company Limited on the basis of a power purchase agreement (PPA). The project activity - electricity generation- will result in greenhouse gas (GHG) emission reductions by avoiding $CO_2$ emissions from electricity generation by fossil fuel power plants, which form part of the generation mix in the Kenya's grid.

The project contributes to the sustainable development of Kenya by:

a) Improving air quality situation in the country by avoiding emissions of oxides of nitrogen and sulphur by displacing thermal power plants.
b) Assisting KenGen to lower the use of thermal power generation plants and use them as stand-by power generation, thereby displacing expensive heavy fuel, diesel, coal and gas-fired generation, thus reducing CO2 emissions to the atmosphere by generating energy without GHG emissions[1].
c) Employing local labor in construction and plant management.
d) Contributing to Kenya's fiscal revenues through the payment of taxes[2].
e) Helping the country improve the hydrocarbon trade balance through reduction of oil imports to be used for electricity generation.
f) Increasing the number of clean energy projects in the country.
g) Assisting poor rural communities through the implementation of community programs funded by part of the carbon revenues.

The Project aims to add generation facility of 20MW capacity additional to the existing 144 MW which has supplied an average annual electricity output, 875.6GWh, to the Kenyan Grid in the past 5 years. The additional 20MW capacity increase will supply an estimated annual incremental generation of 60GWh to the Kenya's grid, while a whole electricity output supply expects to become 935.6GWh/y.

Without the CDM incentive, the sponsor would have been conducting a regular maintenance to keep the past operation since project activity needs greater outage length (i.e. six months) of a whole Kiambere Power Station that has generated averaged 875.6GWh/y than a regular maintenance (i.e. one month). Therefore, the

[1] The project's technology is considered load base in the IMNG, thus the project has priority in dispatch and so dispatches all the energy that it produces.
[2] Although the sponsor is a public entity, it pays income taxes.

electricity from Kenyan Grid that has various electricity source including fossil fuel thermal power plants would have been consumed without the project activity, for incremental additional electricity portion.

The operation will expectedly start in July 2008.

**A.3. Project participants:**

| **Name of Party involved (*) ((host) indicates a host Party):** | **Private and/or public entity(ies) project participants(*) (as applicable)** | **Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)** |
|---|---|---|
| Kenya (host) | Kenya Electricity Generating Company Ltd, ("KenGen"). | No |
| Spain | International Bank for Reconstruction and Development (IBRD) as the Trustee of the Community Development Carbon Fund (CDCF). | Yes |
| (*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required. | | |
| Note: *When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM),* at least the host Party (ies) and any known project participants (e.g. those proposing a new methodology) shall be identified. | | |

The Official Contact Person for the Clean Development Mechanism ("CDM") project activity will be:
Joelle Chassard
Carbon Fund Manager
The Spanish Carbon Fund
The World Bank
Washington DC.
USA.
Contact information is listed in Annex 1.

**A.4. Technical description of the project activity:**

**A.4.1. Location of the project activity:**

>> The project activity located at 9932500 N and Longitude 337500 E

**A.4.1.1. Host Party(ies):**

>>Kenya

| A.4.1.2. Region/State/Province etc.: |
|---|

>>Eastern Province

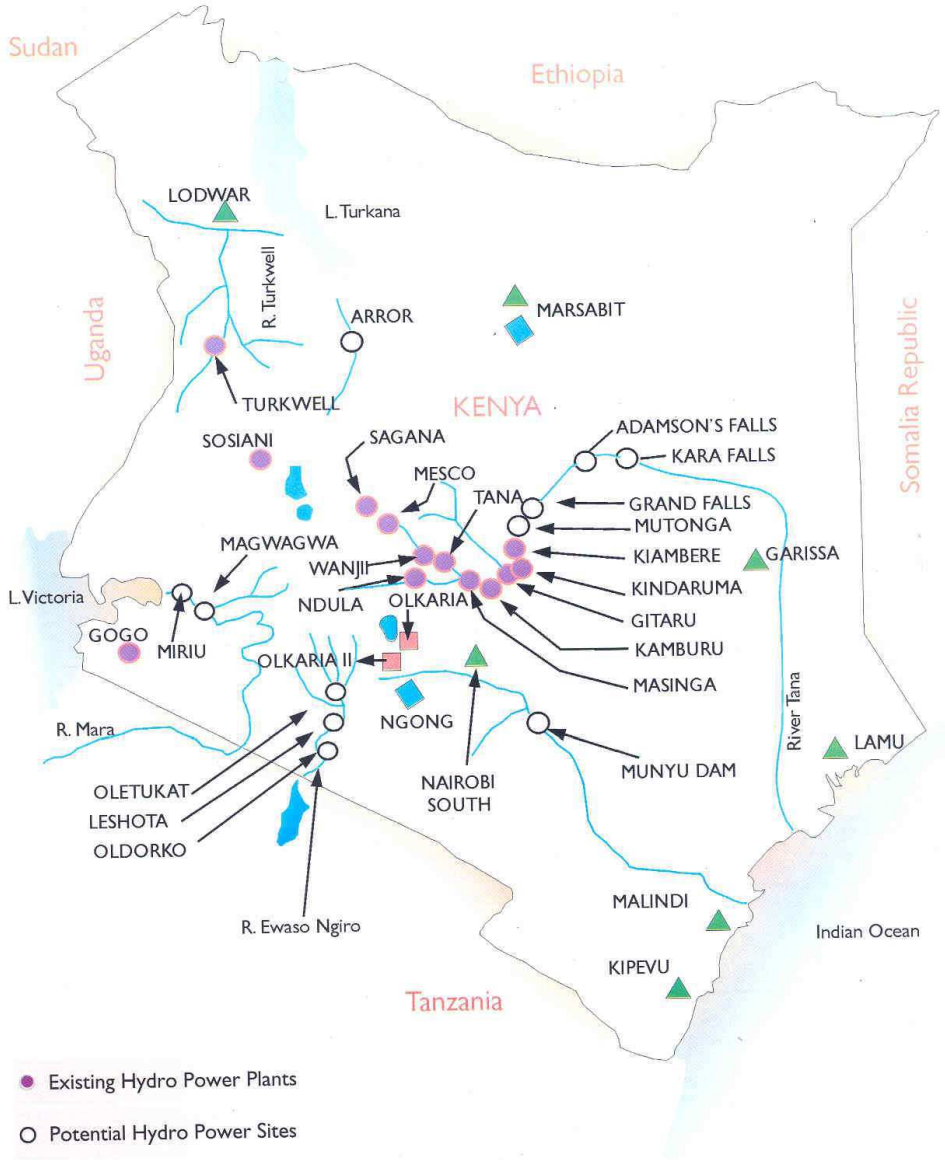
| A.4.1.3. City/Town/Community etc: |
|---|

>> Mbeere Districts

| A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page): |
|---|

Kiambere Power Project is located in Eastern Province downstream of Kindaruma Power station, along the Tana cascade.

Figure 1. General location of Kiambere Hydropower project



**A.4.2. Category(ies) of project activity:**

>> The project falls into:
Scope number: 1.
Sectoral scope: Renewable energy

**A.4.3. Technology to be employed by the project activity:**

>> Kiambere is the last Dam on the Tana, which was commissioned in 1988. The underground powerhouse that accommodates existing 144 MW plant situated 4 km away from the saddle dam where the intake structure is located. The water conveyance is by a 6 m diameter headrace. The existing 144MW plant, consisting of 2 sets x 72MW units, supplies annual electricity 875.6 GWh, averaged in last 5 years (See Annex 6 for historical electricity output.)

Upgrading the turbines with new runners will give increase output by 20 MW in total Kiambere Power Station.

Such upgrading is beyond usual maintenance and takes much longer time such as six months than a usual maintenance (one month).

The detail for modification include the following: .

- To replace the whole turbine with a more efficient, powerful and cavitations free runner (expected installed capacity with new runner as 82 MW x 2 sets instead of existing 72MW x 2 sets.
- To replace head cover, guide vanes, bottom ring
- To install new electronic governor and adoption to the existing hydraulic parts of governor
- To install new excitation system
- To install additional power cable to carry the extra power

This modification will sent an estimated incremental annual electricity by 60 GWh to the Kenyan Grid, while the whole electricity output expects to become 935.6GWh/y.

The project activity, the modification of the existing Kiambere Power Station, does not newly construct a dam or associated reservoir since this is a merely retrofit of the existing power station.

**A.4.4 Estimated amount of emission reductions over the chosen crediting period:**

>> Once implemented, the project is estimated to 38,376t$CO_2$e annually, generating an expected total of 246,246 t$CO_2$e for the duration of the initial 7-year crediting period.

The project estimated annual ERs, over the first 7-year crediting period, are as follow:

| Year | Annual estimation of emissions reductions in tonnes of $CO_2e$ |
|---|---|
| Aug 2008 – July 2009 | 38,376 |
| Aug 2009– July 2010 | 38,376 |
| Aug 2010– July 2011 | 38,376 |
| Aug 2011– July 2012 | 38,376 |
| Aug 2012– July 2013 | 38,376 |
| Aug 2013– July 2014 | 38,376 |
| Aug 2014– July 2015 | 38,376 |
| **Total estimated reductions (tonnes of CO2e)** | 268,632 |
| **Total number of crediting years** | 7 x 3 = 21 years |
| **Annual average over the crediting period of estimated reductions (tonnes of CO2e)** | 38,376 |
| | |

**A.4.5. Public funding of the project activity:**

>> No public funding is available for the proposed project.

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

**B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

>> Approved consolidated baseline methodology ACM0002-Version 7: Consolidated baseline methodology for grid-connected electricity generation from renewable sources ("the methodology").

The methodology will be used in conjunction with the approved monitoring methodology ACM0002-Version 7 ("the monitoring methodology").

**B.2 Justification of the choice of the methodology and why it is applicable to the project activity:**

>> The project will be a grid-connected hydro power generation activity and meets all the conditions stated in the methodology (ACM0002). These conditions are:

- The project will be a modification of hydro power plant that supplies incremental additional electricity (20MW) to the Kenyan Grid.
- The project will not be an activity that involves switching from fossil fuels to renewable energy at the project site

The electricity grid (the *Kenyan Grid*) will be clearly identified and information on the characteristics of this grid is available.

Considering KenGen's operation for hydro power facility, the existing two units of 72MW would have been operated with usual maintenance throughout crediting period.

**B.3. Description of the sources and gases included in the project boundary**

>>In line with the methodology, the only greenhouse gas accounted for in the calculation of the emission reduction is CO2.

| | Source | Gas | Included | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | Power plants connected to the Kenyan Grid | CO2 | Yes | Included as per the ACM00002 methodology |
| | | CH4 | No | Excluded as per ACM0002. This is conservative. |
| | | N2O | No | Excluded as per ACM0002. This is conservative. |
| **Project Activity** | Not applicable: the project is a zero-emissions renewable power source | CO2 | No | Excluded. The project activity is a zero-emission project activity. |
| | | CH4 | No | Excluded. The project activity is a zero-emission project activity. |
| | | N2O | No | Excluded. The project activity is a zero-emission project activity. |

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

According to methodology ACM0002, the baseline scenario for the proposed project is the "electricity that would have been otherwise generated by the operation of grid-connected power plants and by the addition of new generating sources of the Kenyan Grid". Following the selected methodology: ACM0002, the baseline emission factor is calculated as a combined margin ("CM"), consisting of the weighted average of the operating margin emission factor calculated with dispatch data ("OM") and the build margin emission factor ("BM"), weights being the default values 50% and 50%, respectively - all margins expressed in tCO2/MWh. The project boundary for the project is the Kenyan Grid.

The baseline emission factor will be calculated ex-post for the first crediting period. The margins calculation can be seen under B.6.4.

The estimated ERs per year for the first crediting period equal 38,376 tCO2/yr[3] times seven, which is equal to 268,632 tCO2e or estimated ERs[4].

[3] All margins were rounded to the fifth decimal, but the CERs per year were rounded down to the nearest integer.
[4] All margins estimations can be seen in E.4.

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>**

The following steps from the "Tools for the demonstration and assessment of additionality" - Version 3 - will be completed in this section:

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations.
Step 2: Investment analysis.
Step 3: Barriers analysis.
Step 4: Common practice analysis.

