Programme design document form for CDM programmes of activities (Version 03.0)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

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Title: Installation of Energy Efficient Transformers (IEET)
Version: 15
Date: 11/06/2014

History of IEETCDM-PoA DD

Version	Date
01	10 April 2012
02	12 June 2012
03	07 July 2012
04	23 July 2012
05	28 Aug 2012
06	17 Sept 2012
07	26 Sept 2012
08	23 Oct 2012
09	02 Nov 2012
10	29 Nov 2012
11	03 Dec 2012
12	11 Dec 2012
13	13 Dec 2012
14	25 July 2013
15	11 June 2014

A.2. Purpose and general description of the PoA

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The IEETCDM-PoA aims to install high energy efficient transformers across national electricity distribution grids. This may also involve adoption of the energy efficient transformers in the replacement of the inefficient and faulty baseline transformers. The first Host Country to be included under the CDM-PoA is the Republic of Kenya, however, additional Host Countries may be added post-registration.

Current trends in the Kenyan energy sector

The electric power sector in Kenya relies largely on renewable energy sources such as hydro power and geothermal. The interconnected system in Kenya had a total installed capacity of 1,593 MW as at June 2011; made up of 763 MW of hydro, 586 MW of thermal, 198 MW of geothermal, 5 MW of wind, 26MW from

cogeneration and 14MW in isolated mini-grids. The peak demand recorded in 2010/2011 was 1,194MW compared to 1,107MW the previous year. The current peak demand is 1236 MW recorded in March 2012[1]. Production from hydro has declined in recent years due to drought, with oil-fired power plants playing an auxiliary but increasing role. Increasing dependency on costly imported oils is likely raise electricity prices. To ensure a reliable energy supply, Kenya plans to build more power plants with a total capacity of more than 2000 MW by 2015 from a variety of energy sources including geothermal, hydro, wind, coal, and diesel[2].

Energy efficiency measures have in the past received very modest support and capital investment until recently when the Kenya Power and Lighting Company ("KPLC"), the national power utility, implemented a rollout plan for energy efficient compact fluorescent lamps (CFLs) to replace inefficient incandescent lamps (ICLs). These measures remain the most feasible and suitable because they are cheaper than renewable energy sources e.g. geothermal, wind etc., therefore offering a fast approach to energy conservation and climate change mitigation.

Supply side energy management

Several factors have been identified to contribute to increase in system losses in the Kenyan electricity distribution network among them:

- Inefficient transformer technology in use
- Overstretched and overloaded network
- Theft due to high tariffs
- Large component of demand supplied at low voltage
- Mismatch between power demand and capacity of step-down transformers supplying it
- Long LV circuits some of very thin conductors[3]

The following are the planned strategies to address the current status of losses in the network:

- Adoption of energy efficient transformers for grid expansion as well as corrective maintenance
- Re-conductoring of 11kV feeders
- Use of single phase transformers close to customers' premises
- Upgrading overloaded substations
- Intensification of anti-fraud initiatives
- Replacement of electro-mechanical meters with electronic ones as well as replacement of faulty ones[4]

1. <u>Policy/measure or stated goal of the PoA</u>

Distribution and installation

The stated goal of IEETCDM-PoA is to install high energy efficient transformers across national electricity distribution grids. This may also involve adoption of the energy efficient transformers in the replacement of the inefficient and faulty baseline transformers.

The implementation of this CDM-PoA is expected to result in the rapid uptake of efficient transformer technologies. Currently there is little or no effort to introduce energy efficient transformers due to their increased purchase cost, lack of capital and technology barriers. Activities under this Programme of Activities include:

[1] Draft Electricity Sub-Sector Medium Term Plan (2012-2016)
[2] Draft Electricity Sub-Sector Medium Term Plan (2012-2016)
[3] http://www.worldenergy.org/documents/ethiopia_june_30_vi_mwangi_kenya.pdf
[4] http://www.worldenergy.org/documents/ethiopia_june_30_vi_mwangi_kenya.pdf

Technology transfer

Technology will be transferred through the installation of efficient transformers that are not commonly in use, as well as training both within, and external to, the relevant power utilities. This training will essentially cover the following:

- The need for an efficient and low emission electricity distribution system and associated benefits of the program, i.e. reduced generation costs, improved customer access to grid electricity and additional revenues derived from sale of carbon credits;
- Technical details of the installation and maintenance of the energy efficient transformers, which is mostly new and unfamiliar technology;
- Scrapping procedures and equipment; and
- Ongoing program monitoring.

Handling of the replaced transformers

CPA implementers under this PoA will arrange for the collection, transportation, storage and destruction of the replaced baseline transformers by providing the followings:

- A Management Information System and guide for assisting in the status verification of replacement data from the respective transformer locations;
- Selection of companies to perform scrapping through nationally accepted selection systems and verification by a third party;
- Dedicated collection points with personnel trained in scrapping techniques to be implemented; and
- Scrapping of the replaced transformers using guidelines stipulated in the specific CPA-DD guidelines.

Emission reductions

Emissions Reductions (ERs) from this PoA will be achieved through reduction of electricity losses in the transformer, which will then reduce the electricity generation demand. This PoA will help in reducing greenhouse gas emissions in the electricity sector.

Environmental, economic and social benefits

As an energy efficiency project activity, IEETCDM-PoA will produce positive environmental, economic and social benefits through the following ways:

- Reduced dependence on fossil fuel based power plants and hence reduction in GHG emissions;
- Increased awareness of new energy efficient measures available as well as the collective effort to address climate change. This motivates communities on other sustainable environmentally friendly ways to achieve energy efficiency, e.g. efficient household lighting;
- Freeing up existing power generation for connecting new customers;
- There will be direct employment opportunities in-country as a result of the tasks associated with the ongoing annual monitoring and verification processes;
- There will be training and education programs undertaken to train staff involved in distribution/installation of the energy efficient transformers.

2. General operating and implementing framework of PoA

The Coordinating/Managing Entity (Standard Bank Plc) of the Installation of Energy Efficient Transformers (IEET) program will provide overall coordination of the CDM Programme of Activities (CDM-PoA) and will facilitate and support project implementers to implement CDM Component Project Activities (CDM-CPAs).

The aim of this PoA, executed through its operating and implementing framework, is to accelerate the adoption of energy efficient transformers across electricity distribution grids through the following stated

activities:

1. Use a loss-evaluation approach as "Total Cost of Ownership (TCO)" on transformer procurement to compete ordinary higher loss transformer with add-on evaluated $ value as the balance loss value ($/W) and promote low loss transformer. For further details, please refer to Appendix-4 "Typical Loss evaluation criteria for a CPA applying for inclusion in IEET PoA".
2. Replacement of existing faulty transformers with higher efficiency transformers.
3. Installation of energy efficient transformers in new areas covered by the expansion of national electricity distribution grids.
4. Scrapping of the replaced baseline transformers.

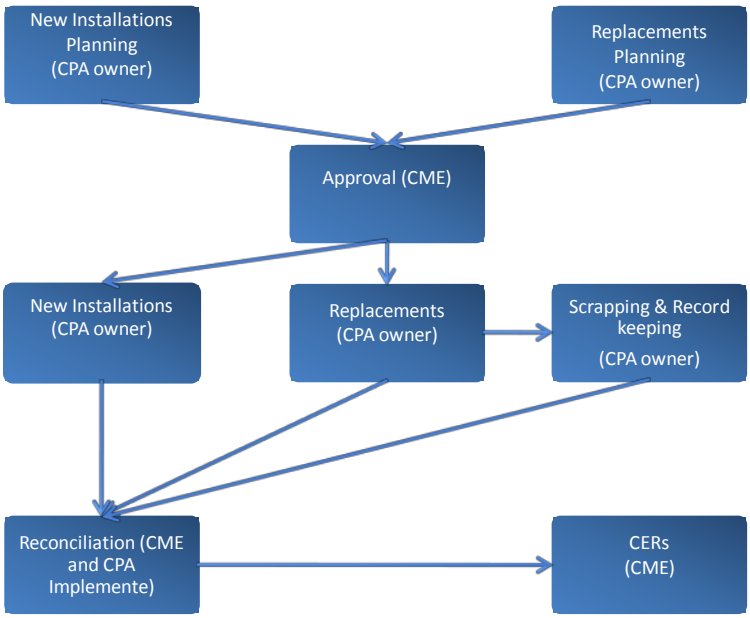

Figure A.2.1:*Schematic illustration of installation procedure.*

An explanation and example of loss-evaluation scheme on transformer purchase evaluation is detailed in Annex 4.

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

The IEET PoA is developed by Standard Bank to promote the uptake of energy efficient transformers across the national electricity distribution grid. There are no mandatory requirements for the adoption of energy efficient transformers in Africa. All players under the PoA (Coordinating/Managing Entity and project implementers) are voluntarily taking part in the program.

Table A.2.1 *Relevant national host country laws/regulations.*

Country	Relevant laws/Regulations	Mandatory requirements	Additional comments
Kenya	Energy Act (2006)	N/A	Objective is to ensure the provision of adequate, quality, cost-effective, affordable supply of energy while encouraging environmental conservation.

A.3. CMEs and participants of PoA

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(a) Coordinating or managing entity of the PoA as the entity which communicates with the Board

The Coordinating/Managing Entity (CME) of the IEETCDM-PoA is Standard Bank Plc. Contact details for the Coordinating/Managing Entity are detailed in Appendix 1.

(b) Project participants being registered in relation to the PoA

The CDM-CPA project implementers are identified in the respective CDM-CPA-DDs.

A.4. Party(ies)

Table A.4.1 *Project participants of the IEETCDM-POA.*

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Kenya (host)	Standard Bank Plc	No
United Kingdom of Great Britain and Northern Ireland	Standard Bank Plc	No

A.5. Physical/ Geographical boundary of the PoA

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The first CPA will be in the republic of Kenya. Other countries will be added post-registration in-line with the project standard and if applicable the latest *"Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities"*[5].

Figure A.5.1: *Map showing national electricity grid of Kenya*[6].

[5] Please refer to http://cdm.unfccc.int/Reference/Standards/index.html

A.6. Technologies/measures

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The PoA aims to implement energy efficient transformers within the geographical boundary of the Republic of Kenya.

The energy efficient transformer that will be implemented in this CPA will reduce the primary voltage of the electric distribution system down to the utilization voltage serving the customer. A transformer is a static device constructed with two or more windings used to transfer alternating current electric power by electromagnetic induction from one circuit to another at the same frequency but with different values of voltage and current. The following diagram depicts the general electricity generation, generation and distribution processes.

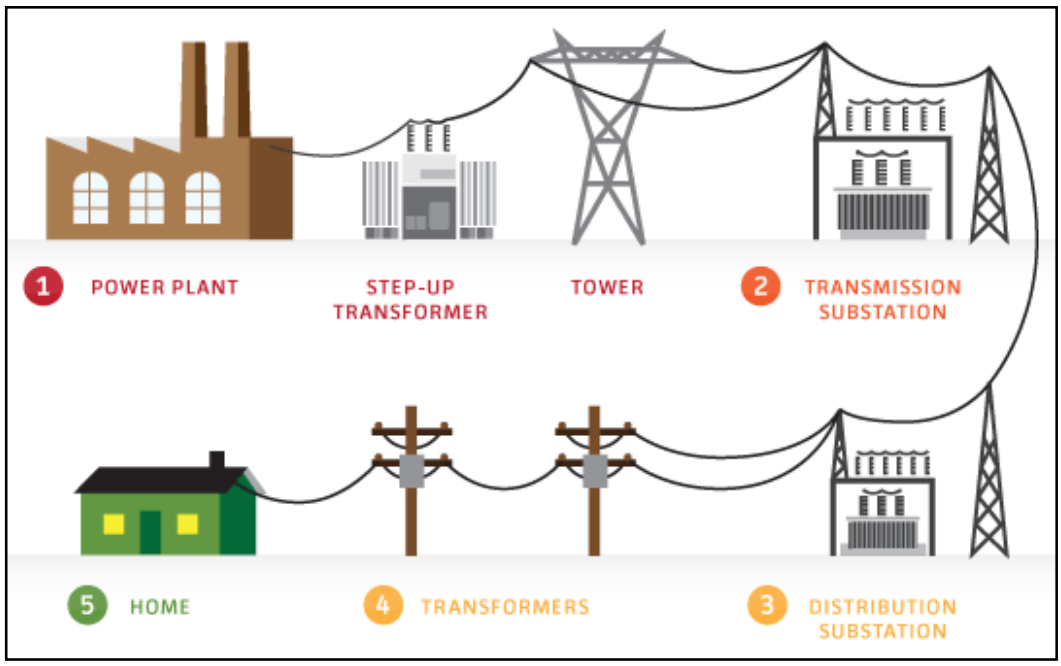

Figure A.6.1: *The electricity generation, transmission and distribution process.*

The major source of GHG emissions arise from the power plants (number 1 as shown in the above figure) for the generation of electricity. Each CPA would intend to reduce GHG emissions by implementing energy efficient tranformers. The transformers that the CPA will implement or replace are those located between the distribution substation and the home (number 4 as shown in the above figure).

Transformer losses
Transformers aren't perfect devices; they don't convert 100% of the energy input to useable energy output. The difference between the energy input and that which is available on their output is quantified in losses. Losses in distribution transformers are classified as follows:

- **Load losses:** Also called coil losses. These are losses due to resistance in the electrical winding of the transformer. These losses include eddy current losses in the primary and secondary conductors of the transformer. Load losses are widely a function of the square of the load current and therefore increase with an increase in transformer loading. They represent the greatest portion of the total losses when a transformer is heavily loaded.
- **No-load losses:** Also called core losses. These are losses due to transformer core magnetizing or

[6]Kenya Power and Lighting Company 2011 Annual Report, available at: http://www.kplc.co.ke/index.php?id=39.

energizing. These losses occur whenever a transformer is energized and remain constant regardless of the amount of electricity flowing through it. They represent the greatest portion of the total losses when the transformer is lightly loaded.

For the purposes of claiming certified emission reductions only no-load losses will be considered.

Facilities, systems and equipment in operation prior to the implementation of the CPAs in the PoA
Facilities, systems and equipment in operation prior to the implementation of the CPA such as substations, electricity poles will remain the same after implementation of the CPA. The CPA introduces equipment (i.e. transformers) that is more energy efficient than the transformers in operation prior to the implementation of the CPA.

Technology/standards and specifications/identification
Transformers installed by the CDM-CPAs may be supplied to the CPA project implementers via a number of manufacturers/suppliers and will be subject to the following conditions:

- Be distribution transformers only/ transformers be installed on distribution grid only;
- Load losses, at rated load, will be demonstrated to be equal or lower than the load losses in transformers that would have been installed in absence of the CDM-CPAs;
- Be new equipment and not transferred from another activity;
- The transformers installed in the CDM-CPAs will comply with and demonstrated using national / international QA/QC standards;
- Project transformers will be identifiable within the CPA's management information system.