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

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

In addition to the alternative of implementing the proposed project activity not undertaken as a CDM project activity, there are two identified realistic and credible alternatives available to the project participants that provide outputs or services comparable with the proposed CDM project activity:

1) Implement the project as a diesel generator power plant[5].
2) Do not implement any power generation project.

**Sub-step 1b. Enforcement of applicable laws and regulations**

The identified alternatives are in compliance with all applicable legal and regulatory requirements of Kenya. The 3 identified alternatives comply with Kenya's Electric Act. Part II and III *of* the Electric Act confirm that the alternatives are a real possibility available to the project developer.

*Because the 3 alternatives identified are in compliance with all applicable laws and regulations and are also realistic and credible alternatives available to the project participants, the project is additional under step 1.*

**Step 2. Investment Analysis**

This step is waived, so continue to Step 3.

**Step 3. Barrier Analysis**

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

While various opportunities arouse for Kenya to increase its clean energy projects after ratification of the Kyoto Protocol, KenGen is pursing its capacity expansion programs with a focus on projects that generate less greenhouse gas emissions (See Annex 5.) This expansion can help Kenya meeting the growing power demands as well as securing energy independency. However, less greenhouse gas emissions projects, such as

[5] Since there is no natural gas available in Kenya, this is the only feasible technology for capacity additions to the grid. This technology presents the lowest investment cost among all other feasible alternatives.

the Optimisation of Kiambere Power Project, face barriers that prevent them from being carried out if they are not registered as CDM activities. Being a registered CDM project activity and negotiating a CER purchase agreement, has both financial and institutional benefits that affect the viability of the project. In particular, the project faced four main barriers:

- Financing barriers
- Outage length barriers
- Tariff barriers
- Crrency barriers

*Financing barriers*

The most significant barrier to develop the project is difficulty in securing financing.

Country risk for Kenya has been considered very high by investors. Until quite recently main rating companies such as Moodys, Fitch or Standard & Poor's have not even provided rating for Kenya[6]. Although Standard & Poors assigned 'B+' long-term foreign currency and 'BB-' long-term local currency sovereign credit ratings on Sep. 2006 for the fist time,, it also admits constrains of ratings on Kenya by low level of economic development and by a vulnerability to exogenous shocks[7]. In this circumstance, access to direct project financing is extremely difficult for Kenyan project. In fact, United Nations statistics on foreign direct investment in the developing world indicate that Kenya's ability to attract foreign direct investment is limited[8].

On the other hand, Kenya does not have domestic strong financial institution for long-term borrowing. This has resulted in most project proponents looking for international financial markets, which offer more attractive rates and longer terms. However, as elaborated above, international market financiers are reluctant to provide funding given the country risk of Kenya.

Further, KenGen is currently facing a big challenge for securing financing for many other power generation projects. As mentioned above, KenGen has earmarked an aggressive capacity expansion program that

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[6] Moodys (go to "Sovereign") - registration required:http://www.moodys.com/cust/default.asp?den=1

Fitch: http://www.fitchibca.com/corporate/sectors/issuers_list_corp.cfm?sector_flag=5&marketsector=1&detail=

Standard & Poor's (go to "Sovereign risks rating since 1975"):

http://www2.standardandpoors.com/servlet/Satellite?vqt=SOVEREIGN+RATINGs+history+&pagename=sp%2FPage%2FSiteSearchResultsPg&search=site&b=10&r=1&s=&ig=&i=&f=null&l=ENG&submit.x=4&submit.y=4

[7] Standard & Poors
http://www2.standardandpoors.com/portal/site/sp/en/us/page.siteselection/site_selection/0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0.html

[8] UNCTAD (United Nations Conference on Trade and Development) World Investment Report 2006
http://www.unctad.org/en/docs/wir2006_en.pdf

includes less greenhouse gas emission, surrounded by evolving opportunities derived from the Kyoto Protocol ratification. The expanding capacity in the program is aggregated approximately 1970MW, comprising mostly renewable energy (hydro, geothermal, and wind), and thermal power (See Annex 4 for project table). Given the Kenya's financial institution circumstance and KenGen's access to capital, it is a serious challenge to secure finance for all these projects.

Furthermore, there has been very little investment of hydro power projects in the country due to relatively large capital cost. The rehabilitation of Kiambere Hydro Power Project (20 MW) involves 10.1 million US$. There is no private sector investment in hydropower power plants of the magnitude of the project activity even though the power generation sector in Kenya has been unbundled. CDM funds are therefore needed to make the project a more attractive investment due to the difficult investment environment for hydro power plants in Kenya. KenGen started the CDM process in order to secure funding to develop and operate the project.

*Outage Length barriers*

The project activity requires more outage length than usual maintenance. While regular maintenance requires only one month down time of the whole Kiambere Power Station, the project activity needs at least six months down time. Since the existing Kiambere Power Station is the second largest installed capacity among KenGen's generation facility, the longer outage period is critical for a whole KenGen's operation. With consideration of current demand in stable power supply, it is difficult to take a choice which requires longer down time.

*Tariff Barriers*

The sponsor has faced very rigid tariff barriers and tends to suffer from low profitability for any power generation project. Unlike usual sale agreement, the determination of the tariff rate is primarily sole discretion of the Energy Regulatory Commission[9] (formally the Electricity Regulatory Board) of the Government of Kenya. It is highly unlikely that they would raise the tariff significantly due to poor financial performance of the Kenya Power and Lighting Company Limited (KPLC), the monopolized transmission and distribution utility. In fact, for improving poor performance of the KPLC, the Government of Kenya has reduced the wholesale tariff from US$0.031/kWh to about US$0.023/kWh, confirmed by Interim Power Purchase Agreement on April 1, 2005. Thus, any power generation project has very limited flexibility for keeping profitability and tends to suffer from lower profit. The CDM will assist the project activity to overcome rigid tariff barriers and further accelerate the investment for developing energy efficient technology in Kenya

*Currency risks barriers*

[9] The Energy Regulatory Commission, the former Electricity Regulatory Board) has been presently established with the broader mandate, which includes not only for electricity sector but also for the entire energy sector such petroleum.

Currency risks are one of important risks for project sponsor, especially in the country like Kenya. At a price of US $ 10.50[10] per ton of $CO_2e$, the sales from CERs will generate about US $3.1 million in the first 7 years, which equals to approximately 9% of the project cost. Since the proceeds from CERs are in hard (foreign) currency, this will enable the company to mitigate currency risks. The hard-currency income will lower considerably foreign exchange risks for the purchase of the turbine and spare parts, and help overcome the high currency risk.

Four barriers have been identified that would prevent the implementation of this type of project (redevelopment of hydro power plants) under the current conditions in Kenya, but did not affect (at the same level) the other alternatives identified; consequently the project is additional under step 3.

**Step 4: Analyse other activities similar to the proposed project**

In order to test whether a credible claim can be made that there are real, prohibitive barriers to development of projects such as Optimization of Kiambere Hydro Power Project, it is important to note that no new hydro power station has been constructed over the last 15 years that supply electric power to the national grid, other than those implemented under the CDM.

Regarding the recent development of hydropower plants there is no relevance for this analysis since the last hydro power plant was constructed or developed in 1989. It is also worthwhile to note that the costs of hydro power plants are site specific.

There are several distinctive differences between the earlier power plants and its expansion. First of all, the ownership of KenGen has been changed. During 2006, the Government of Kenya has divested its interest of the company, by selling 30% of the shares to the public. This new ownership structure requires KenGen to valuate its investment in projects as a private investor on behalf of all of its shareholders (Government and the public), instead as a purely public investment. Second, the prices of relevant commodities for the equipment (steel, etc) have increased 30-40% in the recent years making new hydro project more expensive project. And third, because the deteriorated financial performance of KPLC, the monopoly utility, the Government of Kenya has reduced the wholesale tariff from US$0.031/kWh to about US$0.023/kWh.

## B.6. Emission reductions:

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

[10] Reference: State and Trends of Carbon Market 2006.

>> ACM0002-Version 7 was selected for the project. According to the ACM0002, it is required to estimate the Operating Margin (OM) and Build Margin (BM) emission factor ex-ante, and through weighted average of OM and BM, the Combined Margin baseline emission factor can be obtained and then the emission reductions from CDM project activity can be estimated.

The Operating Margin method selected is the Dispatch Data Analysis OM, the preferred choice. The Build Margin selected is option 2, ex-post calculation. The weights for calculating the Combined Margin are the default 50% for each of the margins.

The margins calculation was performed by the following steps as indicated in the methodology:

**Step 1: Calculation of the ex-ante OM (for estimation purposes only)**
The Dispatch Data Analysis OM is the option selected to calculate the OM emission factor. For the purpose of estimating the emissions reductions recent historical data was used. Following the formulas of the methodology, but using monthly data, result in an emission factor of **0.82 tCO2e/MWh.** The formulas used for calculating the emission factor are the following:

$$EF_{OM,DispatchData,y} = \frac{E_{OM,y}}{EG_y}$$

Formula 1

where *EGy* is the generation of the project (in MWh) in year *y*, and *EOM.y* are the emissions (tCO2) associated with the operating margin calculated as

$$E_{OM,y} = \sum_h EG_h \cdot EF_{DD,h}$$

Formula 2

where *EGh* is the generation of the project (in MWh) in each hour *h* and *EFDD,h*[11] is the hourly generation weighted average emissions per electricity unit (tCO2/MWh) of the set of power plants (*n*) in the top 10% of grid system dispatch order during hour *h*:

$$EF_{DD,h} = \frac{\sum_{i,n} F_{i,n,h} \cdot COEF_{i,n}}{\sum_n GEN_{n,h}}$$

Formula 3

where $F_{i,n,h}$, is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *i* in hour *h*, and *n* refers to the set of plants (*n*) falling within the top 10% of the system dispatch. To determine the set of plants (*n*), obtain from a national dispatch center: a) the grid system dispatch order of operation for each

[11] For estimation purposes the factors were calculated using monthly data instead of hourly data. The actual calculation of the Operating Margin during the lifetime of the project will be with hourly data as indicated by the Methodology.

power plant of the system; and b) the amount of power (MWh) that is dispatched from all plants in the system during each hour that the project activity is operating ($GEN_h$). At each hour *h*, stack each plant's generation ($GEN_{n,h}$) using the merit order. The set of plants (*n*) consists of those plants at the top of the stack (i.e., having the least merit), whose combined generation ($\Sigma$ *GENh*) comprises 10% of total generation from all plants during that hour (including imports to the extent they are dispatched).

*COEFi,n* is the $CO_2$ emission coefficient of fuel *i* ($tCO_2$ / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *n* and the percent oxidation of the fuel

The CO2 emission coefficient *COEFi* is obtained as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i$$

Formula 4

Where:
$NCV_i$ is the net calorific value (energy content) per mass or volume unit of a fuel *i*,
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values), $EF_{CO2,i}$ is the CO2 emission factor per unit of energy of the fuel *i*.
Where available, local values of $NCV_i$ and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

**Step 2: Calculation of the ex-ante BM**
The BM is defined as the generation-weighted average emission factor ($tCO_2$/MWh) of a sample of power plants. Such a sample should be composed by either the 5 most recently built plants or the plants whose aggregated generation comprises the most recent 20% of the Kenyan Grid's generation in the year of project generation occurrence, whichever group's generation is greater – both lists should exclude CDM-Status plants. The methodology gives 2 options for the calculation of the BM. The second option was selected – this option required the BM to be calculated ex-post for the year in which actual project generation and associated emissions reductions occur.

The BM was calculated ex-ante by applying to the selected sample the following formula:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

Formula 5

where *Fi ,j, y* is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*, *j* refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid, *COEFi,j y* is the $CO_2$ emission coefficient of fuel *i* ($tCO_2$ / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant

power sources *j* and the percent oxidation of the fuel in year(s) *y*, and *GENj,y* is the electricity (MWh) delivered to the grid by source *j*.

The CO2 emission coefficient *COEFi* is obtained as indicated in formula 4 above.