A.7 Public funding of PoA

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This Programme of Activities will not receive any public funding from Parties included in Annex I of the UNFCCC.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

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Additionality is demonstrated at the PoA level in accordance with the guidelines stipulated by the approved baseline and monitoring methodology AM0067 *"Methodology for installation of energy efficient transformers in a power distribution grid"* Version 02 and the latest version of the *"Combined tool to identify the baseline scenario and demonstrate additionality"*.

The following steps will be followed to demonstrate additionality in accordance with *"Combined tool to identify the baseline scenario and demonstrate additionality", (Version 05.0.0).*

STEPS
Step 0: Demonstration whether the proposed project activity is the first-of-its-kind
Step 1: Identification of alternative scenarios
Step 2: Barrier analysis
Step 3: Investment analysis
Step 4: Common practice analysis

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

According to the "*Combined tool to identify the baseline scenario and demonstrate additionality*",

(Version 05.0.0) the project has the option to either demonstrate first of its kind or elect not to do so. The PoA chooses to apply first-of-its-kind.

Paragraph 12 of the "*Combined tool to identify the baseline scenario and demonstrate additionality*" Version 05.0.0 states that if the proposed project activity applies measure(s) that are listed in the definitions section of the tool, then the latest version of the "*Guidelines on additionality of first-of-its-kind project activities*" shall be applied. The PoA applies the measure listed in paragraph 9 (b) (ii) of the tool (switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies) and therefore will apply the "*Guidelines on additionality of first-of-its-kind project activities*" Version 02.

A proposed project activity is the first of its kind in the applicable geographic area (Kenya) if:

1. The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by another project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier.

This is the first project in the applicable geographical area (Republic of Kenya) that applies amorphous transformer technologies. No Load Loss of Amorphous transformer is 80%[6] lower than the transformer technologies that are currently installed (i.e. Cold Rolled Grain Oriented (CRGO) silicon steel plate transformers) in the national electricity grid of Kenya. There are currently no ongoing or proposed projects involving the installation of energy efficient transformers similar to the PoA in the national electricity grid of the Republic of Kenya[7]. All transformers that are currently installed in the national electricity grid of Kenya use CRGO silicon steel plate core technology considered inefficient compared to the proposed IEET PoA transformers[7]. The technology applied by the PoA has the same output as the currently installed transformers. Furthermore, the CRGO silicon steel plate transformers are currently installed in the Kenyan national electricity grid, and therefore have started commercial operation in Kenya before the PoA-DD was published for global stakeholder consultation (17 April, 2012).

The table below demonstrate additionality check complying with the Guideline of FOIK guidelines:

FOIK Guidelines	**Project implementation**	**Check Result by the PP**
Para.1 Applicable geographical area	In Kenya	OK, Para 1. is applicable
Para.2 Measure	Switch of technology with or without change of energy source including energy efficiency improvement Energy efficiency improvements Applies amorphous transformer technologies	OK, Para 2. is applicable.

[6]Selecting Energy Efficient Distribution Transformers (SEEDT): A Guide for Achieving Least-Cost Solutions, pp.25.
[7]Energy Regulatory Commission, RE: Application for first of its kind letter for the installation of energy efficient transformers programme of activities, December 2012, Kenya.

Para.3 Output	Less No-load loss	OK, Para 3. is applicable.
Para.4 Different technologies	♦ Same output: Amorphous transformer technologies. The project transformer will deliver the same output. ♦ Differ by one of the following: (a) Differ by energy source: (b) Differ by Feed stock (c) Match to energy saving with the large-scale power capacity.	OK, Para 4. is applicable
Para.5 (a) Identification of FOIK	♦ Applicable geographical area : Republic of Kenya	♦ OK, Kenya is identified as entire host country
	♦ Applied technology: Amorphous transformer technologies. No Load Loss (NLL) of Amorphous transformer is 80% lower than the baseline technology that are different from currently installed (i.e. Cold Rolled Grain Oriented (CRGO) silicon steel plate transformers)	♦ OK, Applied technology: is amorphous transformer which is different than existing transformer technology.
	♦ Different from any other project: Any other project applying amorphous transformer similar to the one proposed under the PoA is not identified. Other CPAs under this project are not to be included in "Any other project", since those CPAs are identified as the projects after the start date of the project activities.	♦ OK, applied No other project is identified that can achieve 80% less No Load Loss applying amorphous transformer
	♦ Identifying other technologies: Application of amorphous transformer that can reduce NLL by 80% is not identified in the national electricity grid of Kenya publicly available information.	♦ OK, Applied No projects with the transformer that can reduce NLL by 80% amorphous transformer can be identified in publically available information related to the national electricity grid of Kenya publicly available.
Para.5 (b) Measures	♦ One or more of the measures: Switch of technology with or without change of energy source including energy efficiency improvement Switch of technology with energy saving is the measure.	OK, Para 5(b). is applicable
Para.5 (c) Crediting period	♦ Crediting period: Maximum 10years with no option of renewal	OK, Para 5 (c). is applicable
Conclusion	♦ Para.(1) ~(5) were checked as being applied.	OK FOIK is demonstrated by checking the Para (1)~(5)

Table B.1: Additionality check for the PoA complying with the FOIK guidelines

Furthermore, the following table depicts difference between the baseline transformer technology and the transformer technology that is proposed under the PoA.

Technology Comparison:

Definition	Items	Existing facility (Baseline transformer)	PoA project (Project transformer)	Difference
Type of good/ service	Goods/ Services	Transformer in distribution grid	Energy efficient transformer in distribution grid	Application of energy efficient transformer
Level of service	Voltage ratio,	11/0.25kV, Single phase 15 to 1000 KVA	11/0.25kV, Single phase 15 to 1,000 KVA	No difference

	Capacity range	33/0.25kV, Single phase 15 to 1,000 KVA	33/0.25kV, Single phase 15 to 1,000 KVA	
		11/0.433kV, Three phase 15 to 1,000 KVA	11/0.433kV, Three phase 15 to 1,000 KVA	
		33/0.433kV, Three phase 15 to 1,000 KVA	33/0.433kV, Three phase 15 to 1,000 KVA	
Magnetic core material in transformer	Material	CRGO silicon steel plate	Amorphous metal	Low no load loss through application of Amorphous metal
Performance specifications	Techno-logy Specifica-tion	$NLL_{BL,k}$: base	$NLL_{PR,k}$: 80% lower	Low energy loss of transformer due to low NLL (no load loss). Difference between $NLL_{BL,k}$ & $NLL_{PR,k}$ will be used to estimate emission reductions.
		$LL_{BL,k}$: base	$LL_{PR,k} \leq LL_{BL,k}$	Difference between $LL_{BL,k}$ & $LL_{PR,k}$ will not be used to estimate emission reductions in accordance with the AM0067.
Compliance with certifications/ testing	IEC, National Standard	International Electrotechnical Commission (IEC) 60076 standard or relevant national standard	International Electrotechnical Commission (IEC) 60076 standard or relevant national standard	Electrical requirement is same.
Conclusion	-	Existing technology	New technology	Project technology is apparently different from the existing one

Table B.2: Technology difference between existing and project transformer

Official specifications and orders from KPLC, the sole manager of the Kenyan national electricity grid demonstrate that the utility has not purchased or installed transformers which have a similar or high energy saving potential than the transformers to be implemented under the proposed PoA. Evaluation of no-load losses from official vendor /supplier records show that the proposed transformer technology is 80%[8] more efficient than the technology of the baseline transformers.

2. The project implements one or more of the measures.

The PoA implements the measure listed in paragraph 2 (b) of the "*Guidelines on additionality of first-of-its-kind project activities*" Version 02, 'switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies'.

3. The project participants selected a crediting period for the project activity that is 'a maximum of 10 years with no option of renewal'

The CPAs that will be included under this PoA will have a maximum crediting period of 10 years with no option of renewal.

[8] 'ERs IEET CPA 001.xlsx' shows a clear demonstration of the losses scenario for both proposed and baseline transformers.

Criteria 1, 2 and 3 are met and therefore the PoA is the first of its kind in the applicable geographic area (Republic of Kenya).

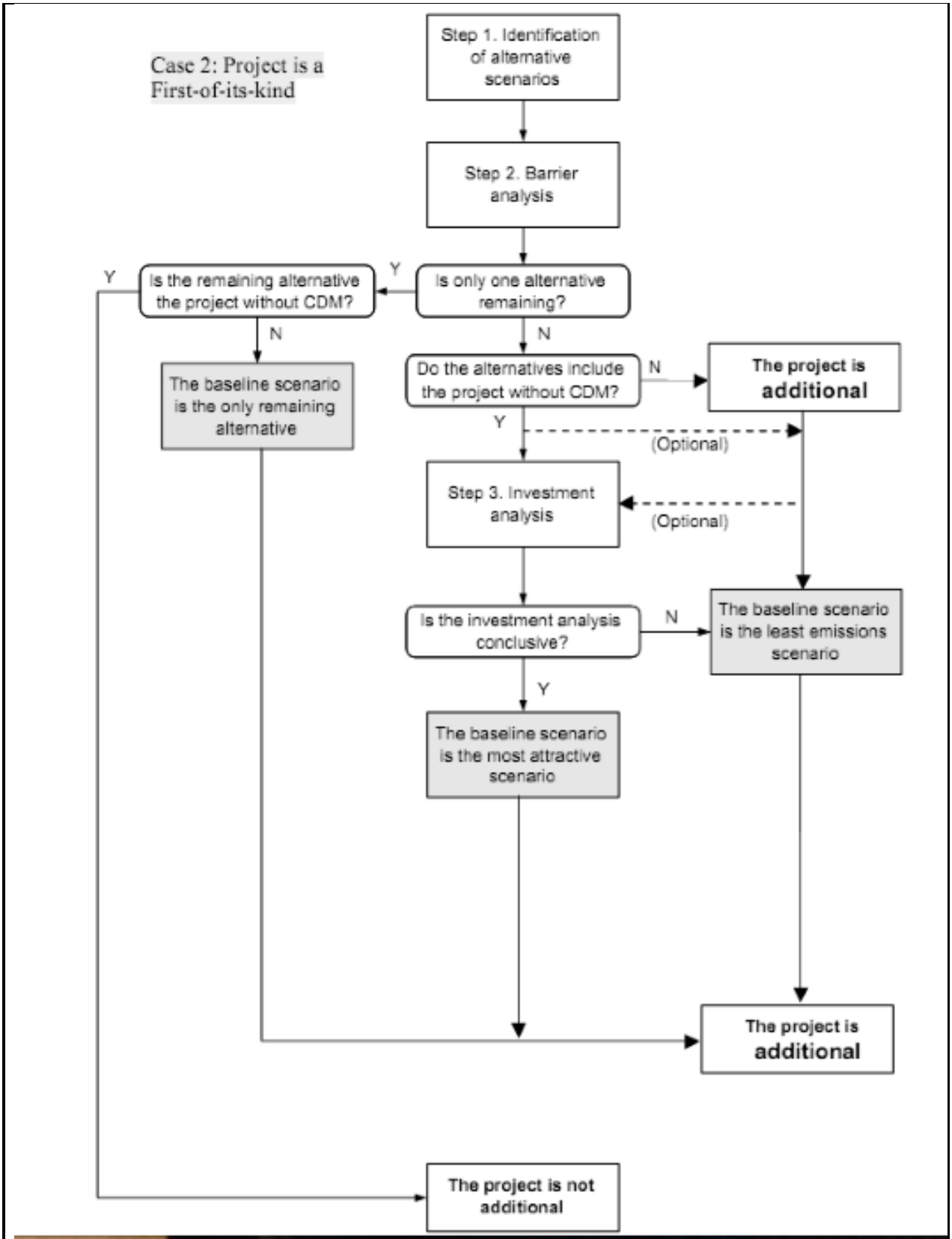
Outcome of Step 0:

Conclusion I: The proposed project activity is the First-of-its-Kind

The CPAs need to comply with following criteria in order to be included as the First of its Kind (FOIK) under this PoA.

1. The applicable geographic area should be the Republic of Kenya.
2. Based on the evaluation of no-load losses, the CPA should apply amorphous transformer technologies that more efficient than the transformer technologies that are currently installed in the national electricity grid of Kenya.
3. The CPA shall apply transformer technologies that is different from transformer technologies that are implemented by another project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier.
4. The crediting period of the CPAs will be a maximum of 10 years with no option of renewal.

As stated earlier, in order to demonstrate additionality, the CPAs that will be included in this PoA will follow all the steps as outlined above in accordance with *"Combined tool to identify the baseline scenario and demonstrate additionality", (Version 05.0.0), case 2: Project is a First-of its-kind. Only one CPA per host country will be eligible for First of its Kind (FOIK).*



Step 1: Identification of alternative scenarios

This step serves to identify all alternative scenarios to the proposed CDM project activity(s) which can be the baseline scenario.

Step 1a: Define alternative scenarios to the proposed CDM project activity

In accordance with the approved baseline and monitoring methodology AM0067 "*Methodology for installation of energy efficient transformers in a power distribution grid*" (Version 02), the project participant has chosen to use the list of credible and plausible alternative scenarios for the installation and replacement of transformers. These alternative scenarios as per the methodology are:

- Replacement or installation of transformers adopting a more efficient technology other than the technologies of the PoA;
- Continuation of current practice. Replacement or installation of transformer with the most commonly used transformers in the Kenyan electricity grid;
- Replacement or installation of transformers as per new performance levels enforced by regulation; or
- Replacement or installation of transformers adopting the PoA technologies without CDM benefits.

Outcome of Step 1a:

List of plausible alternatives scenarios to the project activity are:

1. Replacement or installation of transformers adopting a more efficient technology other than the technologies of the PoA;
2. Continuation of current practice. Replacement or installation of transformer with the most commonly used transformers in the Kenyan electricity grid;
3. Replacement or installation of transformers as per new performance levels enforced by regulation; or
4. Replacement or installation of transformers adopting the PoA technologies without CDM benefits.

Step 1b: Consistency with mandatory applicable laws and regulations

Alternatives 1, 2 and 4 listed in Step 1a above are consistent with mandatory applicable laws and regulations, given there are no current or proposed legislative requirements in Kenya that enforce the distribution of improved transformer technology. Alternative 3 is considered as 'noncompliant' as there are no mandatory laws requiring improved efficiency in transformer technologies.

Outcome of Step 1b:

Three alternatives to the project activity that are consistent with mandatory laws and regulations are identified, these being:

1.Replacement or installation of transformers adopting a more efficient technology other than the technologies of the PoA;

2.Continuation of current practice. Replacement or installation of transformer with the most commonly used transformers in the Kenyan electricity grid;

4.Replacement or installation of transformers adopting the PoA technologies without CDM

benefits.

Step 2: Barrier analysis

This step serves to identify barriers and to assess which alternative scenarios are prevented by these barriers. Please note that as per paragraph 21 of the "*Combined tool to identify the baseline scenario and demonstrate additionality*" Version 05.0.0, the latest approved version of the "*Guidelines for objective demonstration and assessment of barriers*" (Version 01), shall be taken into account when applying this step.

Step 2a: Identify barriers that would prevent the implementation of alternative scenarios

Investment barriers

Kenya's national energy policy has a number of broad objectives including ensuring the adequate, reliable, cost effective and affordable supply of energy to meet its development needs[9]. Promotion of energy efficiency and conservation is one of the Government's key energy policies. Kenya Vision 2030[10] has also recognised the need of increasing energy efficiency in order to reduce Kenya's higher energy cost.

Kenya is struggling to meet its energy requirements due to lack of sufficient foreign exchange caused in part by absence of donor inflows in the 90s. Kenya did not make adequate investment in the energy sector particularly in the expansion of generation and transmission facilities[11].

More broadly, scaling-up investment in energy efficiency is essential to achieving significant reductions in energy related emissions. However, despite energy efficiency's recognised advantages as an investment with immense climate change mitigation benefits, most of energy efficiency opportunities remain unrealised due largely to the significant "investment gap" that exists between the theoretical returns that energy efficiency investments can provide, and the limited capital that is available to make those investments[12].

The above identifed "investment gap" is compounded in Kenya as access to finance has been identified as one of the barriers in Kenya for the adoption of efficient technologies and cleaner energy options. A study conducted by the United Nations Environment Programme (UNEP) suggests promoting access to innovative financing mechanisms to remove such barriers[13].

As a result of the above circumstances, there has been a lack of investment in essential improvements to the Kenyan electricity system, with only lowest cost incremental investments being undertaken. This has led the national power utility to be challenged in meeting the country's growing electricity demand.

Compounding the above situation regarding investments gaps and growing demand, energy efficient upgrades require increased upfront capital investment when compared to 'like for like' replacement of electricity infrastructure. For example, the purchase cost of amorphous-type transformers is approximately 1.5 times higher than that of standard-issue silicon steel plate transformers.

[9]Kenya: Integrated assessment of the Energy Policy, UNEP (2006), page 16.
[10]Kenya Vision 2030, Government of Republic of Kenya (2007), page 8.
[11]African Development Fund 2010, Power Transmission System Improvement Project – Project Appraisal Report, African Development Fund, Cote d'Ivoire and Tunisia.
[12]See pages 7 and 27 of International Energy Agency, 2010. "Money Matters – Mitigating risk to spark private investment in energy efficiency". Information Paper, Energy Efficiency Series. Paris, September, 2010. This reference provides considerable detail on the various risks perceived by investors when evaluating energy efficiency projects.
[13]See page 50 of the Kenya: Integrated assessment of the Energy Policy by UNEP, available at: http://www.unep.ch/etb/areas/pdf/Kenya%20ReportFINAL.pdf

Economic evaluation of losses recognizes that transformers will have energy losses over their operating lifetime and the losses will cost money over that time. This economic analysis makes a determination of the cost of the future losses expressed in today's dollars to enable a comparison of alternative products[14]. Considering loss evaluation when purchasing transformers will economically disadvantage the cheaper, less efficient technology reducing the potential impact of this barrier.

Technological barriers

Currently there are no 'energy efficient' transformers (as proposed to be deployed under each CPA) operating in Kenya.

Standard and/or current equipment and materials (e.g. transformers, conductors, capacitors, substation diameters and bays etc.) are recommended for electricity transmission grid infrastructural development for reasons that[15]:

- They offer economic and monetary value due to bulk purchase
- These equipment and materials are easily stocked for replacement in cases of failure and redundancy: standardization allows reduction of the amount of spare parts.
- It offers ease in operation and maintenance owing to its uniformity and commonality.
- It makes it easier for the utility to train its technical staff on the standard equipment
- It is easier and cheaper to repair and service baseline transformers using parts recovered from retired equipment. Power utilities therefore opt to buy standard technologies to avoid meeting the cost of new parts associated with new technologies.

Given the above technology barriers, historically in Kenya replacing 'like for like' transformers (alternative 2) has been common practice as it proposes a least up-front cost, familiar and lower risk option.

The transformer technology types to be implemented by each CPA are considered to be the most efficient available given that more efficient technologies such as super-conductive transformers have not yet been industrially developed[16].

Prevailing practice barriers

Energy efficiency continues to be a peripheral issue in the overall energy sector planning and development in Africa. Experiences so far shows that the adoption of energy efficiency is inhibited by barriers including lack of appreciation of the benefits, initial capital requirements, resistance to change, absence of policy and regulatory frameworks, and subsidized energy costs[17].

As stated previously, currently there are no 'energy efficient' transformers (as proposed to be deployed under each CPA) operating in Kenya. Therefore historically the currently used less efficient transformer technology has been preferred. To date no similar project has previously been implemented in the Kenyan electricity grid.
As stated previously considering loss evaluation when purchasing transformers will to a degree reduce the potential impact of this barrier.

[14]Feller M, Distribution Transformer Loss Evaluation, Public Power, Oct 2007.
[15]Ministry of Energy 2012, Updated Least Cost Power Development Plan, Ministry of Energy, Republic of Kenya, page 50.
[16]http://www.leonardo-energy.org/amorphous-distribution-transformers.
[17]Scaling up Renewable Energy in Africa, paragraph 66, page 32.

Outcome of Step 2a:

List of barriers that may prevent one of more alternative scenarios to occur are as follows:

- Investment Barrier
- Technological Barrier
- Prevailing practice barrier

Step 2b: Eliminate alternative scenarios which are prevented by the identified barriers

This step serves to identify which alternative scenarios the identified barriers prevent.

Scenarios	Prevented by identified barriers
1. *Replacement or installation of transformers adopting a more efficient technology other than the technologies of the PoA;* There are no transformers technologically available which are more efficient than the proposed transformers in each CPA.	Yes
2. *Continuation of current practice. Replacement or installation of transformer with the most commonly used transformers in the Kenyan electricity grid;* Replacing transformers with 'like for like' technology is the least upfront cost and lowest risk investment option. As noted in the barriers discussion this is due to; these equipment being easily stocked for replacement in cases of failure and redundancy; they offer ease in operation and maintenance owing to its uniformity and commonality; and the utility has experience with operating this standard equipment. As such this option would not be prevented by the barriers presented above.	No
4. *Replacement or installation of transformers adopting the PoA technologies without CDM benefits.* This scenario is not prevented. Even though adopting a more efficient technology will require increased upfront investment and presents a potential perception of a higher risk of equipment underperformance (due to lack of common practice experience in operating the equipment), These increased upfront and on-going costs may be alleviated by the consideration of loss evaluation in the investment decision. *Prima facie* the barriers identified may not prevent this scenario, an investment analysis is required to determine impact of consideration of loss evaluation.	No

Outcome of Step 2b:

Scenario 2 (Continuation of current practice. Replacement or installation of transformer with the most commonly used transformers in the Kenyan electricity grid) and Scenario 4 (Replacement or installation of transformers adopting the PoA technologies without CDM benefits) are not prevented by the identified barriers.

Outcome of Step 2:

There is more than one alternative scenario (scenario 2 & 4) that is not prevented by any barrier. These scenarios include the proposed project activity without being registered as a CDM project. Each CPA is considered to be first-of-its-kind, and therefore the proposed project activity without CDM can be excluded from the alternative scenarios as per the guidance of the "*Combined tool to identify the baseline scenario and demonstrate additionality*" Version 05.0.0. This leaves only scenario 2 (continuation of current practice), and therefore it can be considered the baseline scenario.

Given that each CPA has been demonstrated to be first-of-its-kind, it is considered at this stage to be additional by both the "*Guidelines on additionality of first-of-its-kind project activities*", Version 02 and the "*Combined tool to identify the baseline scenario and demonstrate additionality*" Version 05.0.0.

Step 3: Investment analysis:

Not mandatory to conduct as per the tool

Step 4: Common practice analysis:

Not mandatory to conduct as per the tool

Conclusion

The identification of alternate scenarios indicates two relevant, plausible alternatives to the project activity that are consistent with mandatory laws and regulations. As the proposed project activity is considered first-of-its-kind however, the proposed project activity without CDM can be excluded as per the "*Combined tool to identify the baseline scenario and demonstrate additionality*" Version 05.0.0. Therefore, scenario 2 (continuation of current practice) is considered to be the baseline scenario.

Given that each CPA has been demonstrated to be first-of-its-kind, it is also considered to be additional by the "*Guidelines on additionality of first-of-its-kind project activities*", Version 02 and the "*Combined tool to identify the baseline scenario and demonstrate additionality*" Version 05.0.0 and hence Step 3 and Step 4 of the tool is not required to demonstrate. Please note that only one CPA per host country will be eligible to demonstrate FOIK under this PoA.

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

>>

The following eligibility criteria have been developed in-line with the provisions outlined in Version 03.0 of the *"Standard for the demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities*" and must be met by a CPA applying for inclusion in IEETCDM-PoA:

	Eligibility criteria	**Conformance**
1.	The geographic boundary of the CPA, including anytime induced boundary, is unambiguously identified and consistent with the geographic boundary set in the PoA.	The CPA implementer will provide evidence that proves that the CPA falls within the physical/geographical boundary of PoA.
2.	The CPA operator must demonstrate that double counting does not occur with the particular CPA.	Each CPA will follow the procedures established by the CME to avoid double accounting and comply therewith. The CME will implement a system to avoid double counting of emission reductions. This system will avoid the situation where a new CPA that has been already registered either as a CDM project activity, or as a CPA of another PoA, is included under the PoA. In addition, to avoid double counting each CPA should demonstrate that they can be uniquely identified by location (Country/City/Line + Serial number of transformer)
3.	The CPA involves installation of transformers to new sites or to replace existing less efficient baseline transformers on the distribution electricity grid and shall comply with following criteria: - The transformer shall be having capacity ranging from 15 kVA to 1000 kVA having transformation ratio of 11/0.25kV (single phase), 11/0.433kV (three phase), 33/0.25kV (single phase) and 33/0.433kV (three phase). - Based on the evaluation of no-load losses, the transformer shall be more efficient than the baseline transformers - The transformer shall comply with the International Electrotechnical Commission (IEC) 60076 standard or relevant national standard - Load loss of project transformer should not be more than load loss of baseline transformer - Efficient transformer with amorphous core material	The CPA must provide proof that the project transformer is: -The transformer has capacity ranging from 15 kVA to 1000 kVA having transformation ratio of 11/0.25kV (single phase), 11/0.433kV (three phase), 33/0.25kV (single phase) and 33/0.433kV (three phase). - More efficient than the baseline transformer based on evaluation of no-load loss - Compliant with IEC 60076 or relevant national standard - Load loss of project transformer is less than load loss of baseline transformer -The transformer has amorphous core material
4.	The start date of the CPA is not before the start	The CPA operator will provide documentary

	date of the PoA i.e. 17/04/2012, the on which the CDM PoA DD was published for global stakeholder consultation date of commencement of DOE validation of the PoA. This may be the date when the first procurement contract is signed or the date when installation of transformers starts.	evidence of real action towards the CPA in order to justify the start date. The CME will record the start date of the CPA and confirm that a document check has been done.
5.	Each proposed CPA follows the baseline and monitoring methodology AM0067, Version 02.	The CPA must follow AM0067, Version 2 in order to be included on the PoA. The CME will confirm through a document check that the CPA follows the aforementioned methodology.
6.	The CPA meets the requirements pertaining to the demonstration of additionality as per section B.1 of the PoA-DD.	The CME will check the information and evidence provided by the CPA operator and confirm additionality before submitting the CPA to the DOE for inclusion in the PoA.
7.	Transformers to be installed are compliant with AM0067/Version 02 i.e. Transformers installed by CPAs under the PoA will: • Comply with national / international QA/QC standards. This shall be demonstrated through certification based on test conducted using relevant national/international testing standards from an accredited entity/government recognized entity. The certification report shall include information on the measured performance levels for load losses and no-load losses in various operational conditions and in addition, the associated uncertainty; • Be new equipment and not transferred from other parts of the distribution grid or from another distribution grid. It should be noted that CPAs to be included do not need to undertake local stakeholder consultation and Environmental Impact Assessment as they are conducted at a PoA level.	The CME will assess the information and evidence provided by the CPA implementer that the transformers to be installed are compliant with AM0067/Version 02 includes the followings. •Comply with national / international QA/QC standards. This shall be demonstrated through certification based on test conducted using relevant national/international testing standards from an accredited entity/government recognized entity. The certification report shall include information on the measured performance levels for load losses and no-load losses in various operational conditions and in addition, the associated uncertainty; •Be new equipment and not transferred from other parts of the distribution grid or from another distribution grid. The CME has checked and ensured that the local stakeholder consultation and EIA is conducted prior to the inclusion of the CPA.
8.	No ODA will be diverted as a result of the CPA.	The CPA implementer will provide an affirmation that funding for the CPA from Annex-I parties, if any, does not result in a diversion of Official Development Assistance.
9.	The transformers that the CPA will implement or replace are those located between the distribution substation and home.	The CPA implementer will provide evidence that the transformers that the CPA will implement or replace are those located between the distribution substation and home.
10.	The monitoring plan of the CPA is consistent with the monitoring plan established in Section Appendix 5 of the IEETCDM-PoA-DD.	The CPA must demonstrate that it complies with the monitoring plan outlined in Appendix 5 of the IEETCDM – PoA-DD.
11.	Each CPA implementer should monitor and collect appropriate monitoring data as outlined in the PoA-DD and agree to provide the information to the CME.	An agreement will be signed between the CPA implementer and the CME, which will ensure that each CPA implementer will monitor and collect the required monitoring data and provide the

		information to the CME.
12.	The CME approves the participation of the CPA in the PoA.	A letter from the CME that confirms participation of the CPA in the PoA.
13.	Based on the evaluation of no-load losses, the CPA should apply amorphous transformer technologies that are more efficient than the transformer technologies that are currently installed in the national electricity grid of Kenya.	The CPA implementer will provide evidence that the CPA will apply amorphous transformer technologies that are more efficient than the transformer technologies that are currently installed in the national electricity grid of Kenya
14.	The CPA shall be the first in the applicable geographical area that applies the transformer technology that is different* from transformer technologies that are implemented by any other project including other CPA under this PoA, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier.	The CPA implementer will provide evidence that the CPA is the first in the applicable geographical area and will apply transformer technologies that is different from transformer technologies that are implemented by any other project including other CPA under this PoA, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier.
15.	The crediting period of the CPAs will be a maximum of 10 years with no option of renewal	The CME will check the crediting period of CPAs in the CPA-DD and confirm that the crediting period of CPAs will not be more than 10 years.