The results for this calculation are given in the following table:

| *Power Plant* | *Type* | *Installed capacity* *MW* | *Generation 5 years average* *GWh/yr* | *Emission Factor* *tCO2e/MWh* | *Commissioning year* | *Total Emission* *tCO2e/Yr* |
|---|---|---|---|---|---|---|
| Kipevu_Diesel_1 | Thermal (ST) | 73.5 | 294 | 0.6609 | 1999 | 194,293 |
| Orpower4 | Geothermal | 13 | 104.2 | 0.1000 | 1999 | 10,420 |
| Iberafrica | Thermal (ST) | 56 | 303.4 | 0.7276 | 1997 | 220,748 |
| Olkaria_II | Geothermal | 70 | 483 | 0.1000 | 2003 | 48,300 |
| Tsavo | Thermal (ST) | 74 | 347.6 | 0.6577 | 2001 | 228,610 |
| ***Total*** | | ***286.5*** | ***1,532.20*** | ***0.4584*** | | ***702,370*** |

**Step 3: Calculation of the CM**
Following the methodology, the baseline emission factor is the CM calculated as the weighted average of the OM and the BM as follows:

$CM = w_{OM} \times OM + w_{BM} \times BM$ Formula 6

OM and the BM ex-ante calculation were based on most recent data available at the time of PDD submission.

The $w_{OM}$ and $w_{BM}$ by default for hydro power plants according to the methodology, are 0.50 and 0.50, respectively. The resulting CM_EF is **0.6396 tCO2e/MWh**.

**Step 4: Calculation of Fugitive Emissions from No-condensable Gases**

Since the plant is based on a run-off with no significant storage, there are no emissions of non-condensable gases envisaged.

**Step 5: Calculation of the project's ERs prior to validation.**
ERs per year for the project are to be calculated ex-post annually from the following multiplication:

Baseline emissions (tCO2e) = [OM (calculated ex-post) + BM (calculated ex-ante)]/2 x (annual project generation in MWh= ERs per year (tCO2e).

**B.6.2. Data and parameters that are available at validation:**

*(Copy this table for each data and parameter)*

All data and parameters used to calculate actual emissions reductions will be monitored ex-post. Data and parameters used for an ex-ante estimation as follows:

| *(Copy this table for each data and parameter)* | |
|---|---|
| **Data / Parameter:** | **$EG_y$** |
| Data unit: | MWh. |
| Description: | Energy dispatched to the Kenyan Grid. |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 935,600 MWh per year |
| Description of measurement methods and procedures to be applied: | Electricity meters installed complying with country regulations; records double checked with receipt of sales. |
| QA/QC procedures to be applied: | No special monitoring equipment is needed. The sponsor will utilize a monitoring plan and pre-programmed spreadsheets so the sponsor will just need to collect the information as described and apply the formula as directed in the monitoring plan. The Dispatch Center will be the only data provider for the project generation data. The project staff designated will confirm the data with own records and own records will be double checked with sales receipts. |
| Any comment: | N/A. |

| **Data / Parameter:** | **$EG_{historical}$** |
|---|---|
| Data unit: | MWh. |
| Description: | Averaged annual electricity supplied to grid prior to retrofit |
| Source of data to be used: | KPLC and KenGen |
| Value of data applied for the purpose of calculating expected emission reductions in | 875,600 MWh per year |

| | |
|---|---|
| section B.5 | |
| Description of measurement methods and procedures to be applied: | Historical generation data over the past 120 months |
| QA/QC procedures to be applied: | KenGen's data have been double checked by the data in KPLC. |
| Any comment: | N/A. |

| **Data / Parameter:** | $EF_{OM,y}$ |
|---|---|
| Data unit: | $tCO_2e/MWh$ |
| Description: | Operating Margin Emission Factor |
| Source of data to be used: | Calculated based on formulas 1, 2, 3 and 4 using KPLC data and IPCCC factors |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.82 $tCO_2e/MWh$ |
| Description of measurement methods and procedures to be applied: | Dispatch data, merit order from KPLC and IPCC manual |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Automatically calculated from KPLC databases and ACM0002 procedures. Calculation should be done after KPLC energy balance to ensure data validity |
| Any comment: | N/A. |

| **Data / Parameter:** | $F_{i,n,h}$ |
|---|---|
| Data unit: | Mass or volume |
| Description: | Amount of each fossil fuel consumed by each power source / plant |
| Source of data to be used: | IPCC Guidelines, KenGen and KPLC data |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Included in Annex 3 for each plant |
| Description of measurement methods and procedures to be applied: | This is calculated from generation data of each specific power plant using IPCC guidelines. |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | |
| Any comment: | N/A. |

| **Data / Parameter:** | $COEF_{i,j,y}$ |
|---|---|
| Data unit: | $tCO_2$/mass or volume |
| Description: | $CO_2$ emission factor of each plant by fuel type used *i*, taking into account the carbon content of the fuels used by relevant power sources j and percent of oxidation of fuel in year y |
| Source of data to be used: | IPCC Guidelines, KenGen and KPLC data |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | Obtained using IPCC world-wide default values |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants. For new plants, validation should be accomplished through fuel type normal emission factors from similar plants. |
| Any comment: | ***j*** refers to the power sources delivering electricity to the grid, not including low operating cost and must run power plants, and including imports to the grid. |

| **Data / Parameter:** | $EF_y$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | CO2e Emission factor of the grid |
| Source of data to be used: | Calculated based on formula 4 |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Automatic calculation through a revised worksheet |
| Any comment: | |

| **Data / Parameter:** | $EF_{BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin Emission Factor of the grid |
| Source of data to be used: | Calculated based on formula 5, KPLC data and IPCC factors |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.4584 $tCO_2e$/MWh |
| Description of measurement methods and procedures to be applied: | Dispatch data, merit order from KPLC and IPCC manual |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Automatic calculation through a revised worksheet |
| Any comment: | |

| **Data / Parameter:** | $GEN_{j, y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Generation of electricity delivered to the grid by each power plant |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Data automatically obtained from KPLC database |
| Any comment: | ***j*** refers to the power sources delivering electricity to the grid |

| **Data / Parameter:** | *Plant name* |
|---|---|
| Data unit: | Text |
| Description: | Plant name. Identification of power sources |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | As new power plants are available in the system |
| QA/QC procedures to be applied: | |
| Any comment: | |

| **Data / Parameter:** | $GEN_{j, y\ IMPORTS}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity imports to the project electricity system |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | |
| Any comment: | |

| **Data / Parameter:** | $COEF_{j, y\ IMPORTS}$ |
|---|---|
| Data unit: | $tCO_2$/mass or volume |
| Description: | $CO_2$ emission coefficient of fuels used in connected electricity systems (if imports occur) |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing imports. For new imports, validation should be accomplished through fuel type or grid normal emission factors. |
| Any comment: | ***j*** refers to the power sources delivering electricity to the grid |

| **Data / Parameter:** | $NCV_i$ |
|---|---|
| Data unit: | TJ/mass or volume |
| Description: | Net calorific fuel value per mass or volume unit of a fuel i |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants and their fuels. |
| Any comment: | |

| **Data / Parameter:** | $OXID_i$ |
|---|---|
| Data unit: | % |
| Description: | Oxidation factor of the fuel |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | |
| Any comment: | |

| **Data / Parameter:** | $SFC_{BM,i}$ |
|---|---|
| Data unit: | ton of fuel /MWh or TJ of fuel /MWh |
| Description: | Specific fuel consumption of the ith electricity generation plant |
| Source of data to be used: | KPLC and KenGen |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants. For new plants, validation should be accomplished through fuel type normal emission factors from similar plants. |
| Any comment: | |

| **Data / Parameter:** | $CEF_{BM,}$ |
|---|---|
| Data unit: | $tCO_2$/(ton of fuel or TJ of fuel). |
| Description: | $CO_2$ content of fuel used in electricity thermal generation plants |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants. For new plants, validation should be accomplished through fuel type normal emission factors from similar plants. |
| Any comment: | |

### B.6.3 Ex-ante calculation of emission reductions:

The estimated ERs per year for the first crediting period equal 38,376 tCO2/yr[12] times seven, which is equal to 268,632 tCO2e or estimated ERs[13].

### B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

| Year | Estimation of Project Activity Emissions (tones of $CO_2e$) | Estimation of Baseline emissions (tones of $CO_2e$) | Estimation of Leakage (tones of $CO_2e$) | Estimation of overall emissions reductions (tones of $CO_2e$) |
|---|---|---|---|---|
| Aug 2008 – July 2009 | 0 | 38,376 | 0 | 38,376 |
| Aug 2009– July 2010 | 0 | 38,376 | 0 | 38,376 |
| Aug 2010– July 2011 | 0 | 38,376 | 0 | 38,376 |
| Aug 2011– July 2012 | 0 | 38,376 | 0 | 38,376 |
| Aug 2012– July 2013 | 0 | 38,376 | 0 | 38,376 |
| Aug 2013– July 2014 | 0 | 38,376 | 0 | 38,376 |
| Aug 2014– July 2015 | 0 | 38,376 | 0 | 38,376 |
| Total | 0 | 268,632 | 0 | 268,632 |

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

### B.7.1 Data and parameters monitored:

*(Copy this table for each data and parameter)*

| **Data / Parameter:** | **$EG_y$** |
|---|---|
| Data unit: | MWh. |
| Description: | Energy dispatched to the Kenyan Grid. |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 935,600 MWh per year |
| Description of measurement methods | Electricity meters installed complying with country regulations; records double checked with receipt of sales. |

[12] All margins were rounded to the fifth decimal, but the CERs per year were rounded down to the nearest integer.
[13] All margins estimations can be seen in E.4.

| | |
|---|---|
| and procedures to be applied: | |
| QA/QC procedures to be applied: | No special monitoring equipment is needed. The sponsor will utilize a monitoring plan and pre-programmed spreadsheets so the sponsor will just need to collect the information as described and apply the formula as directed in the monitoring plan. The Dispatch Center will be the only data provider for the project generation data. The project staff designated will confirm the data with own records and own records will be double checked with sales receipts. |
| Any comment: | N/A. |

| **Data / Parameter:** | $EF_{OM,y}$ |
|---|---|
| Data unit: | $tCO_2e/MWh$ |
| Description: | Operating Margin Emission Factor |
| Source of data to be used: | Calculated based on formulas 1, 2, 3 and 4 using KPLC data and IPCCC factors |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.82 $tCO_2e/MWh$ |
| Description of measurement methods and procedures to be applied: | Dispatch data, merit order from KPLC and IPCC manual |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Automatically calculated from KPLC databases and ACM0002 procedures. Calculation should be done after KPLC energy balance to ensure data validity |
| Any comment: | N/A. |

| **Data / Parameter:** | $F_{i,n,h}$ |
|---|---|
| Data unit: | Mass or volume |
| Description: | Amount of each fossil fuel consumed by each power source / plant |
| Source of data to be used: | IPCC Guidelines, KenGen and KPLC data |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Included in Annex 3 for each plant |
| Description of measurement methods and procedures to be applied: | This is calculated from generation data of each specific power plant using IPCC guidelines. |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | |
| Any comment: | N/A. |

| **Data / Parameter:** | $COEF_{i,j,y}$ |
|---|---|
| Data unit: | $tCO_2$/mass or volume |
| Description: | $CO_2$ emission factor of each plant by fuel type used *i*, taking into account the carbon content of the fuels used by relevant power sources j and percent of oxidation of fuel in year y |
| Source of data to be used: | IPCC Guidelines, KenGen and KPLC data |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | Obtained using IPCC world-wide default values |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants. For new plants, validation should be accomplished through fuel type normal emission factors from similar plants. |
| Any comment: | ***j*** refers to the power sources delivering electricity to the grid, not including low operating cost and must run power plants, and including imports to the grid. |

| **Data / Parameter:** | $EF_y$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | CO2e Emission factor of the grid |
| Source of data to be used: | Calculated based on formula 4 |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Automatic calculation through a revised worksheet |
| Any comment: | |

| **Data / Parameter:** | $EF_{BM,y}$ |
|---|---|
| Data unit: | tCO2e/MWh |
| Description: | Build Margin Emission Factor of the grid |
| Source of data to be used: | Calculated based on formula 5, KPLC data and IPCC factors |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.4584 $tCO_2e$/MWh |
| Description of measurement methods and procedures to be applied: | Dispatch data, merit order from KPLC and IPCC manual |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Automatic calculation through a revised worksheet |
| Any comment: | |