*** The CPA transformer will need to have following characteristics:**

Definition	Items	Existing facility	PoA project	Difference
Type of good/ service	Goods/ Services	Transformer in distribution grid	Energy efficient transformer in distribution grid	Application of energy efficient transformer
Level of service	Voltage ratio, Capacity range	11/0.25kV, Single phase 15 to 1000 KVA	11/0.25kV, Single phase 15 to 1,000 KVA	No difference
		33/0.25kV, Single phase 15 to 1,000 KVA	33/0.25kV, Single phase 15 to 1,000 KVA	
		11/0.433kV, Three phase 15 to 1,000 KVA	11/0.433kV, Three phase 15 to 1,000 KVA	
		33/0.433kV, Three phase 15 to 1,000 KVA	33/0.433kV, Three phase 15 to 1,000 KVA	
Magnetic core material in transformer	Material	CRGO silicon steel plate	Amorphous metal	Low no load loss through application of Amorphous metal
Performance specifications	Techno-logy Specifica-tion	$NLL_{BL,k}$: base	$NLL_{PR,k}$: 80% lower	Low energy loss of transformer due to low NLL (no load loss). Difference between $NLL_{BL,k}$ & $NLL_{PR,k}$ will be used to estimate emission reductions.
		$LL_{BL,k}$: base	$LL_{PR,k} \leq LL_{BL,k}$	Difference between $LL_{BL,k}$ & $LL_{PR,k}$ will not be used to estimate emission reductions in accordance with the AM0067.

Compliance with certifications/ testing	IEC, National Standard	International Electrotechnical Commission (IEC) 60076 standard or relevant national standard	International Electrotechnical Commission (IEC) 60076 standard or relevant national standard	Electrical requirement is same.
Conclusion	-	Existing technology	New technology	Project technology is apparently different from the existing one

B.3. Application of methodologies

Each CPA that applies to be included in IEETCDM-PoA-DD shall apply Version 02 of the approved baseline and monitoring methodology AM0067, "*Methodology for installation of energy efficient transformers in a power distribution grid"*.

In line and in addition to the provisions under AM0067, the design of the PoA and each CPA will apply the latest version of the following tools:

- "Combined tool to identify the baseline scenario and demonstrate additionality".
- "Tool to calculate emission factor for an electrical system".

Please refer to Appendix 3 for a detailed description of how each generic CPA meets the applicability conditions of the methodology.

Please note that the PoA will not involve sampling as each transformer will be monitored individually.

SECTION C. Management system

>>

Standard Bank Plc is the Coordinating/Managing Entity of the Installation of Energy Efficient Transformers (IEET) program. Standard Bank Plc will provide overall coordination of the CDM Programme of Activities (CDM-PoA) and will facilitate and support project implementers to implement CDM Component Project Activities (CDM-CPAs).

Management structure and responsibilities
The CME will implement a monitoring plan that allows the Designated Operational Entity (DOE) to verify all CPAs in the PoA. For each CPA, all relevant monitoring parameters will be monitored by the CPA implementers.

Database
The CME will establish and maintain a database for each and every CPA that will record all relevant CPA specific data such as:

- Name of the CPA;
- Name of the implementing entity of the CPA;
- Contact details of the implementing entity including contact person, address, telephone and email address;
- Transformer type and capacity;
- Verification status and monitoring reports of each CPA.

Monitoring will be carried out in each CPA. The CME will provide guidance to the CPA implementing entity on how the monitoring should be conducted and collected with regards to emission reduction

calculations. The start and end dates of each monitoring period for each individual CPA, together with the emission reductions attributable to that monitoring period, will be recorded in the database.

As the CME for this PoA, Standard Bank Plc will be responsible for managing the CDM cycle and coordinating the issuance of CERs. The following diagram outlines the project activities and management process:

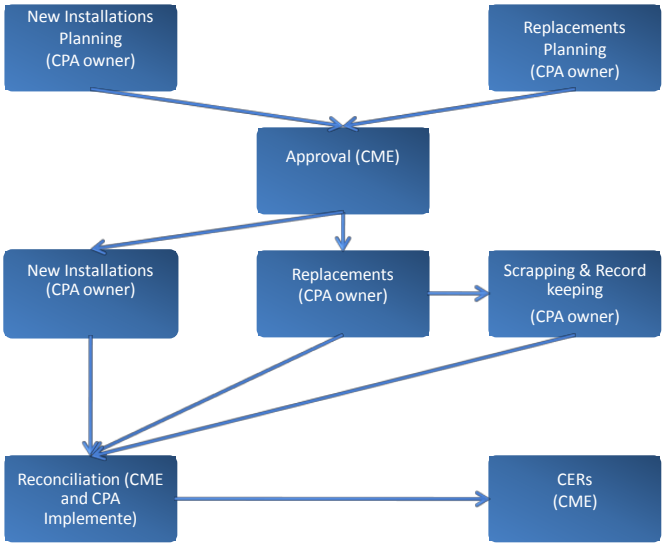


Figure C.1: *Schematic illustration of project activities and management.*

The CME will utilize the *CPA Inclusion Management System* that includes among others:

1. Roles and responsibilities;
2. Training and capacity development
3. Procedures for technical review of inclusion of CPAs
4. Procedure to avoid double counting
5. Procedures for technical review of inclusion of CPAs
6. Measures for continual improvements of the PoA management

A copy of the *CPA Inclusion Management System* has been submitted to the DOE for validation.

SECTION D. Duration of PoA

D.1. Start date of PoA

>>

17/04/2012

This is the date on which the CDM PoA was published for global stakeholder consultation.

D.2. Duration of the PoA

>>

28 years

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

>>

Environmental analysis of IEETCDM-PoA is done at PoA level.

Justification:

The design document of the PoA describes virtually every procedure regarding governance of all the CPAs and includes:

- Installation
- Replacements
- Identification
- Scrapping
- Role of entities, etc.

In addition, CPAs may be implemented in almost identical environments targeting identical baselines. In this regard, it is reasonable that the environmental analysis of IEETCDM-PoA be undertaken at PoA level.

E.2. Analysis of the environmental impacts

>>

The IEET CDM-PoA involves the installation of energy efficient distribution transformers across electricity distribution grids and scrapping of all the replaced baseline transformers. This documentation takes into account that in the absence of this PoA, replaced worn out transformers will be taken for refurbishment and returned back to operation in the same sites or elsewhere.

Air pollution

There is no problem of electric insulation oil leakage for both baseline and the project transformers. The electric insulation oil obtained from the process of scrapping the baseline transformers does not contain polychlorobiphenyl and is non-volatile and can be recycled after disposal. The implementation of the IEETCDM-PoA saves electricity; consequently reducing green-house gases released during generation of the same amount of electricity by fossil fuel based grid-connected power plants. The tools used during the exchange of distribution transformers produce negligible emissions.

Waste water

Installation of energy efficient transformers will not involve the discharge of wastewater. Distribution transformers are scrapped into four kinds of waste: electric insulation oil, waste aluminum coil, waste iron core and oil tanks. The process of scrapping will be undertaken by accompany that satisfies the requirements laid down by the CME, and is to involve no wastewater discharge.

Noise

There is no obvious, excessive noise generated during the process of the installation of distribution transformers.

Solid waste

The solid waste from the project activity is the replaced faulty transformers. No other solid waste will be generated during the process of installing the energy efficient transformers as well as during scrapping of the replaced transformers.

Solution

CPA implementers will put in place an Environmental Management Plan which will be in line with regulations stipulated under relevant local environment management authority guidelines.

Ecological environment

Implementation of the activities under IEETCDM-PoA - i.e. installation and scrapping - will not affect the ecological environment by way of, among others, deforestation or new road reserves, around transformer locations.

Conclusion

Generally, the proposed project activity does not have an obvious negative effect on the environment on the whole. There are many beneficial effects such as reduced dependence on fossil fuels for electricity generation, increased access to grid electricity etc. Therefore the project will have positive impact on the environment.

E.3. Environmental impact assessment

>>

An EIA is not required for CPAs in the host country of the Republic of Kenya, as activities under the IEET CDM-PoA are not in the second schedule of the Environmental Management and C*o-ordination Act*, *1999* (EMCA, 1999) of activities that require an Environmental Impact Assessment (EIA).

SECTION F. Local stakeholder comments

F.1. Solicitation of comments from local stakeholders

>>

- Local stakeholder consultation of IEETCDM-PoA is done at PoA level.

Justification

All CPAs are implemented in almost similar environments targeting similar baseline features. It is therefore anticipated that there will be no significant social impact variations within the individual CPAs and hence it is reasonable to invite local stakeholder comments on IEETCDM-PoA at PoA level.

On 21March 2012 a CDM stakeholder consultation meeting was held in Nairobi, Kenya to receive further comments and inputs from various groups of stakeholders. Stakeholders were invited to the meeting through e-mail, phone calls and newspaper advertisements. The meeting was advertised on two most widely read newspapers i.e. *Daily Nation* and *The Standard* on 12 March 2012. Phone calls and emails invitations were made to several stakeholders two weeks before the meeting date.

F.2. Summary of comments received

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Table F.2.1 *Stakeholder comments received.*

No.	Name of stakeholder	Question
1.	• Miki Cardovillis: Kinetic Energy Limited	• Provide information about the company called Cool nrg and their location and role this project
2.	• Miki Cardovillis: Kinetic Energy Limited	• Explain more about the efficient transformers - Amorphous core type/High efficient steel core type transformers
3.	• Miki Cardovillis: Kinetic Energy Limited	• What will KPLC earn from the 50GWh savings and carbon credits?
4.	• Miki Cardovillis: Kinetic Energy Limited	• Provide the current carbon footprint of KPLC?
5.	• George Gachoki: Building Plan Limited	• It was indicated that the efficient transformers can save 30% energy. Is this the maximum possible?
6.	• George Gachoki: Building Plan Limited	• It was indicated that the carbon credits would enable electricity tariff rise mitigation. What are the benefits in figures?
7.	• George Gachoki: Building Plan Limited	• The 29,000 new transformers would generate e-waste. Is there a way to address that?
8.	• Miki Cardovillis: Kinetic Energy Limited	• What is the current price of CERs in the world market?
9.	• Stephen Abuga: formerly at	• The efficient lighting project seems to have

	Kenya Power and Lighting Company Limited	covered Nairobi and other cities and therefore customers in rural areas were not reached. What are we doing to benefit all customers in the next phase of the CFL project?
10.	• Miki Cardovillis: Kinetic Energy Limited	• How will the monitoring of the project be done and which entity will do this?
11.	• George Gachoki: Building Plan Limited	• What is the benefit of this project compared to the cost?
12.	• Miki Cardovillis: Kinetic Energy Limited	• How does the cost of these efficient transformers compare with the old ones?
13.	• Simon Kimitei: Kenya Power and Lighting Company Limited	• Does Standard Bank find this project beneficial and how does it benefit?
14.	• Simon Kimitei: Kenya Power and Lighting Company Limited	• Does the project target to include transformers procured by REA, KETRACO and other companies in Kenya?
15.	• Jacob George: Vijai Electricals Limited	• What steps will be taken to ensure international practices and experiences are applied in this project?

F.3. Report on consideration of comments received

>>

Table F.3.1: *Responses to stakeholder comments.*

No.	Question	Response
1.	• *Provide information about the company called Cool nrg and their location and role in this project*	• Cool nrg is an international carbon project development company, contracted by Standard Bank to develop CDM projects. The company head office is located in Australia but they have an office in Nairobi, Kenya.
2.	• *Explain more about the efficient transformers -Amorphous core type/High efficient steel core type transformers*	• Energy efficient transformers are designed to minimize losses especially at no-load and load states. They have amorphous steel core with lower hysteresis losses compared to conventional transformers whose core consist of stacks of laminations made from silicon steel.
3.	• *What will KPLC earn from the 50GWh savings and carbon credits?*	• KPLC will pass the benefits of the CDM projects to consumers through mitigation of tariff increases by equivalent.
4.	• *Provide the current carbon footprint of KPLC?*	• The carbon footprint of the company has not been computed. Fossil oil based thermal plants in the system contribute about 30% of the annual generation. Mitigation of Greenhouse Gas emissions is timely for mitigation of climate change and high cost of producing

		electricity.
5.	• *It was indicated that the efficient transformers can save 30% energy. Is this the maximum possible?*	• Current figures stated by manufacturers indicate transformer losses can be reduced to around this value. During procurement, specifications will be developed to allow competition between the high efficiency transformers available in the market.
6.	• *It was indicated that the carbon credits would enable electricity tariff rise mitigation. What are the benefits in figures?*	• This will be determined once we obtain the GHG reduction levels associated with the project are determined, and will depend on the market price of the CERs at that time.
7.	• *The 29,000 new transformers would generate e-waste. Is there a way to address that?*	• The program involves adoption of energy efficient transformers as new installations and replacement of faulty transformers and not direct replacements. In addition, transformers have long economic life beyond 20 years.
8.	• *What is the current price of CERs in the world market?*	• The current price is about €7 per CER or tonnes of CO2 reduction.
9.	• *The efficient lighting project seems to have covered Nairobi and other cities and therefore customers in rural areas were not reached. What are we doing to benefit all customers in the next phase of the CFL project?*	• There were only 1.25 million CFLs distributed countrywide in the first phase of the efficient lighting project and therefore many customers missed out.
10.	• *How will the monitoring of the project be done and which entity will do this?*	• KPLC is the owner of the project. Standard Bank and KPLC will be involved in the monitoring and reporting of the CDM project. An appropriate monitoring plan is being developed for this project as required by the UNFCCC project design rules.
11.	• *What is the benefit of this project compared to the cost?*	• The project will be viable with the inclusion of carbon revenues. Other benefits include reduction in generation costs and hence retail tariffs, reduced investment requirements due to lower demand and increased customer satisfaction as the benefits of the projects shall be passed to consumers.
12.	• *How does the cost of these efficient transformers compare with the old ones?*	• The more efficient transformers are more expensive but usually the cost gradually comes down over time. This is also common with green/renewable energy. Bids will be invited for supply of the transformers and therefore it is expected that prices quoted will be competitive. The efficiency gains will also result in benefits.
13.	• *Does Standard Bank find this project beneficial and how does it*	• Standard Bank is contracted to develop and implement the project and thereafter buy the

	benefit?	accruing carbon credits for trading in the global market.
14.	• *Does the project target to include transformers procured by REA, KETRACO and other companies in Kenya?*	• Yes. This is a Programme of Activities that allows participation by other partners including the private sector. REA operates under specifications set and maintained by KPLC.
15.	• *What steps will be taken to ensure international practices and experiences are applied in this project?*	In the implementation, UNFCCC has approved guidelines for project CDM project development and implementation which must be followed. The consultant has international experience and does research to ensure that the best practices are applied in the project. With regard to the transformers, international technical standards will be used in the procurement so as to ensure quality transformers are procured.

SECTION G. Approval and authorization

>>

IEET CDM-PoA has received a Letter of Approval from the National Environment Management Authority (NEMA), the Kenyan Designated National Authority (DNA) and the United Kingdom of Great Britain and Northern Ireland DNA. Standard Bank Plc is the authorized Coordinating/Managing Entity (CME) of the PoA.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

>>

Each CPA under the PoA Installation of Energy Efficient Transformers (IEET) aims to install high energy efficient transformers across national electricity distribution grids. This may also involve adoption of the energy efficient transformers in the replacement of the inefficient and faulty baseline transformers.

Note: This part of F-CDM-PoA-DD contains text sections in black and text sections in blue font. The black text sections are common to all CDM-CPAs and cannot be changed or edited by CDM-CPA implementers in preparing F-CDM-CPA-DDs. The blue text sections are to be edited/completed by CDM-CPA implementers in preparing F-CDM-CPA-DDs.

Title of the CPA

Title: IEET/CPA-*<insert number provided by CME>/<insert country(ies) name(s) where CDM-CPA will be implemented>/<insert CPA implementer(owner)>*
Version: *<insert document version number>*
Date: *dd/mm/yyyy*

History of*<insert name of CPA>*DD

Version	Date	Nature and purpose of revision(s)
01	*dd/mm/yyyy*	*<insert reason for nature and purpose of revision >*

This CDM-CPA is developed under the IEET CDM-PoA.*<insert name of CPA>*involves the following activities and technologies which are applicable according to IEETPoA:

1. *<insert measure(s)/technology(ies) of the CDM-CPA>*

1. Goal of *<insert name of CPA>*

Distribution and installation

The aim of this CDM-CPA is to install*<insert forecast number or number of transformers to be installed>*energy efficient transformers on the distribution grid(s) of*<insert country(ies) name(s) where CDM-CPA will be implemented>*. Energy efficient transformers will be installed in new sites as well as to replace *<insert existing (conventional transformer type(s)>*.

Installation of energy efficient transformers will be carried out in a manner compliant with the IEET CDM-PoA under which this CDM-PoA is designed and implemented.

Handling of the replaced transformers

*<insert CPA implementer(owner)>*will arrange for the collection, transportation, storage and destruction of the replaced baseline transformers by providing the following:

- A Management Information System and guide for assisting in the status verification of replacement data from the respective transformer locations;
- An Environmental Management Plan prepared in line with stipulated guidelines from relevant National Environmental bodies and the applied UNFCCC methodology;
- Selection of companies to perform scrapping through nationally accepted selection systems and

verification by a third party;
- Dedicated collection points with personnel trained in scrapping techniques to be implemented;
- Scrapping of the replaced transformers using guidelines stipulated in the specific CPA-DD guidelines.

System to avoid double accounting

Each efficient transformer installed will have a sequential number,*<insert number provided by CME>*/00000001[7]. In addition and to avoid double counting, each baseline and project transformer will be uniquely identified by location (Country/City/Line + Serial number)

Baseline transformer scrapping

<Describe here the destruction processes to be used for the exchanged ICLs and how third party verification procedures will be undertaken>.

Documented third party evidence will be held verifying the scrapping of the replaced baseline transformers in the CDM-CPA.*<insert name and status[8] of scrapping entity>.*

Leakage associated with this CDM-CPA is thus avoided through the destruction/scrapping of the replaced baseline transformers as described above.

Record Keeping System

<Describe here the record keeping system that will be used and maintained that will document the following variables:

- *Actual installed type.*
- *Capacity, transformation ratio.*
- *Load loss rate (W).*
- *No-load loss rate (W).*
- *Date of installation*
- *Localization (City/distribution line)*

The description must also detail data control procedures to ensure integrity and accuracy of the data.>

Emission reductions

Emissions Reductions (ERs) through *<insert name of CPA>*will be achieved through reduction of electricity losses hence reduced generation demand aimed at phasing out fossil fuel-based generation plants connected to the national grid of*<insert country(ies) name(s) where CDM-CPA will be implemented>*. It is expected that this CPA will reduce of approximately*<insert estimated number of emission reductions in TCO2>*per year.

Environmental, economic and social benefits

As an energy efficiency project activity,*<insert name of CPA>*will produce positive environmental, economic and social benefits through the following ways:

<insert project benefits including:

- *Reduced dependence on fossil fuel based power plants and hence reduction in GHG emissions*
- *Increased awareness of new energy efficient measures available as well as the collective effort to address climate change. This motivates communities on other sustainable environmentally friendly ways to achieve energy efficiency e.g. efficient household lighting*
- *Freeing up existing power generation for new customers: the project activity aims at saving enough energy to provide power and light to 1,000,000 homes currently not connected to the national grid*

[7]Numbering system is described section C (ii) on the IEET PoA-DD.
[8]Information regarding registration and experience of the company.

- *Direct employment opportunities in-country as a result of the tasks associated with the ongoing annual monitoring and verification processes.*
- *CDM capacity-building opportunities as the CDM-PoA is developed and implemented.*
- *Training and education programs undertaken to train staff involved in distribution/installation of the energy efficient transformers.*
- *By registering with the UNFCCC, the project will result in foreign exchange by way of trading carbon credits>.*

2. General operating and implementing framework of IEET CDM PoA

The Coordinating/Managing Entity (Standard Bank Plc) of the Installation of Energy Efficient Transformers (IEET) Programme of Activities will provide overall coordination of the PoA and will facilitate and support project implementers to implement *<insert name of CPA>.*

Confirmation that the *<insert name of CPA>*is a voluntary action and the Implementer is aware and agreed that their activity is subscribed to IEETCDM-PoA.

The implementer for this CDM-CPA,*<insert full name(s) of CPA implementer(owner)>,*is undertaking this **activity voluntarily.**

*<insert full name(s) of CPA implementer(owner)>*is aware of and has agreed that their activity is being subscribed to the IEETCDM-PoA. The CPA implementer has signed a contractual agreement to that effect with the CDM-PoA CME.

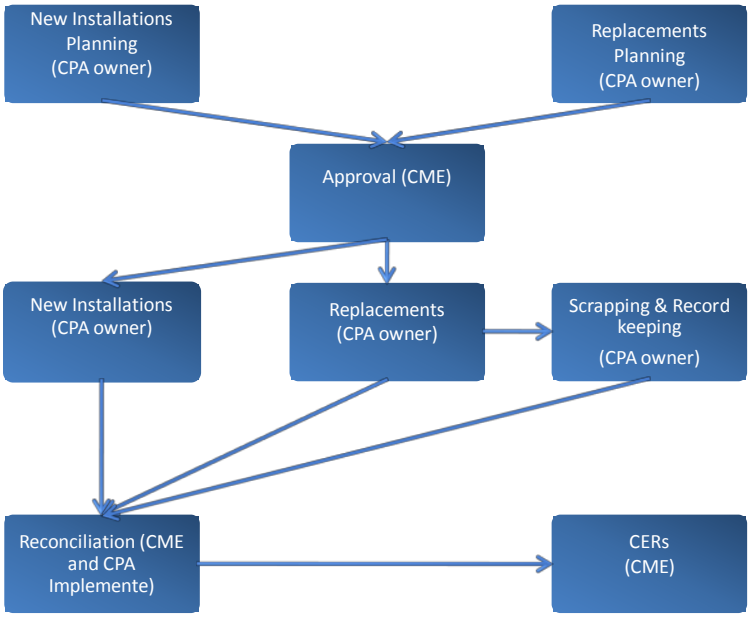


Figure A.1.1: *Schematic illustration of installation procedure.*

SECTION B. Application of a baseline and monitoring methodology

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

>>

Approved baseline and monitoring methodology to be applied

As per IEETCDM-PoA, Version 02 of AM0067, *"Methodology for installation of energy efficient transformers in a power distribution grid"*. Sectoral Scope 02, EB 41, will be applied in*<insert name of CPA>.*

In line and in addition to the baseline and monitoring methodology this CDM-CPA design refers to the latest version of following tools:

(1) "Combined tool to identify the baseline scenario and demonstrate additionality";
(2) "Tool to calculate emission factor for an electrical system".

B.2. Application of methodology(ies)

>>

Methodological measure	Justification
1. Replacement of existing lower-efficiency transformers with higher efficiency transformers in an existing distribution grid	*<insert name of CPA>*involves replacement of existing transformers with higher efficiency transformers in the electricity distribution grid of*<insert country(ies) name(s) where CDM-CPA will be implemented>*.
2. Install new high efficiency transformers in the new areas covered by expansion of the distribution grid where in the absence of the project, lower efficiency transformers would have been installed.	*<insert name of CPA>*will install new high efficiency transformers in the new areas covered by expansion of the distribution grid where in the absence of the project, lower efficiency transformers would have been installed.
3. Emission reductions due to reduction in no-load losses alone are claimed	Only no-load losses are included in the calculation of emission reductions. *<please provide supporting documentation/reference/spreadsheet>*
4. Installation of transformers within the distribution grid is governed by performance levels established by local or national regulation, which define maximum permissible load losses and no-load losses	Installation of transformers within the distribution grid is governed by performance levels established by *<please insert source of regulation >*, which define maximum permissible load losses and no-load losses.
5. Load losses, at rated load, of the transformers implemented under the project activity are demonstrated to be equal or lower than the load losses in transformers that would have been installed in absence of the project activity	Demonstration is done for the baseline and project scenario to show that load losses for project transformers are lower than the load losses in transformers that would have been installed in absence of the project activity.
6. The transformers installed in the project activity comply with national / international QA/QC standards. This shall be demonstrated through certification based on test conducted using relevant national/international testing standards from an accredited entity/government recognized entity. The certification report shall	Transformers installed will be subject to*<insert applied QA/QC standard(s)>*.This shall be demonstrated through certification based on test conducted using*<insert testing standard(s)>*from*<insert testing laboratory/facility and information on facility* accreditation>. The certification report shall include information on the measured performance levels for load losses and

include information on the measured performance levels for load losses and no-load losses in various operational conditions and in addition, the associated uncertainty	no-load losses in various operational conditions and in addition, the associated uncertainty.
7. Project proponent implements a system to ensure that the replaced transformers are not used in other parts of the distribution grid or in another distribution grid	*<insert full name(s) of CPA implementer(owner)>*has in place a *Management Information System* that admits and stores replacement and scrapping records. This will ensure that the replaced transformers are not used in other parts of the distribution grid or in another distribution grid.
8. A complete list of co-ordinates uniquely identifying each transformer installed under the project activity is provided	The *Management Information System* described above also admits information on the location of each project transformer by a complete coordinate system.
9. Data on total number and type of transformers installed over the last three years previous the project implementation is available	Data on total number and type of transformers installed over the last three years previous the project implementation is available.

Combined tool to identify the baseline scenario and demonstrate additionality, Version 05.0.0 and additional explanations	
10. Methodologies using this tool are only applicable if the potential alternative scenarios to the proposed project activity available to project participants cannot be implemented in parallel to the proposed project activity for example, an energy efficiency CDM project where the identified potential alternative scenarios are: (a) retrofit of an existing equipment, or (b) replacement of the existing equipment by new equipment, or (c) the continued use of the existing equipment without any retrofits	*<insert name of CPA>*is an energy efficiency CDM project where the identified potential alternative scenarios are: (a) replacement and installation of transformers using energy efficient amorphous technology and (b) the continuation of the current practice which is replacement and installation using the existing inefficient technology.
11. Guidelines for objective demonstration and assessment of barriers	• *<insert name of CPA>*meets requirements for No. 10 above.
12. Guidelines on the assessment of investment analysis	• *<insert name of CPA>*meets requirements for No. 10 above.

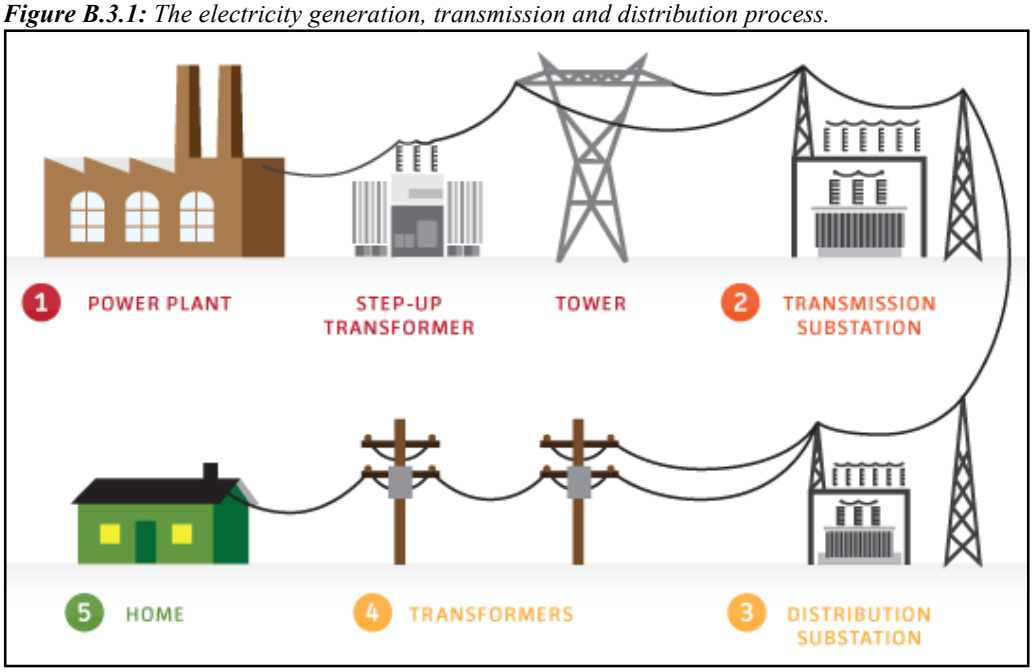
Tool to calculate emission factor for an electrical system, Version 03.0.0	
13. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	*<insert name of CPA>*results in electricity savings that would have been provided by the grid.
14. In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Project electricity systems is located in *<insert country(ies) name(s) where CDM-CPA will be implemented>*

B.3. Sources and GHGs

The boundary for *<insert name of CPA>* under this PoA is the national electricity grid of *<insert country where CPA is implemented>* where the energy efficient transformers are installed and includes all power plants connected physically to.