| **Data / Parameter:** | $GEN_{j, y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Generation of electricity delivered to the grid by each power plant |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | Data automatically obtained from KPLC database |
| Any comment: | ***j*** refers to the power sources delivering electricity to the grid |

| **Data / Parameter:** | *Plant name* |
|---|---|
| Data unit: | Text |
| Description: | Plant name. Identification of power sources |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | As new power plants are available in the system |
| QA/QC procedures to be applied: | |
| Any comment: | |

| **Data / Parameter:** | $GEN_{j, y\ IMPORTS}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity imports to the project electricity system |
| Source of data to be used: | KPLC |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | |
| Any comment: | |

| **Data / Parameter:** | $COEF_{j, y\ IMPORTS}$ |
|---|---|
| Data unit: | $tCO_2$/mass or volume |
| Description: | $CO_2$ emission coefficient of fuels used in connected electricity systems (if imports occur) |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing imports. For new imports, validation should be accomplished through fuel type or grid normal emission factors. |
| Any comment: | ***j*** refers to the power sources delivering electricity to the grid |

| **Data / Parameter:** | $NCV_i$ |
|---|---|
| Data unit: | TJ/mass or volume |
| Description: | Net calorific fuel value per mass or volume unit of a fuel i |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants and their fuels. |
| Any comment: | |

| **Data / Parameter:** | $OXID_i$ |
|---|---|
| Data unit: | % |
| Description: | Oxidation factor of the fuel |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly |
| QA/QC procedures to be applied: | |
| Any comment: | |

| **Data / Parameter:** | $SFC_{BM,i}$ |
|---|---|
| Data unit: | ton of fuel /MWh or TJ of fuel /MWh |
| Description: | Specific fuel consumption of the ith electricity generation plant |
| Source of data to be used: | KPLC and KenGen |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants. For new plants, validation should be accomplished through fuel type normal emission factors from similar plants. |
| Any comment: | |

| **Data / Parameter:** | $CEF_{BM,}$ |
|---|---|
| Data unit: | $tCO_2$/(ton of fuel or TJ of fuel). |
| Description: | $CO_2$ content of fuel used in electricity thermal generation plants |
| Source of data to be used: | IPCC Guidelines |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | |
| Monitoring frequency | Yearly or twice a year |
| QA/QC procedures to be applied: | Internal validation check should be performed contrasting historical data for existing plants. For new plants, validation should be accomplished through fuel type normal emission factors from similar plants. |
| Any comment: | |

**B.7.2 Description of the monitoring plan:**

**>>** The monitoring methodology determines the baseline emissions by observing the actual power dispatch data from KPLC. Note that the detail in the Annex 4 Monitoring and Verification Protocol.

Please refer to section B.6.3 for formulae reference

The monitoring methodology involves the monitoring of the following:

- Electricity generated and fed into the grid by the proposed CDM project.
- Public data on dispatch of electricity and other relevant information from KPLC.
- Public data on official KPLC report.

**1-. Data Processing for ER calculation**

***Step 1. Calculation of Operating Margin Emission Factors***

The next diagram shows the complete process for calculating and assigning the operating emission factors for the Optimisation of Kiambere Power Project:

Net Hourly Generator output from Optimisation of Kiambere Power Project and other units in the system
(MWh)

⇩

Analysis of hourly dispatch from all units to determine the top 10% on the margin
(KPLC hourly data)

⇩

Calculation of emission factor of all operational thermal units of the system
(KPLC, KenGen, IPCCC Guidelines)
(tonnes $CO_2e$/MWh)

⇩

Determination of $EF_{OM}$ of the project as the weighted average emission factor
(tonnes $CO_2e$/MWh)

***Step 2 - Calculation of the Build Margin***

The Build Margin is calculated with the least cost options identified in the official expansion plan.

Please refer to formulae stated in section B.6.3 (**formulae 4 and 5**)

The next diagram shows the complete process for calculating and assigning the Build Margin emission factor:

Dispatch of all power units of the system
(MWh)
⇩
Determination of 20% of energy generated from most recent power units
(set of m plants following ACM0002 option 2)
(MWh)
⇩
Calculation of emission factor of thermal units in the plan
(IPCC manual)
(tonnes $CO_2e$/MWh)
⇩
Determination of $EF_{BM}$ (ACM0002) as the weighted average emission factor of the dispatched plants and their individual emission factor
(tonnes $CO_2e$/MWh)

*Step 3 – Calculation of the Project Emissions Reductions*

The combined emission factor for the Optimisation of Kiambere Power Project, according to ACM0002, is calculated with weighted average for both the Operating Margin (OM) and the Build Margin (BM).

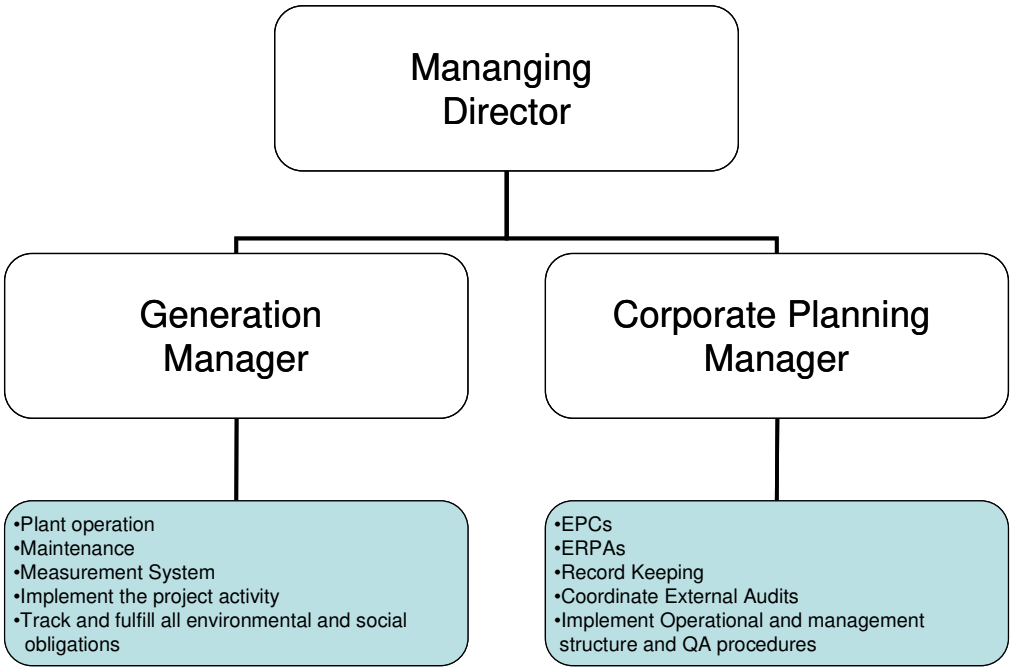
Please refer to formulae stated in section B.6.3 (**formula 6**)

Calculation of Combined Margin Emission factor of $EF_{BM}$ and $EF_{OM}$
(tonnes $CO_2e$/MWh)
⇩
Energy generation of the Optimisation of Kiambere Power Project CDM Project
(from KPLC or metering data)
(MWh)
⇩
Calculation of Baseline Emissions of the Project
(tonnes $CO_2e$)
⇩
Discount any leakage or project activity emissions, if any (no leakage emission was identified for Optimisation of Kiambere Power Project)
(tonnes $CO_2e$)

**2-. Operational and Management structure**

In order to succeed with quality CERs, the project developer will implement and maintain a proper management structure as follows:

**Figure B.6 KenGen General Management Structure**




KenGen will designate a competent manager who will be in charge of and accountable for the generation of ERs including ERPA supervision, monitoring, record keeping, computation of ERs, audits and verification. A generation manager will be in charge of all plant production, maintenance activities, developing the project and fulfil all social and environmental obligations relative to the project activities.

KenGen will ensure that the required capacity and internal training is made available to its operational staff to enable them to undertake all the required tasks in a transparent manner.

**B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)**

>>

The baseline study and monitoring methodology were completed on 09/02/2007 on behalf of the Danish Carbon Fund by:
Mr. Pius Kollikho
Senior Hydrologist
pkollikho@kengen.co.ke,
KenGen, and
Mr. Fernando Cubillos
Sr. Technical Specialist

fcubillos@worldbank.org
Zijun Li
zli4@worldbank.org
The World Bank Carbon Finance Business Unit.

## SECTION C. Duration of the project activity / crediting period

### C.1 Duration of the project activity:

#### C.1.1. Starting date of the project activity:

01/08/2008

#### C.1.2. Expected operational lifetime of the project activity:

>>50 years

### C.2 Choice of the crediting period and related information:

#### C.2.1. Renewable crediting period

##### C.2.1.1. Starting date of the first crediting period:

>> 01/08/2008 (Refer to A. 4)

##### C.2.1.2. Length of the first crediting period:

>>7 years

#### C.2.2. Fixed crediting period:

N/A

##### C.2.2.1. Starting date:

N/A

##### C.2.2.2. Length:

N/A

## SECTION D. Environmental impacts

### D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

No EIA for this project has been conducted since Environmental Coordination and Management Act (EMCA, 1999) does not require EIA in case that the major project activity is replacement of the turbine,

unlike a new hydro power house. However, Annual Environmental Audits for the Kiambere power station will be carried as required by EMCA and guidance by National Environmental Management Authority (NEMA).

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

N/A

## SECTION E. Stakeholders' comments

>>

**E.1. Brief description how comments by local stakeholders have been invited and compiled:**

Stakeholder consultations were done to incorporate comments from the locals before project implementation. There were two stakeholder meetings being held before December 2007.

The first stakeholder meeting was held on 4th October 2007 in the Gitaru conference room with the local stakeholders including chairman, community liaison officer, and representatives of the communities, etc. The role of KenGen was highlighted and its efforts in corporate social responsibility (CSR) were emphasized. The CSR committee of KenGen announced an assistance policy of scholarship award to the five nearby neighbourhoods, to meet their demands of constructing schools, roads and hospitals as earlier requested. KenGen has been assisting the local children's home, planting trees, awarding scholarships to the best students and will continue to do the same in future under its corporate social responsibility project. On 5th December 2007, there was a meeting on presentation of CDCF (community development carbon fund) community Benefit plan presentation. During the meeting, Liaison officer and the HRO training and development department agreed to come up with the community benefit plan by first visiting the projects done by the committee and also those that have been requested by the local community.

**E.2. Summary of the comments received:**

As for local benefits, KenGen has taken actions agreed with the local communities. See Section E.3.

**E.3. Report on how due account was taken of any comments received:**

Based on the needs listed on the stakeholder meeting on December 5th 2007, KenGen and local leaders have agreed on providing water to some parts of the community; constructing six water kiosks at Musumaa sub-location around masinga power station; constructing Classrooms in primary schools and water health centers; etc. The Community Development Carbon Fund will provide some funds towards education and health projects in the project vicinity.