Please find the flow diagram of the *<insert name of CPA>* boundary as follows:

Figure B.3.1: *The electricity generation, transmission and distribution process.*



As described in Figure B.3.1, the major source of GHG emissions arise from the power plants (number 1) for the generation of electricity. Each CPA would intend to reduce GHG emissions by implementing energy efficient tranformers. The transformers that the CPA will implement are those located between the distribution substation and the home (number 4).

The main emission sources and type of GHGs in the project boundary are listed in the table below:

Table B.6.1: *Emissions sources included in or excluded from the project boundary*

Source		Gas	Included	Justification/Explanation
Baseline	Power plants servicing the grid	CO_2	Yes	Emissions that would have occurred at the fossil fuel power plants if the baseline transformers would have been installed.
		CH_4	No	Emission source small – excluded for simplification.
		N_2O	No	Emission source small – excluded for simplification.
Project activity	Power plants servicing the grid	CO_2	Yes	Main emission source.
		CH_4	No	Emission source small – excluded for simplification.
		N_2O	No	Emission source small – excluded for simplification.

Data and parameters to be monitored by each CPA are outlined in Section B.7.1.

B.4. Description of baseline scenario

>>

Each CPA will follow the latest version of the "*Combined tool to identify the baseline scenario and demonstrate additionality*" to describe the baseline scenario as outlined in Section B of the IEET CDM-PoA DD.

B.5. Demonstration of eligibility for a generic CPA

>>

Eligibility criteria:

	Eligibility criteria	**Conformance for *<insert name of CPA>***
1.	The geographic boundary of the CPA, including anytime induced boundary, is unambiguously identified and consistent with the geographic boundary set in the PoA.	*<Confirm consistency and provide description and evidence>*
2.	The CPA operator must demonstrate that double counting does not occur with the particular CPA.	*<Confirm consistency and provide description and evidence>*
3.	The CPA involves installation of transformers to new sites or to replace existing less efficient baseline transformers on the distribution electricity grid and shall comply with following criteria: - The transformer shall be having capacity ranging from 15 kVA to 1000 kVA having transformation ratio of 11/0.25kV (single phase), 11/0.433kV(three phase), 33/0.25kV (single phase) and 33/0.433kV (three phase). - Based on the evaluation of no-load losses, the transformer shall be more efficient than the baseline transformers - The transformer shall comply with the International Electrotechnical Commission (IEC) 60076 standard or relevant national standard - Load loss of project transformer should not be more than load loss of baseline transformer - Efficient transformer with amorphous core material	*<Confirm consistency and provide description and evidence>*
4.	The start date of the CPA is not before the start date of the PoA i.e. 17/04/2012, the on which the CDM PoA DD was published for global	*<Confirm consistency and provide description and evidence>*

	stakeholder consultation. This may be the date when the first procurement contract is signed or the date when installation of transformers starts.	
5.	Each proposed CPA follows the baseline and monitoring methodology AM0067, Version 02.	*<Confirm consistency and provide description and evidence>*
6.	The CPA meets the requirements pertaining to the demonstration of additionality as per section B.1 of the PoA-DD.	*<Confirm consistency and provide description and evidence>*
7.	Transformers to be installed are compliant with AM0067/Version 02 i.e. Transformers installed by CPAs under the PoA will: • Comply with national / international QA/QC standards. This shall be demonstrated through certification based on test conducted using relevant national/international testing standards from an accredited entity/government recognized entity. The certification report shall include information on the measured performance levels for load losses and no-load losses in various operational conditions and in addition, the associated uncertainty; • Be new equipment and not transferred from other parts of the distribution grid or from another distribution grid. It should be noted that CPAs to be included do not need to undertake local stakeholder consultation and Environmental Impact Assessment as they are conducted at a PoA level.	*<Confirm consistency and provide description and evidence>*
8.	No ODA will be diverted as a result of the CPA.	*<Confirm consistency and provide description and evidence>*
9.	The transformers that the CPA will implement or replace are those located between the distribution substation and home.	*<Confirm consistency and provide description and evidence>*
10.	The monitoring plan of the CPA is consistent with the monitoring plan established in Section Appendix 5 of the IEETCDM-PoA-DD.	*<Confirm consistency and provide description and evidence>*
11.	Each CPA implementer should monitor and collect appropriate monitoring data as outlined in the PoA-DD and agree to provide the information to the CME.	*<Confirm consistency and provide description and evidence>*
12.	The CME approves the participation of the CPA in the PoA.	*<Confirm consistency and provide description and evidence>*
13.	Based on the evaluation of no-load losses, the CPA should apply amorphous transformer technologies that are more efficient than the transformer technologies that are currently installed in the national electricity grid of	*<Confirm consistency and provide description and evidence>*

	Kenya.	
14.	The CPA shall be the first in the applicable geographical area that applies the transformer technology that is different* from transformer technologies that are implemented by any other project including other CPA under this PoA project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier.	*<Confirm consistency and provide description and evidence>*
15.	The crediting period of the CPAs will be a maximum of 10 years with no option of renewal	*<Confirm consistency and provide description and evidence>*

***The CPA transformer will be having following characteristics:**

Definition	Items	Existing facility	PoA project	Difference
Type of good/ service	Goods/ Services	Transformer in distribution grid	Energy efficient transformer in distribution grid	Application of energy efficient transformer
Level of service	Voltage ratio, Capacity range	11/0.25kV, Single phase 15 to 1000 KVA	11/0.25kV, Single phase 15 to 1,000 KVA	No difference
		33/0.25kV, Single phase 15 to 1,000 KVA	33/0.25kV, Single phase 15 to 1,000 KVA	
		11/0.433kV, Three phase 15 to 1,000 KVA	11/0.433kV, Three phase 15 to 1,000 KVA	
		33/0.433kV, Three phase 15 to 1,000 KVA	33/0.433kV, Three phase 15 to 1,000 KVA	
Magnetic core material in transformer	Material	CRGO silicon steel plate	Amorphous metal	Low no load loss through application of Amorphous metal
Performance specifications	Techno-logy Specifica-tion	$NLL_{BL,k}$: base	$NLL_{PR,k}$: 80% lower	Low energy loss of transformer due to low NLL (no load loss). Difference between $NLL_{BL,k}$ & $NLL_{PR,k}$ will be used to estimate emission reductions.
		$LL_{BL,k}$: base	$LL_{PR,k} \leq LL_{BL,k}$	Difference between $LL_{BL,k}$ & $LL_{PR,k}$ will not be used to estimate emission reductions in accordance with the AM0067.
Compliance with certifications/ testing	IEC, National Standard	International Electrotechnical Commission (IEC) 60076 standard or relevant national standard	International Electrotechnical Commission (IEC) 60076 standard or relevant national standard	Electrical requirement is same.
Conclusion	-	Existing technology	New technology	Project technology is apparently different from the existing one

Confirmation of additionality of <*insert name of CPA*> for inclusion into IEET CDM PoA

Demonstration of additionality for <*insert name of CPA*> has been done in accordance to guidelines stipulated by the approved baseline and monitoring methodology AM0067*"Methodology for installation of energy efficient transformers in a power distribution grid"*Version 02. In this regard, the demonstration applies the latest of the *"Combined tool to identify the baseline scenario and demonstrate additionality"*<*insert version*>

Additionality is demonstrated at the PoA level. However, CPAs will <*provide a full description of all the steps and criteria as applied in section B.1 of the PoA-DD* >

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

B.6.1, Explanation of methodological choices

>>

Estimation of emission reductions of <*insert name of CPA*> refers to Version 02 of AM0067of the applied methodology. In addition and in line with the provisions of the applied methodology, the CPA design also applies Version 03.0.0 of the *"Tool to calculate the emission factor of an electricity system"*.

1. Baseline emissions

The baseline emissions, *BEy* in a year '*y'* are given by equation 1 below:

$$BE_y = \sum_{k=1}^{n} \left(NLL_{BL,k} \times n_{k,y}\right) \times MP \times (1 - Br) \times EF_{CO2,grid,y} \times 10^{-6} \qquad \text{……(1)}$$

Where:

BEy	= Baseline emissions in year '*y*' (tCO_2/year)
k	= Index 'k' represents type of transformers, installed in the project activity
$NLL_{BL,k}$	= No-load loss rate of the transformer type 'k' that would have been installed by the end of the year '*y-1'* in the baseline scenario. No-load loss rate for each baseline transformer type 'k' is determined individually, as given in equation 2 below
MP	= Duration of each monitoring period (hours)
Br	= Black out rate of each monitoring period (%)
$EF_{CO2,grid,y}$	= CO_2 emission factor of the grid for year 'y' where the project activity is implemented (tCO_2/MWh). EF is calculated adopting the combined margin and as described in the "Tool to calculate the emission factor of an electricity system"
$n_{k,y}$	= Cumulative number of type 'k' transformers installed by the project activity at the end of year 'y-1'

Procedure to estimate Baseline no-Load Loss (*$NLL_{BL,K}$*)

(1) Baseline scenario 2: *BL k NLL*, is calculated as per the procedure defined as follows in equation 2 below:

$$NLL_{BL,k} = \min\left\{NLL_{reg,k}, NLL_{AVG,k}\right\} \qquad \text{……(2)}$$

Where:

$NLL_{reg,k}$ = No-load loss rate defined by the national regulations for *k* type of transformers (W)
$NLL_{AVG\,k}$ = Average of no-load loss rate provided by the manufacturers of all *k* type of transformers whose performance is among the top 20 % (W)

Procedure to calculate $NLL_{AVG,k:}$

(i) List all transformer type k installed in geographical area during the most recent five years before the implementation of the project activity (N);
(ii) Order the transformers from least to highest No-Load Losses, the No-Load Losses as defined by the manufacturer's performance level specification;
(iii) Take the first 20% (0.2N) of all transformers from the order arrived at in (ii) and average them.

(2) Baseline scenario 3: $NLL_{BL,k}$ is defined by the performance levels enforced through regulation.

The baseline scenario as can be seen from section D.4 above is *<please state the baseline scenario>*Therefore, $NLL_{BL,k}$ is estimated as per the procedure defined in*<choose one of the procedures above>:*

2. Project Emissions

The project emissions PE_y in a year y is given by equation 3 below:

$$PE_y = \sum_{k=1}^{n}\left[(1+UNC)\times NLL_{PR,k,y}\times n_k \times MP \times (1-Br)\times EF_{CO2,grid,y}\times 10^{-6}\right] \quad \text{.....(3)}$$

Where:

PEy = Project emissions in year '*y*' (tCO_2/year)
k = Index 'k', type of transformer, in the geographical region of the project activity area installed by the project activity at the end of year 'y-1'
$NLL_{PR\,k,y}$ = No-load loss rate of the energy efficiency transformer i which will have been installed by the end of the year '*y-1'* in the project activity (Watts)
MP = Duration of each monitoring period (hours)
Br = Black out rate of each monitoring period (%)
$EF_{CO2,grid,y}$ = EF is calculated adopting the combined margin and as described in the "Tool to calculate the emission factor of an electricity system"
UNC = Maximum allowable uncertainty for the no-load losses stated in the certification report provided by an accredited entity
N_k = Total cumulative number of type 'k' transformers installed by the project activity at the end of year 'y-1'

3. Leakage

The project activity does not include leakage emissions since replaced transformers are not used elsewhere.

4. Emission reductions

Emission reductions are calculated as shown below:

.....(4)

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year y (t CO_2)

BE_y = Baseline Emissions in year y (t CO_2)

PE_y = Project emissions in year y (t CO_2)

5. CO_2Emission Factor

The CO2Emission Factor calculation applies*<please insert the latest tool for calculating the emission factor for an electricity system available on the UNFCCC website including among others>:*

6. Tables
7. Equations
8. Flow diagrams
9. References>

Calculations shall be based on data from an official source (where available)[9] and made publicly available. *<please describe the source of the data used for calculating the grid emission factor>*

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

>>

Data / Parameter:	$LL_{BL,k}$
Data unit:	Watts
Description:	Load loss rate of the transformer type 'k' that would have been installed in the baseline scenario
Source of data:	Manufacturer's performance test report which measured at the time of pre-delivery inspection
Value(s) applied:	*<please fill in>*
Choice of data or Measurement methods and procedures:	*<please insert standard for sampling and procedure for inspection>*

[9]Plant Emission Factors used for the calculation of Emission Factors should be obtained in the following priority:

1. *Acquired directly* from the dispatch center or power producers, if available; or
2. *Calculated*, if data on fuel type, fuel Emission Factor, fuel input and power output can be obtained for each plant;
   If confidential data available from the relevant host Party authority are used, the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon Emission Factor and the corresponding list of plants;
3. Calculated, as above, but using estimates such as: default IPCC values from the 2006 IPCC Guidelines for National GHG Inventories for net calorific values and carbon Emission Factors for fuels instead of plant-specific values technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply; conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date; or
4. Calculated, for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.