**Annex 1**

**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

| | |
|---|---|
| Organization: | Kenya Electricity Generating Company Ltd (KenGen) |
| Street/P.O.Box: | Kolobot Road, P.O Box 47936-00100 |
| Building: | Stima Plaza |
| City: | Nairobi |
| State/Region: | Nairobi |
| Postfix/ZIP: | 20 |
| Country: | Kenya |
| Telephone: | 254-20-3666000 |
| FAX: | 254-20-248848 |
| E-Mail: | jwahogo@kengen.co.ke |
| URL: | http://www.kengen.co.ke |
| Represented by: | James Wahogo |
| Title: | Corporate Planning and Strategy Manager |
| Salutation: | Mr. |
| Last Name: | Wahogo |
| Middle Name: | Karari |
| First Name: | James |
| Department: | Corporate Planning and Strategy |
| Mobile: | 254-722753597 |
| Direct FAX: | 254-20-248848 |
| Direct tel: | 254-20-3666425 |
| Personal E-Mail: | jwahogo@kengen.co.ke |

| | |
|---|---|
| Organization: | International Bank for Reconstruction and Development as the Trustee of the Danish Carbon Fund (DCF) |
| Street/P.O.Box: | 1818 H street |
| Building: | |
| City: | Washington |
| State/Region: | District of Colombia (DC) |
| Postfix/ZIP: | 20433 |
| Country: | Unites States of America |
| Telephone: | |
| FAX: | |
| E-Mail: | IBRD-carbonfinance@worldbank.org |
| URL: | http://carbonfinance.org/ |
| Represented by: | |
| Title: | Manager, Carbon Finance Unit |
| Salutation: | Ms. |
| Last Name: | Chassard |
| Middle Name: | |
| First Name: | Joelle |
| Department: | Carbon Finance Unit, the World Bank |
| Mobile: | |
| Direct FAX: | |

| | |
|---|---|
| Organization: | DNA of Spain |
| Street/P.O.Box: | Plaza San Juan De La Cruz |
| Building: | |
| City: | Madrid |
| State/Region: | |
| Postfix/ZIP: | 28071 |
| Country: | Spain |
| Telephone: | 915976026 |
| FAX: | 915975991 |
| E-Mail: | sgpccc@mma.es |
| URL: | |
| Represented by: | |
| Title: | General Secretary |
| Salutation: | |
| Last Name: | Gonzalo Aizpiri |
| Middle Name: | |
| First Name: | Arturo |
| Department: | Department of Prevention of Pollution and Climate Change |
| Mobile: | |

| | |
|---|---|
| Direct FAX: | |
| Direct tel: | |
| Personal E-Mail: | |

**Annex 2**

## INFORMATION REGARDING PUBLIC FUNDING

No public funding is available for the proposed project.

## Annex 3

## BASELINE INFORMATION

**Table A3-1 Power plants connected to Kenya national power grid in 2004**

| *Power Plant* | *Type* | *Installed capacity (MW)* | *Average generation (GWh/y) 2000-4* | *% of Total Generation* | *Fuel Consumption (1,000 toe)* | *Commissioning year* |
|---|---|---|---|---|---|---|
| Tana | Hydro | 14.4 | 67.2 | 1.42% | 0 | 1932-56 |
| Wanjii | Hydro | 7.4 | 41 | 0.87% | 0 | 1952 |
| Kamburu | Hydro | 94.2 | 366.4 | 7.75% | 0 | 1974-76 |
| Gitaru | Hydro | 225 | 733.8 | 15.52% | 0 | 1978 |
| Kindaruma | Hydro | 40 | 171.6 | 3.63% | 0 | 1968 |
| Masinga | Hydro | 40 | 152 | 3.22% | 0 | 1981 |
| Kiambere | Hydro | 144 | 763.6 | 16.16% | 0 | 1988 |
| Small Hydro | Hydro | 6.3 | 24.8 | 0.52% | 0 | 1925-58 |
| Turkwel | Hydro | 106 | 275.6 | 5.83% | 0 | 1991 |
| Olkaria I (Kengen) | Geothermal | 45 | 326.2 | 6.90% | 0 | 1981 |
| Olkaria II (Kengen) | Geothermal | 70 | 483 | 10.22% | 0 | 2003 |
| OrPower (IPP) | Geothermal | 13 | 104.2 | 2.20% | 0 | 1999 |
| KenGen Wind | Wind | 0.35 | 0.24 | 0.01% | 0 | 1995 |
| ***Total of Hydro, Geothermal & Wind*** | | ***805.65*** | ***3,509.64*** | ***74.25%*** | | |
| Kipevu Steam | Thermal (ST) | 63 | 81.4 | 1.72% | 27.48 | 1972-76 |
| Kipevu I Diesel | Thermal (ST) | 73.5 | 294 | 6.22% | 62.10 | 1999 |
| Kipevu GT1 and GT2 | Thermal (GT) | 60 | 94.4 | 2.00% | 28.32 | 1987-97 |
| Nairobi Gas Turbine | Thermal (GT) | 13.5 | 1.56 | 0.03% | 0.69 | 1972 |
| Iberafrica Diesel (IPP) | Thermal (ST) | 56 | 303.4 | 6.42% | 68.27 | 1997 |
| Westmont Barge GT (IPP) | Thermal (GT) | 0 | 94.6 | 2.00% | 25.54 | 1997 |
| Tsavo Power Plant (IPP) | Thermal (ST) | 74 | 347.6 | 7.35% | 76.12 | 2001 |
| ***Total of Thermal*** | | ***340*** | ***1,216.96*** | ***25.75%*** | | |
| **Total** | | **1,145.65** | **4,726.60** | **100%** | **288.52** | |

| | IPCC default value | Reference |
|---|---|---|
| Net calorific value | 41.868 GJ/toe | Table 1-1, IPCC Workbook |
| C emission factor | Natural gas = 15.3 (dry)<br>Fuel oil = 20 (crude oil) | Table 1-1, IPCC Reference Manual |
| Fraction of C oxidized | Natural gas = 0.995<br>Crude Oil = 0.99 | Table 1-6, IPCC Reference Manual |

**Table A3 The most recent 20% of plants built, on a generation basis**

| Power Plant | Type of Generation | Installed Capacity (MW) | Generation (GWh/year) 2004/05) | Fuel Consumption (1,000 toe) | Commission Year | % of Total |
|---|---|---|---|---|---|---|
| Iberafrica Diesel | Thermal (ST) | 56 | 330 | 74.250 | 1997 | 6.3% |
| OrPower (IPP) | Geothermal | 13 | 115 | - | 1999 | 2.2% |
| Kipevu I Diesel | Thermal (ST) | 73.5 | 330 | 69.700 | 1999 | 6.3% |
| Tsavo Power Plant | Thermal (ST) | 74 | 508 | 111.252 | 2001 | 9.7% |
| Olkaia II (Kengen) | Geothermal | 70 | 549 | 0 | 2003 | 10.5% |
| **Sum of Olkaria & Tsavo** | | **144** | **1,057** | **111.252** | | **20.2%** |

**Table A4 The most recent five (5) plants built**

| Power Plant | Type of Generation | Installed Capacity (MW) | Average Generation (GWh/year) 2000-4 | Fuel Consumption (1,000 toe) 2000-4 | Commission Year |
|---|---|---|---|---|---|
| Iberafrica Diesel (IPP) | Thermal (ST) | 56 | 303.4 | 68.27 | 1997 |
| OrPower (IPP) | Geothermal | 13 | 104.2 | - | 1999 |
| Kipevu I Diesel | Thermal (ST) | 73.5 | 294.0 | 62.10 | 1999 |
| Tsavo Power Plant (IPP) | Thermal (ST) | 74 | 347.6 | 76.12 | 2001 |
| Olkaia II (Kengen) | Geothermal | 70 | 483.0 | - | 2003 |
| **Total** | | **286.5** | **1,532.2** | **206.49** | |

The most recent (5) plants are selected as sample group because of larger amount of the larger total annual generation.

**Annex 4**

**MONITORING PLAN**

**Refer to the CDM Operations Plan from the next page.**

# 1. THE CDM OPERATIONS PLAN

## 1.1 Purpose of the CDM Operations Plan

Monitoring, in the context of Clean Development Mechanism (CDM) of the Kyoto Protocol describes the systematic surveillance of a project's performance by measuring and recording performance-related indicators relevant to the project or activity. Verification is the periodic auditing of monitoring results, the assessment of achieved emission reductions (ER) and of the project's continued conformance with all relevant project criteria.

This CDM Operations Plan defines the criteria against which the Optimisation of Kiambere Power Project performance in terms of its greenhouse gas (GHG) reductions and conformance with all relevant Clean Development Mechanism (sustainable development) criteria will be monitored and verified. As such the CDM Operations Plan, after its validation, will be an integral part of the contractual agreement between the IBRD and Kenya Electricity Generating Company Limited (KenGen).

The CDM Operations Plan is a part of the project design documents. The CDM Operations Plan builds on the baseline scenario identified in the Optimisation of Kiambere Power Project Baseline Study and is fully consistent with the Baseline Study.

## 1.2 Use of the CDM OPERATIONS PLAN by the Project Operator

The CDM Operations Plan is a working document that identifies the key project performance indicators and sets out the procedures for tracking, monitoring, calculating and verifying the impacts of the project, in particular with respect to the project's ERs.

This CDM Operations Plan must be used by the project operator when planning and implementing the project and during the projects operation. Adherences to the instructions in the CDM Operations Plan is necessary for the project operators, to successfully measure and track the project impacts, and prepare for the periodic audit and verification process that will have to be undertaken to confirm the achieved Emission Reductions (ERs). The CDM Operations Plan is thus the basis for the production and delivery of ERs to the IBRD or other buyers and for any related revenue stream that the operator expects to receive.

The CDM Operations Plan assists the operator in establishing a credible, transparent, and adequate data measurement, collection, recording and management system to successfully develop and maintain the proper information required for an audit of the collected information and for the verification and certification of the achieved ERs and other project outcomes. Specifically, the CDM Operations Plan provides the requirements and instructions for:

- Establishing and maintaining the appropriate monitoring system including spreadsheets for the calculation of ERs.
- Checking whether the project meets key sustainable development indicators;
- Implementing the necessary measurement and management operations;
- Preparing for the requirements of independent, third party verification and audits.

The CDM Operations Plan ensures environmental integrity and accuracy of crediting ERs by only allowing actual ER to be accounted for after they have been achieved. The CDM Operations Plan must therefore be used throughout the life of the project. It must be adopted as key input into the detailed planning of the project, and included into the operational manuals of the project.

The CDM Operations Plan can be updated and adjusted to meet operational requirements, provided the Verifier approves such modifications during the process of initial or periodic verification. In particular, any shifts in the applicable baseline that are identified by following this CDM OPERATIONS PLAN may lead to such amendments, which may be mandated by the Verifier.

### 1.3 Structure of the CDM Operations Plan

The CDM OPERATIONS PLAN document contains the following parts:

- **Section 2** explains concepts and principle assumptions applied in monitoring the GHG performance of the project and in calculating ERs. The section also discusses data sources and assumption and lays out why the CDM Operations Plan is expected to compute ERs in a conservative manner.
- **Section 3** contains instructions regarding operational and monitoring obligations the operator is expected to assume.
- **Section 4** presents the functioning of the CDM Operations Plan electronic workbook. The workbook is implemented as Excel spreadsheets and is an integral part of the CDM Operations Plan.
- **Section 5** contains the sustainable development CDM Operations Plan for the project, which allows assessing the environmental and development performance of the project against set targets (to be specified during the project's detailed design).
- **Section 6** explains the management and operation system that needs to be put in place to ensure a consistent, high quality monitoring work.
- **Section 7**, finally, describes the IBRD verification regime and details the auditing and verification procedures for the project.

## 2. CONCEPTS AND PRINCIPLE ASSUMPTIONS

The CDM Operations Plan builds on the baseline study. In the CDM Operations Plan, the methodology is guided by the need and limitation of measuring project performance indicators, and calculates ERs in an efficient and transparent way.

### 2.1 Emission reduction from the Optimisation of Kiambere Power Project Project

The Optimisation of Kiambere Power Project consists of upgrading the turbines with new runners at the existing Kiambere Power plant and hence increasing output by 20 MW. The project utilises discharge water from Kindaruma power station and will produce an average annual generation of 60 GWh. Optimisation of Kiambere Power Project is located in Eastern Province in Mbeere district.
The commissioning is scheduled for July 2008.

In a centrally planned system the baseline can be determined on the basis of the least cost expansion as defined by the planning authority. In Kenya, the Ministry of Energy (MOE) is responsible for policy formulation, coordination of the least cost expansion planning for the sub-sector and the planning and implementation of the rural electrification program. Independent Power Producers (IPPs) are free to choose the projects they want to develop and base their decisions on the returns on investments. Potential candidates for capacity expansions in the Kenyan Interconnected Grid System (IGS) are mostly thermal options: Coal fuelled plants, geothermal plants, gas fuelled combined cycle plants (CC), medium speed diesel (MSD) and gas fuelled open cycle turbines (GT), in addition to hydro power even though most economical hydro resources have been exploited in Kenya and there are only a few small hydro projects that can be developed. The baseline study establishes that the least cost expansion option for the Kenyan grid is coal thermal power generation. It is shown that coal generating plants, medium speed diesel (MSD) and gas fuelled open cycle turbines (GT) capacity addition will be dominant. The dispatch of power, based on economic merit order determined by lowest marginal cost of supply, favors coal thermal generating sources. At the margin, therefore, generation from Optimisation of Kiambere Power Project and other CDM projects in the system will displace coal thermal power that would have been dispatched in the absence of these CDM projects.

As indicated in the baseline study, the actual emission reduction to be credited from the project will depend on the country's expansion plan and the actual dispatch data for the IGS provided by the Kenya Power and Lighting Company Limited (KPLC)[14], considering that Emission Reductions of CDM projects must be accounted as first build, first served principle[15]. In the case of Optimisation of Kiambere Power Project, this

[14] The institutional set-up in the power sector is discussed in detail in subsequent section of this study.

[15] The "first-built first-served" principle implies that the "last" plant, existing in the grid, that would have been dispatched to meet the electricity requirement fulfilled by all the CDM projects in the grid is considered to be displaced due to introduction of the First CDM project built in the system. Similarly the first marginal plant is considered to be displaced by the CDM plant built last. Note that all CDM projects (even projects adopting other methodologies) must be considered.

will be the third CDM project in the system (IGS). The methodology for carrying this out and the monitoring and verification protocol for establishing the emission reduction are provided in this document.

## 2.2 Geographic and System Boundaries for the CDM OPERATIONS PLAN

The Baseline Study defines the project boundary to correspond to the Interconnected Grid System (IGS) for the purpose of identifying potential emissions and leakage during the projects lifetime.

The Interconnected Grid System (IGS) accounts for about 99% of the power generation capacity in Kenya.

The Baseline Study has not found leakage to be a problem for the project as the project is a closed system. Therefore the CDM Operations Plan does not correct the calculated ERs to account for leakage.

## 2.3 Time Boundary and Baseline Review Protocol

The Baseline Study has opted for a 7-year renewable baseline (for a total crediting period of 21 years) for which the project is likely to generate ERs in compliance with the CDM.

## 2.4 Calculating Emission Reductions

The emission reduction from the project result from the electricity from Optimisation of Kiambere Power Project displacing power generated mainly by thermal units on the margin in the Interconnected Grid System.

The Interconnected Grid System is coordinated by the Kenya Power and Lighting Company Ltd (KPLC). KPLC is the sole distribution and transmission company in Kenya.

The KPLC programs the dispatch of the power units by strict economic priority, considering the river flows, water availability, the operational cost of the thermal units and the filling of the hourly load curve of the demand. The outcome is the hourly generation program for each power unit and the hourly marginal cost of the whole system (that cost represents the highest operational cost of the power units generating in each hour). KPLC must coordinate in real time the dispatch at minimum cost of the power units according to the monthly, weekly, and daily programs.

KPLC keeps daily and monthly reports of the actual operation of the IGS, including in that report the half hourly generation for each power unit. The information required is provided to KenGen whenever needed.

The outline of the method to calculate the emission reduction is as follows:

### 2.4.1 Key Steps for Estimating Operating Margin Emission Factor

Net Hourly Generator output from other CDM Projects and Optimisation of Kiambere Power Project
(Kiambere Power Project is first in order of precedence for ER abatement)
(MWh)

⇩

Analysis of hourly dispatch from all units of the IGS to determine
top 10% of Marginal Plant(s) dispatched
(KPLC hourly data)

⇩

Calculation of emission factor of all operational units of the system
(KPLC/KenGen reports and IPCC manual)
(tonnes CO2e/MWh)

⇩

Determination of $EF_{OM}$ as the weighted average emission factor of the Marginal Plant(s) dispatched in the top 10% of the merit order
(tonnes CO2e/MWh)

### 2.4.2 Key Steps for Estimating Build Margin Emission Factor

IGS Dispatch of all power units of the system
(MWh)

⇩

Determination of 20% of energy generated from most recent power units
(set of m plants following ACM002 option2)
(MWh)

⇩

Calculation of emission factor of thermal units in the plan
(KPLC/KenGen reports and IPCC manual)
(tonnes CO2e/MWh)

⇩

Determination of $EF_{BM}$ (ACM002) as the weighted average emission factor of the dispatched plants and their individual emission factor
(tonnes CO2e/MWh)

### 2.4.3 Key Steps for Estimating Kiambere Power Project Emissions

Calculation of Combined Margin Emission factor of $EF_{BM}$ and $EF_{OM}$
(tonnes CO2e/MWh)

⇩

Energy generation of the Kiambere Power Project CDM Project
(from KPLC/KenGen reports or metering data)
(MWh)

⇩

Calculation of Baseline Emissions of the Project
(tonnes CO2e)

⇩

Discount any leakage or project activity emissions, if any
(No leakage emission was identified for Kiambere Power Project)
(tonnes CO2e)

## 2.5 Why is the CDM Operations Plan Conservative?

Care has been taken to avoid that the CDM Operations Plan methodology and the simplifications and assumptions made will lead to an overestimation of ERs as compared to the "true" numbers. The CDM Operations Plan is based on *actual* hourly dispatch data for the Interconnected Grid System and these are used to calculate the actual marginal plant that Optimisation of Kiambere Power Project displaces.

## 3. OPERATIONAL AND MONITORING OBLIGATIONS

The operator of the *Optimisation of Kiambere Power Project* will have certain operational and data collection obligations to fulfill, in order to maximize the greenhouse gas emissions reductions and to ensure that sufficient information is available to calculate ERs in a transparent manner and to allow for a successful verification of these ERs.

### 3.1 Operational Obligations

The operational obligations of the Project Operator are to ensure that all reasonable steps are taken to maximize the generation from the Optimisation of Kiambere Power Project and thereby maximize the GHG emissions reduction. This is in the interest of the operator anyway.

### 3.2 Data Requirements and Project Database

The data required for the CDM Operations Plan is in line with the kind of information collected by an electricity utility. The data used in this CDM Operations Plan will be collected by KenGen/KPLC/IPPs and comes from the following sources:

- The hourly generation of the project is obtained from the metering system of the plant, which is KPLC dispatch centre is able to obtain though System Control and Data Acquisition (SCADA) system.
- The actual dispatch of all units in the system and dispatch priority list of the power units is collected from the KPLC who keep electronic version of the half hourly dispatch data.

# 4. PROJECT WORKBOOK

This section explains and illustrates the steps required by the operator to enable the GHG emissions reductions to be calculated on a monthly basis using the Optimisation of Kiambere Power Project project workbook. It presents the worksheets contained in the workbook and illustrates their use. The electronic workbook is an Annex to the CDM OPERATIONS PLAN and an integral part thereof.

## 4.1 Main Data

The Optimisation of Kiambere Power Project CDM Operations Plan consists of one workbook made up of the following four separate worksheets:

- **Generation and other data collected from KPLC dispatch centre:** Data from electricity generation of all units of the system from KPLC Dispatch Center, dispatch priority order of all power generation facilities based on economic merit order for each power plant in the IGS.
- **Tonnes of $CO_2e$ ($tCO_2$) Emission Factors:** Emission Factor of thermal units of the system calculated every six months form the KPLC/KenGen generation data.
- **Dispatch estimation without CDM projects:** Determination of hourly marginal energy displacement due to CDM project activity (Optimisation of Kiambere Power Project and other CDM projects in the IGS).
- **Emission Displacement:** Determination of energy and emission displacement due to the operation of Optimisation of Kiambere Power Project, where Optimisation of Kiambere Power Project displacement is the third CDM project in the order of displacement.

*The following color key is used by the workbook:*

- **Title Field:** Light blue fields describe data and are the headings for the worksheet sections, a darker blue code is used for the main headings;
- **Equation fields:** Where appropriate, algebraic representations of the calculations being performed are included in the tables in the white fields*;*
- **Input Field - from database:** Yellow fields indicate cells in which the project operator is required to supply data input needed to run the worksheet;
- **Input Field - from cell within workbook:** Orange fields indicate cells to which the project operator is required to transfer data from another cell in the workbook;
- **Standard Conversion Fields:** Purple fields contain constants and/or conversion factors that are needed in the equations to calculate key values;
- **Calculation Fields:** Green fields include formulas that automatically calculate a parameter once the project operator has entered the input data in the yellow fields.

All data collected for the CDM Operations Plan will be stored on database that can transferred to an excel worksheet. The operator must complete the workbook per month starting from commissioning date of the Project. Every month, the operator must internally validate the emission reduction calculation of the project

and keep a signed registry for verification purposes. The monthly reports together with the operator's database and monitoring records form the "paper trail" which is essential for auditing purposes. The monthly workbooks will be a transparent record of electricity generation, emissions reductions, sustainable development data, etc. In some instances cumulative calculations are made. For example, the workbooks present a clear record, from month to month, of the cumulative greenhouse gas emissions reductions. The following sections describe how the first three worksheets calculate ERs.

## 4.2 Energy Generation of The CDM Project

The hourly net generation of Optimisation of Kiambere Power Project is obtained from the metering system of the power plant, but is also available from KPLC dispatch centre, who read able to read all power plants in the interconnected grid system. This information is compiled by KPLC dispatch centre as all other plants of the IGS. With this data, KPLC dispatch centre provides half hourly report of the system dispatch and hourly data is obtained by summing half hourly generation data.

### Step 1 – Energy Generation at Optimisation of Kiambere Power Project

| | | | Hour | | | | |
|---|---|---|---|---|---|---|---|
| Day | | | 1 | 2 | 3 | .. | 24 |
| | 1 | Energy Generation (MWh) | | | | | |
| | 2 | Energy Generation (MWh) | | | | | |
| | 3 | Energy Generation (MWh) | | | | | |
| | | Energy Generation (MWh) | | | | | |
| | 31 | Energy Generation (MWh) | | | | | |

## 4.3 Energy Generation Data of All Generating Units of the System

Data from electricity generation and dispatch Center consists of Data on actual operation of all units of the SIC, in particular the hourly dispatch of electricity generation from each power plant in the IGS.

### 4.3.1 Actual Dispatch in the KPLC dispatch

For every hour of the monitoring period, the actual dispatch of the IGS is obtained from the KPLC dispatch Centre. This information is send to KenGen designated people daily. A sample data is reproduced below.

| KENYA'S INTERGRATED GENERATION SYSTEM (MWh) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| STATION | 1 | 2 | 3 | 4 | 5 | 23 | 24 | TOTAL |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| HYDRO | | | | | | | | |
| | | | | | | | | |
| WANJII | 9.02 | 9.01 | 9.01 | 9.01 | …. | 9.09 | 9.10 | 109.327 |
| TANA | 15.60 | 15.40 | 15.60 | 15.40 | …. | 16.00 | 16.00 | 182.700 |
| MASINGA | 80.00 | 78.00 | 44.00 | 40.00 | …. | 74.00 | 66.00 | 797.000 |
| KAMBURU | 94.00 | 88.00 | 90.00 | 88.00 | …. | 86.00 | 88.00 | 1,326.000 |
| GITARU | 238.00 | 252.00 | 244.00 | 244.00 | …. | 276.00 | 214.00 | 3,718.000 |
| KINDARUMA | 44.00 | 44.00 | 44.00 | 44.00 | …. | 40.00 | 34.00 | 493.000 |
| KIAMBERE | 224.00 | 264.00 | 266.00 | 262.00 | …. | 242.00 | 236.00 | 3,183.000 |
| NDULA | 1.27 | 1.27 | 1.27 | 1.27 | …. | 1.27 | 1.27 | 15.243 |
| | | | | | | | | |
| TOTAL HYDRO | 705.89 | 751.68 | 713.88 | 703.68 | …. | 744.36 | 664.37 | 9,824.270.00 |
| | | | | | | | | |
| THERMAL | | | | | | | | |
| IBERAFRICA | 44.20 | 44.20 | 44.60 | 44.20 | …. | 80.60 | 44.80 | 994.200 |
| N/S FIAT GT | 0.00 | 0.00 | 0.00 | 0.00 | …. | 0.00 | 0.00 | 44.640 |
| OLKARIA 1 | 0.00 | 0.00 | 0.00 | 0.00 | …. | 0.00 | 0.00 | 0 |
| | | | | | | | | |
| ORPOWER4 STEAM | 26.90 | 26.98 | 26.79 | 26.95 | …. | 23.46 | 23.40 | 239.496 |
| MUMIAS POWER | 0.00 | 0.00 | 0.00 | 0.00 | …. | 3.04 | 2.46 | 23.570 |
| KIPEVU STEAM | 0.00 | 0.00 | 0.00 | 0.00 | …. | 0.00 | 0.00 | 0 |
| KIPEVU GT 1 | 0.00 | 0.00 | 0.00 | 0.00 | …. | 30.00 | 4.00 | 64.000 |
| KIPEVU GT 2 | 0.00 | 0.00 | 0.00 | 0.00 | …. | 66.00 | 2.00 | 126.000 |
| KIPEVU DIESEL | 40.00 | 40.00 | 38.00 | 40.00 | …. | 98.00 | 72.00 | 806.000 |
| | | | | | | | | |
| TOTAL THERMAL | 111.10 | 111.18 | 109.39 | 111.15 | 0.00 | 301.10 | 148.66 | 2,297.906.00 |