Purpose of data	Applicability
Additional comment:	*<please fill in if applicable>*

Data / Parameter:	$NLL_{avg,k}$
Data unit:	Watts
Description:	Average of no-load loss rate provided by the manufacturers of all k type of transformers installed in the geographical region whose performance is among the top 20 % of their type in last five years prior to the implementation of the project activity
Source of data:	Manufacturer's performance test report which measured at the time of pre-delivery inspection
Value(s) applied:	*<please fill in>*
Choice of data or Measurement methods and procedures:	*<please insert standard for sampling and procedure for inspection>*
Purpose of data	Calculation of baseline emissions
Additional comment:	*<please fill in if applicable>*

Data / Parameter:	$NLL_{reg,k}$
Data unit:	Watts
Description:	• No-load losses (W) defined by the national regulations for k type of transformers
Source of data:	• Local, national legislation for transformer performance levels
Value(s) applied:	*<please fill in>*
Choice of data or Measurement methods and procedures:	*<please insert standard for sampling and procedure for inspection>*
Purpose of data	Calculation of baseline emissions
Additional comment:	*<please fill in if applicable>*

B.6.3. Ex-ante calculations of emission reductions

>>

1. **Calculate baseline emissions**

Sample calculations

$$BE_y = \sum_{k=1}^{n} \left(NLL_{BL,k} \times n_{k,y}\right) \times MP \times (1 - Br) \times EF_{CO2,grid,y} \times 10^{-6}$$

Where:

BEy	= Baseline emissions in year '*y*' (tCO_2/year)
k	= Index 'k' represents type of transformers, installed in the project activity
$NLL_{BL,k}$	= No-load loss rate of the transformer type 'k' that would have been installed by the end of the year '*y-1'* in the baseline scenario. No-load loss rate for each baseline transformer type 'k' is determined individually, as given in equation 2 below
MP	= Duration of each monitoring period (hours)
Br	= Black out rate of each monitoring period (%)
$EF_{CO2,grid,y}$	= CO_2 emission factor of the grid for year 'y' where the project activity is implemented (tCO_2/MWh). EF is calculated adopting the combined margin and as described in the "Tool to calculate the emission factor of an electricity system"
$n_{k,y}$	= Cumulative number of type 'k' transformers installed by the project activity at the end of year 'y-1'

Sample calculation for a *<insert transformer type>*

BEy	= *<insert value>*
k	= *<insert value>*
$NLL_{BL,k}$	= *<insert value in the table in section B.6.2>*
MP	= *<insert value>*
Br	= *<insert value>*
$EF_{CO2,grid,y}$	= *<insert value>*
$n_{k,y}$	= *<insert value>*

<provide a sample calculation here according to equation 1>

2. Project emissions

$$PE_y = \sum_{k=1}^{n}\left[(1+UNC)\times NLL_{PR,k,y}\times n_k \times MP \times (1-Br)\times EF_{CO2,grid,y}\times 10^{-6}\right]$$

Where:

PEy	= Project emissions in year '*y*' (tCO_2/year)
k	= Index 'k', type of transformer, in the geographical region of the project activity area installed by the project activity at the end of year 'y-1'
$NLL_{PR\,k,y}$	= No-load loss rate of the energy efficiency transformer i which will have been installed by the end of the year '*y-1'* in the project activity (Watts)
MP	= Duration of each monitoring period (hours)
Br	= Black out rate of each monitoring period (%)
$EF_{CO2,grid,y}$	= EF is calculated adopting the combined margin and as described in the "Tool to calculate the emission factor of an electricity system"
UNC	= Maximum allowable uncertainty for the no-load losses stated in the certification report provided by an accredited entity
N_k	= Total cumulative number of type 'k' transformers installed by the project activity at the end of year 'y-1'

Sample calculation for a *<insert transformer type>*

PEy	= *<insert value>*
k	= *<insert value>*
$NLL_{PR\,k,y}$	= *<insert value in the table in section B.7.1>*
MP	= *<insert value>*
Br	= *<insert value>*
$EF_{CO2,grid,y}$	= *<insert value>*
UNC	= *<insert value>*

N_k = *<insert value>*

<provide a sample calculation here according to equation 3>

3. **Emission reductions**

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year y (t CO_2)
BE_y = Baseline Emissions in year y (t CO_2)
PE_y = Project emissions in year y (t CO_2)

Sample calculation:

ER_y = *<insert value>*
BE_y = *<insert value>*
PE_y = *<insert value>*

<provide a sample calculation here according to equation 4>

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

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

Data / Parameter:	$EF_{CO2,grid,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid for year 'y' where the project activity is implemented
Source of data:	*<Official statistics or data obtained from local power company>*
Value(s) applied	*<please fill in>*
Measurement methods and procedures:	Calculated by the "combined margin method" described in specified in *"Tool to calculate emission factor of an electricity system"*
Monitoring frequency:	Annually
QA/QC procedures:	*<please fill in>*
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

Data / Parameter:	MP
Data unit:	Hours
Description:	Duration of each monitoring period
Source of data:	*<Official statistics or data obtained from local power company>*
Value(s) applied	*<please fill in>*

Measurement methods and procedures:	*<please fill in>*
Monitoring frequency:	To be specified in the CDM-PDD document
QA/QC procedures:	*<please fill in>*
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

Data / Parameter:	Br
Data unit:	%
Description:	Black out rate in the corresponding monitoring period
Source of data:	*<Official statistics or data obtained from local power company>*
Value(s) applied	*<please fill in>*
Measurement methods and procedures:	*<please fill in>*
Monitoring frequency:	Yearly.
QA/QC procedures:	*<please fill in>*
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

Data / Parameter:	k
Data unit:	Number
Description:	Type of transformer (type based on capacity and transformation ratio) installed by the project activity
Source of data:	Record of installation of high efficiency transformers provided by installation entities
Value(s) applied	*<please fill in>*
Measurement methods and procedures:	*<please fill in>*
Monitoring frequency:	At each transformer installation, replacement or removal.
QA/QC procedures:	*<please fill in>*
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

Data / Parameter:	$n_{k,y}$

Data unit:	Number
Description:	Cumulative number of transformers of type 'k' installed in the project activity by the end of year 'y-1'
Source of data:	Record of installation of high efficiency transformers provided by installation entities.
Value(s) applied	*<please fill in>*
Measurement methods and procedures:	*<please fill in>*
Monitoring frequency:	*<please fill in>*
QA/QC procedures:	*<please fill in>*
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

Data / Parameter:	$NLL_{PR,k,y}$
Data unit:	Watts
Description:	No-load loss rate of the high energy efficiency transformers type 'k' installed by end of year 'y-1' by the project activity
Source of data:	Manufacturer's performance test report which measured at the time of pre-delivery inspection
Value(s) applied	*<please fill in>*
Measurement methods and procedures:	According with local, national or international standards
Monitoring frequency:	Every time a transformer is installed.
QA/QC procedures:	Manufacturer's performance test report submitted by the manufacturer validated by certification entity.
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

Data / Parameter:	$LL_{PR,k}$
Data unit:	Watts
Description:	Load loss of the transformer type k which would have been installed
Source of data:	Manufacturer's performance test report which measured at the time of pre-delivery inspection
Value(s) applied	*<please fill in>*
Measurement methods and procedures:	Load-losses values at a rated current which measured at the time of pre-delivery inspection.
Monitoring frequency:	Every time a transformer is installed.

QA/QC procedures:	Manufacturer's performance test report submitted by the manufacturer validated by certification entity.
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

Data / Parameter:	Number of replaced transformers
Data unit:	Number
Description:	Historical record of replaced transformers under the project activity. The record shall include information on how the transformers are not going to be use in other parts of the grid or in another grid
Source of data:	Record of removal/installation of transformers provided by installation entities. Records of disposition of transformers provided by utility.
Value(s) applied	*<please fill in>*
Measurement methods and procedures:	*<please fill in>*
Monitoring frequency:	Annually
QA/QC procedures:	*<please fill in>*
Purpose of data	*<please fill in>*
Additional comment:	*<please fill in>*

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

>>

The monitoring plan for *<insert name of CPA>* has been developed in accordance with *<insert version number of the applied methodology>*.

Monitoring objective

Baseline emission factor for*<insert name of CPA>* is determined ex ante. Therefore no load loss rates of energy efficient transformers installed by the CPA are defined as the key data to be monitored.

Parameters to be monitored

<insert here a detailed description of CDM-CPA record keeping system, the data it will capture, how it will be operationalised and the quality assurance processes to ensure data quality and integrity. As per the IEETCDM-PoA, each CPA implementer will use and maintain a record keeping system to capture and document the required data. This record keeping system must be approved by the PoA and maintain appropriate records documenting the following variables inter-alia:

1. *Load and No-load loss rate (W) of energy efficiency transformers installed by the project activity;*
2. *Specifications of each high-efficiency transformer installed by the project activity (date of installation, localization, technical data);*
3. *CO_2 emission factor (tCO_2/MWh) of the grid;*
4. *Yearly blackout rate of the grid during the year 'y' (%);*
5. *The number of transformers which are installed in the project activity and are in operation. (i.e. consider the number of high-efficiency transformers removed since installed)>*

Information from the CDM-CPA record keeping system will be consolidated and stored in the CME project database.

See Appendix 5 for a detailed monitoring plan.

Appendix 1. Contact information on entity/individual responsible for the PoA

Organization	Standard Bank Plc
Street/P.O. Box	20 Gresham Street
Building	
City	London
State/Region	
Postcode	EC2V 7JE
Country	United Kingdom
Telephone	+44 20 3145 5000
Fax	+44 20 3189 6930
E-mail	co2@standardbank.com
Website	www.standardbank.com
Contact person	FenellaAouane
Title	
Salutation	Mrs
Last name	Aouane
Middle name	
First name	Fenella
Department	Carbon Trading
Mobile	

Appendix 2. Affirmation regarding public funding

The project activity will not receive any public funding from Parties included in Annex I of the UNFCCC.

Appendix 3. Application of methodology(ies)

Appendix 3.1: *Methodological measures and justification.*

Methodological measure	**Condition for generic CPAs**
1. Replacement of existing lower-efficiency transformers with higher efficiency transformers in an existing distribution grid	CPAs under IEET CDM PoA will involve replacement of existing transformers with higher efficiency transformers in the electricity distribution grid.
2. Install new high efficiency transformers in the new areas covered by expansion of the distribution grid where in the absence of the project, lower efficiency transformers would have been installed.	CPAs under IEET CDM PoA will install new high efficiency transformers in the new areas covered by expansion of the distribution grid where in the absence of the project, lower efficiency transformers would have been installed.
3. Emission reductions due to reduction in no-load losses alone are claimed	Only no-load losses will be included in the calculation of emission reductions
4. Installation of transformers within the distribution grid is governed by performance levels established by local or national regulation, which define maximum permissible load losses and no-load losses	Installation of transformers will be carried out with reference to local or national regulation governing maximum permissible load and no load loses*.
5. Load losses, at rated load, of the transformers implemented under the project activity are demonstrated to be equal or lower than the load losses in transformers that would have been installed in absence of the project activity	Demonstration will be done for the baseline and project scenario to show that load losses for project transformers are lower than the load losses in transformers that would have been installed in absence of the project activity.
6. The transformers installed in the project activity comply with national / international QA/QC standards. This shall be demonstrated through certification based on test conducted using relevant national/international testing standards from an accredited entity/government recognized entity. The certification report shall include information on the measured performance levels for load losses and no-load losses in various operational conditions and in addition, the associated uncertainty	The transformers installed in the project activity will comply with national / international QA/QC standards. This shall be demonstrated through certification based on test conducted using relevant national/international testing standards from an accredited entity/government recognized entity. The certification report shall include information on the measured performance levels for load losses and no-load losses in various operational conditions and in addition, the associated uncertainty
7. Project proponent implements a system to ensure that the replaced transformers are not used in other parts of the distribution grid or in another distribution grid	CPA implementers will have a Management Information System that will admit and store replacement and scrapping records. This will be used to ensure that the replaced transformers are not used in other parts of the distribution grid or in another distribution grid.
8. A complete list of co-ordinates uniquely identifying each transformer installed under the project activity is provided	The Management Information System in criterion 8 above will track the location of each project transformer by means of a complete coordinate system.
9. Data on total number and type of transformers	Data on total number and type of transformers

installed over the last three years previous the project implementation is available	installed over the last three years previous the project implementation must be available.

*In the context of Kenya, the national/local regulation regarding the values of maximum permissible load losses and no-load losses doesn't exist such that International Electrotechnical Commission (IEC) standards are applied to the Kenyan Grid Systems by Kenya Power and Lighting (KPLC). The specifications set out by the KPLC for transformers are based on IEC 60076 and EN 50464-1.

Kenya Power and Lighting Company (KPLC) and the Rural Electrification Authority (REA) are the two power distribution utilities operating in Kenya. The Kenya Power and Lighting Company sets specifications or regulations for all the transformer types procured even those procured by REA. Regulations (specifications) for all equipment including transformers set by KPLC are taken as national regulations as the utility has the mandate through an Act of Parliament, which sets up the Energy Regulatory Commission. The specifications set by KPLC for technical selection criteria for tenders/ suppliers are based on IEC standards.

Combined tool to identify the baseline scenario and demonstrate additionality, Version 05.0.0 and additional explanations	
10. Methodologies using this tool are only applicable if the potential alternative scenarios to the proposed project activity available to project participants cannot be implemented in parallel to the proposed project activity for example, an energy efficiency CDM project where the identified potential alternative scenarios are: (a) retrofit of an existing equipment, or (b) replacement of the existing equipment by new equipment, or (c) the continued use of the existing equipment without any retrofits	The project activity will be energy efficiency CDM project where the identified potential alternative scenarios are: (a) replacement and installation of transformers using energy efficient amorphous technology and (b) the continuation of the current practice which is replacement and installation using the existing inefficient technology.
11. Guidelines for objective demonstration and assessment of barriers	Project activity must meet requirements for No. 10 above

Tool to calculate emission factor for an electrical system, Version 03.0.0	
12. This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	Project activity will result in electricity savings that would have been provided by the grid.
13. In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	Project electricity systems for the countries covered by the PoA will not be located partially or totally in annex 1 countries.

Appendix 4. Further background information on ex ante calculation of emission reductions

Determination of the Grid Emission Factor

The Grid Emission Factor calculation shall be done in accordance with the guideline stipulated in *<please insert the latest tool for calculating the emission factor for an electricity system available on the UNFCCC website including among others:*

1. *Tables*
2. *Equations*
3. *Flow diagrams*
4. *References>*

Calculations shall be based on data from an official source (where available)[10]and made publicly available. *<please describe the source of the data used for calculating the grid emission factor>*

[10]Plant Emission Factors used for the calculation of Emission Factors should be obtained in the following priority:

1. *Acquired directly* from the dispatch center or power producers, if available; or
2. *Calculated*, if data on fuel type, fuel Emission Factor, fuel input and power output can be obtained for each plant;
   If confidential data available from the relevant host Party authority are used, the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon Emission Factor and the corresponding list of plants;
3. Calculated, as above, but using estimates such as: default IPCC values from the 2006 IPCC Guidelines for National GHG Inventories for net calorific values and carbon Emission Factors for fuels instead of plant-specific values technology provider's name plate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply; conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant's technology, size and commissioning date.
4. Calculated, for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.

Appendix 4.1: *<Insert CPA title here, example below is based on IEET/CPA-001/KENYA/KPLC>* ex ante calculation of emissions reductions.