### 4.3.2 Dispatch Priority List

For every month the KPLC dispatch centre produces a dispatch merit order list of the power units in the IGS according to their marginal operation cost. That information is also available from KPLC dispatch centre and a sample is reproduced below.

| Station | Merit Order (Based on Variable cost) |
|---|---|
| Orpower4 | 1 |
| Geothermal | 2 |
| Hydro | 2 |
| Wind(Ngong) | 2 |
| Mumias | 3 |
| Tsavo | 4 |
| Kipevu Diesel 1 | 5 |
| Iberafrica | 6 |
| Aggreko (Embakasi) | 7 |
| UETC Day & Peak | 8 |
| UETC Night | 8 |
| Thermal KVN GT1 | 9 |
| Thermal KVN GT2 | 9 |
| Fiat GT | 10 |

## 4.4 The Build Margin Calculation

For the first crediting period, the Build Margin emission factor $EF_{BM}$, must be updated annually ex post for the year in which actual project generation and associated emissions reductions occur, accounting energy and emission form the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

All generation data is obtained from KPLC dispatch centre as indicated on section 4.3. All power units in the system can be arranged chronologically with commissioning dates that can be obtained from KenGen or KPLC annual reports.

The following table presents an example how to calculate the Build Margin Emission Factor for the Optimisation of Kiambere Power Project for a given year

| *Power Plant* | *Type* | *Installed capacity* | *Generation 5 years average* | *Emission Factor* | *Commissioning year* | *Total Emission* |
|---|---|---|---|---|---|---|
| | | *MW* | *GWh/yr* | *tCO2e/MWh* | | *tCO2e/Yr* |
| Kipevu_Diesel_1 | Thermal (ST) | 73.5 | 294 | 0.6609 | 1999 | 194,293 |
| Orpower4 | Geothermal | 13 | 104.2 | 0.1000 | 1999 | 10,420 |
| Iberafrica | Thermal (ST) | 56 | 303.4 | 0.7276 | 1997 | 220,748 |
| Olkaria_II | Geothermal | 70 | 483 | 0.1000 | 2003 | 48,300 |
| Tsavo | Thermal (ST) | 74 | 347.6 | 0.6577 | 2001 | 228,610 |
| ***Total*** | | ***286.5*** | ***1,532.20*** | ***0.4584*** | | ***702,370*** |

## 5. MANAGEMENT AND OPERATIONAL SYSTEMS CDM OPERATIONS PLAN

In order to ensure a successful operation of the Optimisation of Kiambere Power plant and the credibility and verifiability of the ERs achieved, the project must have a well defined management and operational system. It is the obligation of the operator to put such a system in place for the project. It must include the operation and management of the monitoring and record keeping system that is described in this CDM Operations Plan. The proper functioning of the Optimisation of Kiambere Power Project management and operational system must be monitored by the operator and will be subject to third party verification as far as the ability of the project to generate credible ERs is concerned. Therefore, the project management responsibilities that concern this CDM Operations Plan are outlined in this section.

### 5.1 Allocation of Project Management Responsibilities

The management and operation of the project is the responsibility of Kenya Electricity Generating Company Limited (KenGen), the project operator. Ensuring the environmental credibility of the project through accurate and systematic monitoring of the project's implementation and operation for the purpose of achieving trustworthy ERs is the key responsibility and accountability of the operator as far as this CDM Operations Plan is concerned. For calculating the ERs, the operator, KenGen shall rely on the data the company collects and the data collected by KPLC, based on the actual operation of the IGS dispatch, including in that report the hourly generation for each power unit.

Independent verifiers will periodically audit the operator and his management systems to ensure credibility and transparency of the reported ERs and other performance indicators of the Optimisation of Kiambere Power Project.

For the time the IBRD has an interest in the project, the IBRD has the responsibility to ensure the credibility of the generated ERs, arrange for periodic verification in line with the Kyoto Protocol requirements and modalities for the CDM and other relevant rules, to receive the verified and certified ERs and to pay the operator as agreed.

### 5.2 Management and Operational Systems

It is the responsibility of the operator to develop and implement a management and operational system that meets the requirements of the project and of this CDM Operations Plan. The CDM Operations Plan can only offer general guidance in this regard. This includes:

### 5.2.1 Data handling

The establishment of a transparent system for the collection, computation and storage of data, including adequate record keeping and data monitoring systems. The operator must develop and implement a protocol that provides for these critical functions and processes, which must be fit for independent auditing.

For electronic and paper based data entry and record keeping system, there must be clarity in terms of the procedures and protocols for collection and entry of data, use of workbooks and spreadsheets and any assumptions made, so that compliance with requirements can be assessed by a third party. Stand-by processes and systems, e.g. paper based systems, must be outlined and used in the event of and to provide for the possibility of system failures. The record keeping system must provide the paper train that can be audited.

### 5.2.2 Quality assurance

The operator, KenGen, must designate a competent manager who will be in charge of and accountable for the generation of ERs including monitoring, record keeping, computation of ERs, audits and verification. He or she will officially sign-off on all GHG Emission worksheets.

Well-defined protocols and routine procedures, with good, professional data entry, extraction and reporting procedures will ease time and costs, while making it considerably easier for the auditor and verifier to do their work - the more organized and transparent the organization the easier to track, monitor, verify and audit.
Proper management processes and systems records must be kept by the operator, KenGen, as the auditors will request copies of such records to judge compliance with the required management systems. Auditors will accept only one set of official information, and any discrepancies between the official, signed records and on-site records will be questioned.

### 5.2.3 Reporting

The operator will report regularly to the IBRD as well as to Government authorities as required by them.

The operator must transmit copies of completed worksheets to the IBRD on a regular basis while maintaining originals on file.

The operator, KenGen, will prepare reports as needed for audit and verification purposes.

The project should prepare a brief annual or biannual report which should include:

- Information on overall project performance,
- Emission reductions generated and verified and comparison with targets,
- Observations regarding CDM Operations Plan baseline scenario indicators,
- Compliance with sustainable development targets,

- Information on adjustment of key CDM Operations Plan assumptions concepts,
- Calculation methods and other amendments of the CDM Operations Plan and the monitoring system.

The report can be combined with the periodic verification report.

### 5.2.4 Training:

It is the responsibility of the operator to ensure that the required capacity and internal training is made available to its operational staff to enable them to undertake the tasks required by this CDM Operations Plan. Initial staff training must be provided before the project starts operating and generating ERs.

### 5.2.5 Verification and commissioning:

The management and operational system and the capacity to implement this CDM Operations Plan must be put in place before the project can start generating ERs.

This will be verified before the project is commissioned by the IBRD to generate ERs that the IBRD will accept.

The following Table summarizes the roles and responsibilities of the various project partners with regard to the monitoring system.

**Table 5.1 CDM Operations Plan P Management and Operation System: Roles of Project Partners**

| | KenGen | IBRD |
|---|---|---|
| Monitoring system | Review CDM Operations Plan and suggest adjustments if necessary<br>Develop and establish management and operations system<br>Establish and maintain monitoring system and implement CDM Operations Plan<br>Establish or confirm sustainable development indicators and performance targets<br>Prepare for initial verification and project commissioning | Review monitoring and management system<br>Ensure project meets requirements and safeguards<br>Arrange for initial verification |
| Data Collection | Establish and maintain data measurement and collection systems for all CDM Operations Plan indicators<br>Check data quality and collection procedures regularly | Review data collection systems |
| Data computation | Enter date in CDM Operations Plan workbooks | Review completed worksheets |

| | KenGen | IBRD |
|---|---|---|
| | Use CDM Operations Plan workbooks to calculate emission reductions | |
| Data storage systems | Implement record maintenance system<br>Store and maintain records (paper trail)<br>Implement sign off system for completed worksheets<br>Forward monthly and annual worksheet outputs | Receive copies of key records and reports<br>Maintain IRBD records |
| Performance monitoring and reporting | Analyze data and compare project performance with project targets<br>Analyze system problems and recommend improvements (performance management)<br>Prepare and forward periodic (monthly) reports | Review reports<br>Evaluate performance and assist with performance management |
| CDM OPERATIONS PLAN Training and Capacity Building | Develop and establish CDM Operations Plan training, and skills review and feedback system<br>Ensure that operational staff is trained and enabled to meet the needs of this CDM Operations Plan | Assist with CDM Operations Plan training and capacity building |
| Quality assurance, audit and verification | Establish and maintain quality assurance system with a view to ensuring transparency and allowing for audits and verification<br>Prepare for, facilitate and co-ordinate audits and verification process | Supervise projects<br>Arrange for periodic verification |

# 6. AUDITING AND VERIFICATION PROCEDURES

## 6.1 Audit and Verification Objectives

Periodic auditing and verification of project results is a mandatory component for all CDM projects and a IBRD requirement. The chief objective of the audit is to independently verify that the project has achieved the emission reductions reported by the operator. Audits are an integral part of the verification process and are undertaken in conjunction with verification and by the same firm.

This section of the CDM Operations Plan outlines the auditing and verification procedures and prerequisites. It provides instructions on how the monitoring work undertaken by the project operator in line with this CDM OPERATIONS PLAN as well as project performance and compliance with CDM requirements will be verified.

## 6.2 The IBRD Audit and Verification Regime

The IBRD submits every project to third party validation and verification, which is conducted by independent firms specializing in environmental auditing services (auditors, validators, verifiers, certifiers). IBRD expects that its auditors to be accredited under the Kyoto Protocol regime for providing these services. The IBRD verification system for CDM projects consists of these four activities:

### 6.2.1 Validation of project design

IBRD projects undergo validation of the project's design, baseline and CDM Operations Plan against CDM requirements and modalities. Validation is a CDM requirement. IBRD will not implement a project unless a validator has confirmed that the project design is in compliance with all relevant CDM requirements. Validated CDM Operations Plan for a project must be followed by the project operator. This CDM Operations Plan can be adjusted or amended, if necessary, in order to improve consistency with its objectives, general concepts and project circumstances, subject to approval by the project verifier. A renewal of validation is not necessary in this case.

### 6.2.2 Initial audit and verification of project readiness

The IBRD requires that each IBRD project successfully completes an initial audit and verification process before the IBRD will commission the project and accept emission reductions delivered by it. While initial verification is not a CDM requirement, the IBRD regards it as an essential and the final step in the IBRD project preparation and implementation cycle. To prevent conflicts of interest, verification must not be conducted by the same firm and individuals that have provided validation services for the project. But the initial auditor / verifier can (and should) also provide subsequent verification services to the project. Initial

verification provides an opportunity for verifiers to become familiar with the project, its context, the project operator and management.

The purpose of the initial audit and verification process is threefold:

- Ensure that the project has been implemented as planned, that the monitoring system is in place and that the project is ready to generate and record GHG emission reductions.
- Approve adjustments and amendments to the CDM Operations Plan that may have become necessary during the detailed design and construction of the project.
- Assist meeting IBRD supervision obligations and clear the way for project commissioning and generation of high quality ERs.

During initial verification auditors are expected to do the following. They will:

- Familiarize themselves with the project and project circumstances,
- Introduce the project staff to the audit and verification process,
- Check whether the project has been implemented as planned,
- Check whether assumptions that have an impact on the monitoring and verification processes and its outcomes are still reasonable, in particular baseline assumptions,
- Confirm system readiness: that the CDM Operations Plan has been implemented in the project's management and operational procedures and that all necessary monitoring elements are in place to ensure generation of verifiable emission reductions.