Transformer Type		UNC	Baseline Tx			Project Tx			Applicability test	No. of project transfsormers	Blackout rate	Monitoring period	Baseline emissions (tCO2/yr)	Project emissions (tCO2/yr)	Emission reductions (tCO2/yr)	MWh savings
KV	KVA		No-Load Loss NLLBL,k (Watts)	Load losses LLBL,k (Watts)	NLLavg (Watt)	No-load losses NLLPR,k (Watts)	Load losses LLPR,k (Watts)	NLLreg,k (Watt)								
11	15	15%	43	264	43	9	238	45	applicable	2707	0.69%	8760	658	152	506	781.47
	25	15%	60	286	63	12	257	60	applicable	2053	0.69%	8760	693	160	533	823.17
	50	15%	98	534	98	20	481	125	applicable	2086	0.69%	8760	1151	265	886	1368.34
	100	15%	180	1108	180	36	997	210	applicable	4547	0.69%	8760	4600	1059	3541	5468.73
	200	15%	272	2380	272	54	2142	305	applicable	6964	0.69%	8760	10672	2455	8217	12690.35
	315	15%	433	2905	433	87	2615	520	applicable	1663	0.69%	8760	4060	934	3126	4827.80
	630	15%	815	5110	815	163	4599	860	applicable	363	0.69%	8760	1666	384	1282	1979.92
	1000	15%	950	7034	950	190	6331	1100	applicable	108	0.69%	8760	577	133	444	685.71
													24,077	5,542	18,535	28625.48

Transformer Type		UNC	Baseline Tx			Project Tx			Applicability test	No. of project transfsormers	Blackout rate	Monitoring period	Baseline emissions (tCO2/yr)	Project emissions per (tCO2/yr)	Emission reductions (tCO2/yr)	MWh savings
KV	KVA		No-Load Loss NLLBL,k (Watts)	Load losses LLBL,k (Watts)	NLLavg (Watt)	No-load losses NLLPR,k (Watts)	Load losses LLPR,k (Watts)	NLLreg,k (Watt)								
33	15	15%	0	0	0	0	0	0	0	0	0.69%	8760	0	0	0	0
	25	15%	60	315	82	12	284	60	applicable	1824	0.69%	8760	616	142	474	732.05
	50	15%	104	634	104	21	571	160	applicable	2604	0.69%	8760	1525	351	1174	1813.13
	100	15%	199	940	199	40	846	270	applicable	2735	0.69%	8760	3065	706	2359	3643.24
	200	15%	362	2465	362	72	2219	500	applicable	592	0.69%	8760	1207	278	929	1434.75
	315	15%	528	3593	528	106	3234	640	applicable	627	0.69%	8760	1864	429	1435	2216.22
	630	15%	1100	4438	1161	220	3994	1100	applicable	82	0.69%	8760	508	117	391	603.86
	1000	15%	1450	6703	1678	290	6033	1450	applicable	45	0.69%	8760	367	85	282	435.52
													9,152	2,108	7,044	10878.00

VARIABLE		YEAR											
		1/07/15 - 30/06/16)*	1/07/16 - 30/06/17	1/07/17 - 30/06/18	1/07/18 - 30/06/19	1/07/19 - 30/06/20	1/07/20 - 30/06/21	1/07/21 - 30/06/22	1/07/22 - 30/06/23	1/07/23 - 30/06/24	1/07/24 - 30/06/25	Total	Average
Baseline emissions (tCO2/yr)	11kV	-	24,077	24,077	24,077	24,077	24,077	24,077	24,077	24,077	24,077	216,693	21,669
	33kV	-	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	9,152	82,368	8,237
	Combined	-	33,229	33,229	33,229	33,229	33,229	33,229	33,229	33,229	33,229	299,061	29,906
Project emissions (tCO2/yr)	11kV	-	5,542	5,542	5,542	5,542	5,542	5,542	5,542	5,542	5,542	49,878	4,988
	33kV	-	2,108	2,108	2,108	2,108	2,108	2,108	2,108	2,108	2,108	18,972	1,897
	Combined	-	7,650	7,650	7,650	7,650	7,650	7,650	7,650	7,650	7,650	68,850	6,885
Emission reductions (tCO2/yr)		-	25,579	25,579	25,579	25,579	25,579	25,579	25,579	25,579	25,579	230,211	23,021

Loss evaluation criteria

Transformer losses shall be capitalized at the following rates to facilitate evaluation and comparison of tenders.

Load (copper) losses	*US$ 2.373 per W for 35 years*
No – load (Iron) losses	*US$ 5.537 per W for 35 years*

Where tenders are being compared, losses will be capitalized at the above rate and added to the bid evaluated price of the transformer

To perform the economic analysis of transformer, it is necessary to calculate its life cycle cost or the total cost of ownership over the lifespan of the transformer. This is referred to as the capitalized cost of the transformer.

The Total Cost of Ownership (TCO) is calculated by:

$$TCO = PP + (A \times P_0) + (B \times P_K) \quad \ldots(i)$$

Where:

PP = Purchase price of the transformer
A = Represents the assigned cost of no-load losses per watt
P_0 = The rated no load loss
B = The assigned cost of load losses per watt
P_K = Rated load loss

A and B are the capitalization factors for no-load loss (P_0) and load loss (P_K) respectively.

$$A = (12 \times C_d + h \times C_e) \times F_c \quad \ldots(ii)$$

$$B = C_e \times h \times L^2 \times F_c \quad \ldots(iii)$$

$$F_c = \frac{(1+i)^n - 1}{i \times (1+i)^n} \quad \ldots(iv)$$

Where:

C_d(KSh/kW) = the demand charge or the monthly rate of peak power (commercial and industrial consumers) = **KSh 600/kW**[11]

C_e(KSh/kWh) = the cost of energy = **KSh. 5.75/kWh**[12]

h = annual utilization hours of the transformer (full year = **8760 hours**)

F_c = present value factor, calculated for n years = **35 years**[13]

i = discount rate (% p.a) = **12% p.a**[14]

[11]http://www.erc.go.ke/ctariff.pdf
[12]http://www.erc.go.ke/ctariff.pdf
[13]Period based on the lifetime time of a transformer i.e. 25-35 years.
[14]Allowed rate of return by the Government of Kenya for projects undertaken by government owned/public utilities.

L = load factor = **70%**

Substituting the values in the above formulae gives:

$$F_c = \frac{(1+0.12)^{35}-1}{0.12\times(1+0.12)^{35}} = 8.177504$$

$$A = (12\times 600 + 8760\times 5.75)\times 8.177504$$ = KSh 470,663.76/kW
= US$ 5.537/W (1US$ = KSh 85)

$$B = 5.75\times 8760\times 0.7^2\times 8.177504$$ = KSh 201,782.06/kW
= US$ 2.373/W (1US$ = KSh 85)

The TCO of the project transformers will therefore be:

$$TCO(US\$) = PP + (5.537\times P_0) + (2.373\times P_K) \quad \ldots(v)$$

Application of Loss Evaluation in evaluating bidders:

	Bidder price in USD	***No load losses (Watts)***	***Load losses (Watts)***	***Total rated losses (Watts)***
Bidder A	*19,000*	*600*	*7450*	*8050*
Bidder B	*22,000*	*300*	*6500*	*6800*
Bidder C	*22,000*	*285*	*6450*	*6735*
Bidder D	*17,000*	*950*	*8600*	*9550*

Applying the loss evaluation equation *v* above we get:

$$TCO(US\$) = PP + (5.537\times P_0) + (2.373\times P_K)$$

= 40,001 for bidder A
= 39,086 for bidder B
= 38,884 for bidder C
= 42,668 for bidder D

Bidder C is selected as the winner.

Description	KPLC requirement	Bidder A	Bidder C	Bidder B	Bidder D
Rating	1000kVA 11/0.433kV	1000kVA 11/0.433kV	1000kVA 11/0.433kV	1000kVA 11/0.433kV	1000kVA 11/0.433kV
Vector symbol	Dyn11	Dyn11	Dyn11	Dyn11	Dyn11
Transformer external paint	Dark admiralty Grey No.632 as per BS 381C. Corrosive environment high	Ok	Ok	Ok	Ok
Tank type	Breathing	Ok	Ok	Ok	Ok
Fittings & accessories	Indicator, pressure relief valve	Ok	Ok	Ok	Ok
Tank sealing	Bolted	Ok	Ok	Ok	Ok
Underbase	Flat	Ok	Ok	Ok	Ok
Skids & Jacking lugs for concrete plinth mounting	40mm diameter axle holes	Ok	Ok	Ok	Ok
Lifting lugs	Required for cover, tank, core	Ok	Ok	Ok	Ok
Termination	Cable box (both HV & LV)	Ok	Ok	Ok	Ok
Position of HV & LV bushing	Side (both HV & LV)	Ok	Ok	Ok	Ok
HV/MV bushings	Brown porcelain	Ok	Ok	Ok	Ok
	Creenpage specify	Ok	Ok	Ok	Ok
	Phase-Earth specify	Ok	Ok	Ok	Ok
	Phase-phase specify	Ok	Ok	Ok	Ok
LV bushings	Brown porcelain	Ok	Ok	Ok	Ok
	Creenpage specify	Ok	Ok	Ok	Ok
	Phase-Earth specify	Ok	Ok	Ok	Ok
	Phase-phase specify	Ok	Ok	Ok	Ok
Terminals	Clamp type	Ok	Ok	Ok	Ok
Cooling method	ONAN	Ok	Ok	Ok	Ok
Core type	Laminated stackings (core type)	Ok	Ok	Ok	Ok
Core clamping	Steel cross-arm	Ok	Ok	Ok	Ok
HV winding	Full coils of electrolytic copper	Ok	Ok	Ok	Ok
LV winding	Electrolytic copper coils, copper foil or aluminium foil	Ok	Ok	Ok	Ok
Rating of LV neutral terminal	As phase terminal	Ok	Ok	Ok	Ok
NLTC tap changer range	±2 ×2.5%	Ok	Ok	Ok	Ok
Tx efficiency at unity p.f. rated voltage & full load	Specify	Ok	Ok	Ok	Ok
Impedance voltage	Maximum tap	Ok	Ok	Ok	Ok
	Nominal tap 5%	Ok	Ok	Ok	Ok
	Minimum tap	Ok	Ok	Ok	Ok
Insulation level	HV 38/95kV	Ok	Ok	Ok	Ok
	LV 5kV	Ok	Ok	Ok	Ok
Number of copies of routine tests to be provided		Ok	Ok	Ok	Ok
Stamped type test certificate with serial Nos. and previous type reports for temperature rise (ii) Dielectric tests (iii)Short ccct withstand (iv)Sound level determination (v)Corrugated tank test for panels of depth exceeding 260mm	Copies of test reports	Ok	Ok	Ok	Ok
Additional tests during acceptance	Bil	Ok	Ok	Ok	Ok
	Temperature rise	Ok	Ok	Ok	Ok
	Tx Leakage test	Ok	Ok	Ok	Ok
Compliance		Ok	Ok	Ok	Ok
Losses at 75 degrees celcius	No load losses, kW	Ok	Ok	Ok	Ok
	Full load losses.KW	Ok	Ok	Ok	Ok
	Full load losses (not exceeding 10KW)	Ok	Ok	Ok	Ok
Total cost of losses in USD	Loss evaluation/capitalization (TCO (US$)=PP+(5.537*Po)+(2.373*Pk))	40,001	39,086	38,884	42,668
	Winner based on bid price + capitalization	not selected	not selected	selected	not selected

	Bidder price in USD	No load losses (Watts)	Load losses (Watts)	Total rated losses (Watts)
Bidder A	19,000	600	7450	8050
Bidder B	22,000	300	6500	6800
Bidder C	22,000	285	6450	6735
Bidder D	17,000	950	8600	9550

Source: KPLC (CPA 001 implementer) extract showing bidder evaluation and selection based on loss evaluation

Appendix 5. Further background information on the monitoring plan

The monitoring plan is designed to establish a credible, transparent and adequate data measurement, collection and tracking system to ensure that the information required for auditing the emission reductions of *<insert name of CPA>*is real and verifiable. The monitoring plan will consist of:

1. Transformer Data Management Information System
2. Scrapping of replaced baseline transformers
3. Monitoring Organization
4. Quality Assurance and Quality Control
5. Training and capacity building

1. Transformer Data Management Information System

*<insert name of CPA owner/implementer>*will set up a transformer management information system that will keep all and exact monitoring data managed by the CME. The management information system will be equipped to avoid double counting and it will be possible to determine the status of verification anytime for*<insert name of CPA>.*

There will be a consistency check between the number of the project transformers installed by*<insert name of CPA>*and the number of the baseline transformers replaced by*<insert name of CPA>.*

2. Scrapping of replaced baseline transformers

Scrapping of the replaced baseline transformers will be done according to IEETCDM-PoA-DD. This will include information to ascertain that replaced baseline transformers are not used in any part of the electricity grid of*<insert country where CPA is implemented>*.This will involve collection, transportation and scrapping of the replaced transformers.

Baseline transformers replaced will be transported to dedicated points. *<The following data on installation and replacement will be fed into the Management Information System:*

- *Location of replaced as well as the new efficient transformer installed*
- *Date of replacement*
- *Date of scrapping*
- *Scrapping number/merit>*

*<insert name of CPA owner/implementer>*will engage an independent entity who will carry out the scrapping and associated monitoring/ reporting with reference to a signed scrapping contract. The result of this will be documentary evidence that baseline transformers were scrapped.

3. Monitoring Organization

*<insert name of CPA owner/implementer>*will arrange for all the activities under the monitoring plan of*<insert name of CPA>*.This will be through selection and training of monitoring personnel. Adequate supervision will be provided to ensure compliance with the applied methodology and hence IEETCDM-PoA-DD. The CME is responsible for monitoring data from the PoA. The CME would work in corroboration with the CPA implementer who will arrange for the activities under IEET.

4. Data Monitoring

This PoA does not involve sampling as all the transformers that are implemented within the PoA would be monitored individually. The monitoring data that is obtained from the monitoring would be utilized for the emission reduction calculations. The CPA implementer will collect the data and submit it to the CME for review on a monthly basis. The CME will store the monitored data in the CME database.

5. Quality Assurance and Quality Control - reliability of data cross check

The CME will be responsible for conducting QA/QC of the monitorewd data. In order to ensure that the quality assurance and quality control procedures for recording, maintaining and archiving data is in line with the PoA requirements, the CME will conductor a data audit on a six month basis. .

This monitoring plan will be subject to quality checks qoverned by IEET CDM-PoA-DD as well as the Management Information System Guide which will be issued by the CME. Data in hard copy forms will be coded into soft copy and collation performed for completeness.

Scrapping activity will be subject to an independent verification as stipulated in the scrapping agreements issued by the CME. An Environmental Management Plan will be put in place in line with of*<insert country where CPA is implemented>*Environmental Guidelines/Regulations to show that scrapping will be done in an environmentally friendly way.

All data collected as part of monitoring will be archived electronically and be kept at least for 2 years after the end of *<insert number of crediting period>*. All measurements will be conducted with calibrated measurement equipment according to *<insert standard applied >* .

6. Training and capacity building

<In order to enhance the monitoring process, training and capacity building sessions plan will be conducted by the CME in conjunction with the CPA implementer>.

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Document information

Version	*Date*	*Description*
03.0	3 December 2012	Revision to clarify the determination of the start date for a PoA and the documentation requirement for generic CPA-DDs. (EB 70, Annex 6).
02.0	11 May 2012	EB 66, Annex 12 Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities".
01.0	2 March 2012	EB 33, Annex 41 Initial adoption.

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