### 6.2.3 Periodic verification of emission reductions

All IBRD projects must undergo periodic audits and verification of emission reductions. This is a CDM requirement and the basis for issuance of Certified Emission Reductions (CERs) and for their value in the market place. Verification is arranged for by the IBRD and conducted at annual or longer intervals as appropriate for the project.

The purpose of periodic audits and verification is to confirm that:

- The project has achieved the ERs claim for the verification period in compliance with the methodology laid down in this CDM Operations Plan.
- The claimed ERs are real and additional to any that would have occurred in the baseline scenario as interpreted and developed in the Baseline Study and this CDM Operations Plan.
- The operation of the project continues to be in compliance with all Kyoto Protocol, IBRD and host country requirements and modalities for CDM projects.
- The project maintains a high quality monitoring systems consistent with the CDM Operations Plan.

As part of the periodic audit and verification process auditors are expected to:

- Review and audit relevant monitoring records and reports,
- Verify that the required measurements and observations have been made for all monitorable indicators in this CDM Operations Plan,

- Check whether the CDM Operations Plan methodology has been applied correctly and consistently
- Check whether achieved ERs have been computed correctly using the provided spreadsheets, and, if necessary, recalculate achieved ERs,
- Verify that all relevant CDM Operations Plan and baseline assumptions are still valid,
- Verify that the management and monitoring system, including data handling, record keeping and reporting, is in place and remains adequate,
- Verify that the social and environmental targets in this CDM Operations Plan have been met and that the project assists the host country in achieving sustainable development,
- Consult with the operator on the continued adequacy of the monitoring system and approve any modifications that need to be made to ensure a high quality monitoring operation.
- Undertake any other activities required by this CDM Operations Plan, by the Kyoto Protocol requirements and modalities for the CDM, by the appropriate host country authorities or by professional auditing and verification standards and practice.

Verification concludes with a formal verification report. The report may include a statement that may permit the renewal of the project's crediting period in line with applicable CDM rules and modalities.

### 6.2.4 Certification of emission reductions

A successfully completed verification process and the related verification report provide the basis for the issuance by the verifier of an emission reduction certificate. The certificate is a legally binding statement which confirms the (successful) verification report's conclusion that has project has achieved the stated quantity of ERs in compliance with all relevant criteria and requirements. The verifier's certificate constitutes sufficient confirmation for the IBRD as to the project's emission reduction performance.

The certificate is issued by the verifier for the project only and it does not automatically constitute or create Certified Emission Reductions (CERs) in the sense of Art. 12 Kyoto Protocol. However, the verifier's certificate may be used by the IBRD and/or Kenyan authorities or authorized entities in the process of issuance and registration of CERs by the competent authority in line with applicable CDM and Kyoto Protocol modalities and procedures.

## 6.3 Auditing Criteria and Needs

Verification includes an audit of the project's output information and data and management systems on the basis of the following established criteria:

- Completeness
- Accuracy
- Coverage
- Risk Management Controls

Auditors / verifiers will request information (in the form of records and documentation) from the operator to determine if key performance indicators meet the objectives of the project as set out in this document. The

operator is required to record all such indicators, and provide satisfactory documentation and an audit trail for verification purposes (see, for instance, the recommended protocols on recording diesel purchases and consumption for the operator, generation and sales records, etc.). The information that will be needed includes

- **Records on reported GHG emission reductions** including the electronic spreadsheets / workbooks and supporting documentation (assumptions, data estimations, measurement methods, etc)
- **Records on reported social and environmental performance** as measured by indicators and targets laid down in this CDM Operations Plan
- **Records on project management,** including monitoring, data collection and management systems

The audit process followed, as with other management systems, is interactive, iterative and participatory. The auditors will determine the credibility and accuracy of the reported performance through spot checks of data measurement and collection systems and interviews with the key project participants. It is necessary for all involved in an audit to understand the audit process and verification requirements.

## 6.4 Audit and Verification Process

Audits procedures used to verify CDM projects are similar to audits of other environmental management systems (ISO 14000, EMS) and should complement these established processes. Principle audit tools are spot check of documents and interview with participating organizations and individuals. Auditors/verifiers are generally free to apply any method that represents good auditing practice and internationally accepted standards. Auditors typically conduct risk-based spot checks, which are checks of the key parameters and systems with the highest risks for data measurement and collection problems. The planning and scheduling of audits and the verification process is covered in this section.

### 6.4.1 Audit preparation and requests for information

The auditor will familiarize himself with the project documentation, project reports, project requirements and expected project performance. The auditor will use this CDM Operations Plan to prepare the audit process. He will make telephone contact with the operator, and if necessary, will request additional information from the operator, the IBRD and other project partners. Two weeks should be allowed for the receipt of this information.

### 6.4.2 Development and delivery of an audit checklist

The auditor will develop a checklist to guide the audit process. The checklist will cover the key points of the audit. The checklist will be sent to the operator (auditee) accompanied by explanatory materials prior to a site visit. Two weeks should be allowed for review, comments and preparation by the auditee.

### 6.4.3 The audit

A visit will be made to the site to undertake the audit. The length of the audit visit is to be agreed between KenGen and IBRD and depends on the complexity of the project and its monitoring system and on previous

performance of an experience with the project and the project operator. Audits on site require normally more than two days. The audit time will be spend checking records and undertaking interviews with staff and other individual, which will allow the auditor to complete the audit checklist. These activities are the basis for completing the verification process and for preparing the verification report.

### 6.4.4 Audit and draft verification reports

The auditor will produce an audit report and a draft verification report, which summarizes the audit findings. The draft verification report will state the number of ERs achieved by the project and will point to areas of possible non-compliance if warranted. The report will also include conclusions on data quality, the projects monitoring and management and operational system, and other areas where corrective action may be required to come into compliance, improve performance or mitigate risks. The draft report will be submitted to the IBRD, a copy will be sent to the operator. Both parties will be given opportunity to comment on the report. The operator will also have the opportunity to come into compliance, if necessary, by submitting the appropriate evidence or by taking corrective action.

### 6.4.5 Final verification report:

The auditor will revise the draft report taking into consideration reviews, comments and further findings and issue the final verification report, if possible within two weeks of receiving all comments. If justified, the final verification report will conclude and explain that, within the verification period, the project has generated the stated quantity of ERs in compliance with all applicable CDM and other requirements. The final verification report is the basis for the issuance of a certificate by the verifier, which will state and confirm the conclusions of the report.

### 6.4.6 Non-compliance and dispute settlement

In the event of non-compliance findings, the auditee will be given sufficient time to demonstrate compliance. An eight week period from the issuance of the draft report is recommended for the operator to address identified deficiencies and come into compliance. It is the responsibility of the verifier to ensure that dispute over any non-compliance issue is communicated clearly and that any attempt is made to resolve it. The verifier will have final decision over the process. The verifier will also provide guidance as appropriate on how identified deficiencies can be met so that the operator can come into compliance in the following period.

### 6.4.7 Audit and verification schedule:

Audits and verification of the project will be conducted annually at first, then at intervals over the life of the project. The audit schedule will be determined by the IBRD in consultation with auditors and the project operator. Audit intervals will depend on audit outcomes and experience with the project's performance and compliance with the CDM Operations Plan, the quality of its monitoring management and operational systems, and the type and number of corrective actions required by the verifier.

## 6.5 Roles and Responsibilities

Audit responsibilities are allocated between the project participants as follows:

**The IBRD**

- The IBRD will make the arrangements for the audit and select a third party auditor/verifier in accordance with IBRD requirements and selection criteria and in consultation with the relevant host country CDM authority.
- It is the IBRD's obligation to ensure that the audit process is fair, that auditors/verifier are fully independent of the project operator and that and all possible conflicts of interests are avoided. The IBRD requires details of the experts to be used on the audit/verification team, and holds the right to veto unsuitable individuals.
- The IBRD will facilitate the audit work and verification process and will work with the project participants to ensure co-operation.

**Project operator, KenGen:**

- The operator will prepare for the audit and verification process to the best of his abilities.
- He will facilitate the audit through providing auditors with all the required information, before, during and, in the event of queries, after the audit.
- The operator will fully cooperate with the auditors and instruct his staff and management to be available for interviews and respond honestly to all audit questions.
- It is the operator's contractual obligation and in his best interest to fully cooperate with auditors and verifier, since only successful verification will enable him to deliver ERs to the IBRD in fulfillment of his contract with the IBRD.

**Auditor / verifier:**

- The auditors for the project must be a professional organization with a proven track record in environmental auditing and verification, experience with CDM projects and work in developing countries. The audit firm must guarantee professional work and assure the quality of the audit and verification team.
- The auditor / verifier must undertake the audit to the best of their professional ability. The auditor's responsibilities include to
    a) Provide the checklists and request for information in good time,
    b) Allow adequate time for sufficient review and preparation,
    c) Provide publishable reports in the agreed format,
    d) Work with the operator, host country authorities and IBRD as appropriate,
    e) Report on lessons learnt during the course of the project.

**Annex 5**

# GENERATION PROJECT EXPANSION

**INTRODUCTION**

The power demand in Kenya has risen considerably owing to the improved economic growth within the last two years. The recorded peak demand has reached almost 920MW leaving the reserve margin between supply and demand at barely 100MW. This margin is far below the recommended 15% to allow for any plant outage, which is required during maintenance.

Further, with the ongoing power system reinforcement and the accelerated customer creation strategy by Kenya Power and Lighting Company Ltd, the demand is projected to rise at an average of 150MW per year. With this rising demand, the reserve margin will continue to drop significantly with the consequence of power rationing during peak hours.

KenGen being the major supplier and contributing about 85% of all power consumed in the country is stepping up its capacity expansion program to keep up with the rising demand as well as mitigate any adverse hydrological phenomena that might recur in future.

After ratification of the Kyoto Protocol various opportunities arose for Kenya to increase its clean energy projects. In view of this, KenGen is pursuing its capacity expansion programs by having a focus on projects that generate less green house gas emissions. Carbon finance is one major source of investment capital required to implement these projects.

Most of the projects are hydropower, geothermal and thermal (See Table 1 below).

**Table 1: Project Summary**

| | Projects | Capacity (MW) |
|---|---|---|
| **1** | **Hydro Projects** | |
| (a) | Upgrading of Kiambere Power Plant | 20.00 |
| (b) | Sondu Miriu Power Plant | 60.00 |
| (c) | Sang'oro Power Plant | 20.00 |
| (d) | Redevelopment of Tana Power Station | 10.00 |
| (e) | Raising of Masinga Reservoir | - |
| (f) | Kindaruma 3rd Unit | 20.00 |
| (g) | Rehabilitation/Upgrading of Small and Major Hydro plants | |
| | | |
| **2** | **Geothermal Projects** | |
| (a) | Olkaria II 3rd Unit | 35.00 |
| (b) | Eburru Geothermal Plant | 2.50 |
| (c) | Olkaria Domes Appraisal Drilling | - |
| (d) | Olkaria IV Geothermal Plant | 70.00 |
| (e) | Olkaria Make-up Wells Drilling | - |
| (f) | Olkaria I Life extension | |
| | | |
| **3** | **Thermal Projects** | |
| (a) | Kipevu Combined Cycle Power Plant | 30.00 |
| (b) | Mombasa Gas Turbine Power Plant | 80.00 |
| (c) | Coal Plant I | 150.00 |
| (d) | Coal Plant II | 150.00 |
| (e) | Coal Plant III | 150.00 |
| (f) | LNG Importation, Storage & Regasification Project | - |
| (g) | Relocation of Lamu power station | |
| | | |
| **4** | **Wind Projects** | |
| (a) | Ngong Wind Project | 6.00 |
| (b) | Kinangop Wind Project | 30.00 |
| (c) | Marsabit Wind Project | - |
| | | |
| **5** | **Other Projects** | |
| (a) | KenGen- EEPCO joint Venture | 600 |
| (b) | Karuma Hydro power project | 200 |
| (c) | KenGen-Chemelil joint Venture | |
| (d) | Karura hydropower project | 60-75 |
| (e) | Nandi Forest hydropower project | 50-60 |
| (f) | Mutonga hydropower project | 60 |
| (g) | Low Grand Falls hydropower project | 140 |

DFI: Development Financial Institution