CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

CarbonSoft Open Source PoA: LED Lighting Distribution in East Africa

A.2. Description of the small-scale programme of activities (PoA):

CarbonSoft is focused on supporting the development of purpose-designed, renewable energy charged, (e.g., solar powered)[1] LED lamp distribution projects. These projects will specifically replace existing and predominant use of kerosene-based lighting with purpose designed LED lamps in countries situated in the Eastern part of the African continent (the "PoA" or "Projects").

1. General operating and implementing framework of PoA

According to the recent "From Carbon to Light" report one quarter of humanity continues to obtain illumination by burning fossil fuels, which is estimated to generate 190 million tonnes of carbon dioxide ("CO2") per year[2].

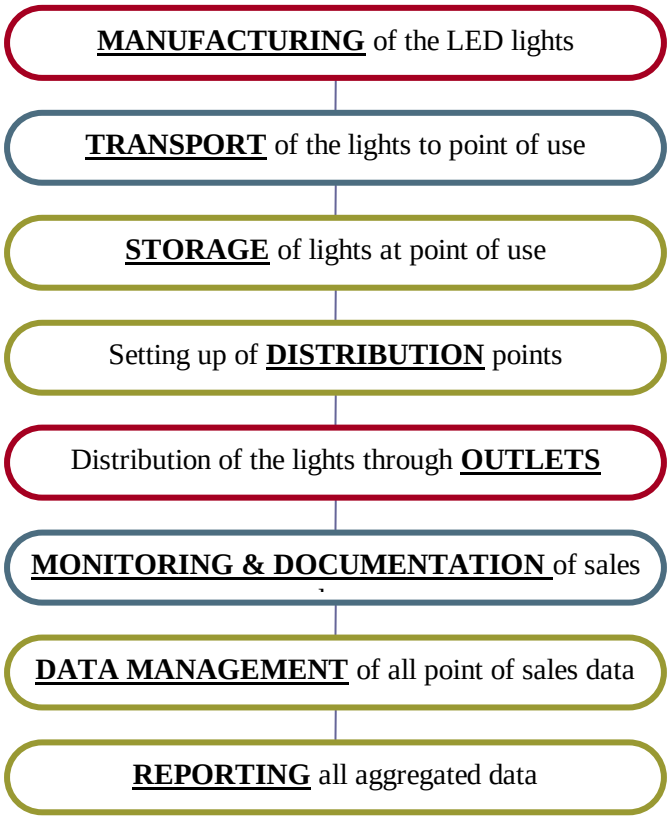
Undertaking approved activities as described in this PoA, will create the opportunity for people using kerosene for lighting to access and obtain high quality, low cost lighting solutions that meet the quality standards specified in AMS.III.AR.

Qualifying Project Lamps consist of at least one Light Emitting Diode ("LEDs") that provide high quality, long-life and consistent luminosity. The lighting source is connected to a rechargeable battery, which is in turn connected to an energy source such as a photovoltaic ("PV") panel. In practical terms an LED is a semiconductor diode that emits light when an electrical current is applied. LEDs are ideal for rural lighting purposes due to their efficiency, long lifetime, ruggedness and low maintenance costs associated.

[1] As per the methodology, AMS.III.AR version 1, LED lamps may be charged from a number of energy sources.

[2] http://light.lbl.gov/pubs.html. Accessed September 2011

Process flow for a generic project under the PoA:



2. Policies and measures of the stated goal of the PoA

The CME of the PoA will develop and coordinate project developers to replace kerosene-based lighting with approved Project Lamps in East Africa. The implementation of the PoA will have the following impacts;

- **Cost savings**: By replacing kerosene, families may have more available income to spend on their welfare priorities such as education, medicine and food

- **Energy Conservation**: By using LED lights, kerosene is saved. The batteries can be charged by renewable sources of energy, like solar, which lead to energy conservation

- **Job creation**: the supply, storage, distribution and maintenance (including battery renewal) of the Project Lamps may stimulate the creation of new employment opportunities across the region of the CPA

- **Clean-energy education**: The promotion and use of LED lamps that use renewable sources of energy for charging may enable families to experience sustainable development in a tangible way that can positively affects their lives. Incorporating the management and maintenance of LED lamps utilizing clean energy in a household will provide direct education

- **Improved education environment**: The use of LED lamps has been recognized to promote improved learning conditions that in turn favour increased literacy. Whilst official data is not available for countries in the East African region, one study focused on Indian homes claims that average study time of students rose from 1.47 hours to 2.71 hours per day[3], with a positive effect on school performance

- **Improved health and safety**: human deaths and physical burns are commonly associated with the use of flame-based domestic appliances. Reduction in the use of kerosene may contribute to the prevention of such domestic accidents and will also reduce indoor air pollution

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/Coordinating/ Managing Entity

The proposed PoA is a voluntary action by the private group, CarbonSoft Corporation Limited as Managing Entity of the PoA.

A.3. Coordinating/managing entity and participants of SSC-POA:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant (Yes/No)
1. Ethiopia 2. The Republic of Uganda 3. The Republic of Rwanda 4. The Republic of Kenya 5. The Republic of Zambia 6. The Republic of Malawi 7. The Republic of Mozambique 8. The Republic of Madagascar 9. The Republic of Zimbabwe	Coordinating Coordinating/ Managing Entity: CarbonSoft Corporation Ltd.	No

[3] http://light.lbl.gov/pubs/tr/lumina-tr5.pdf

A.4. Technical description of the small-scale programme of activities:

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A.4.1. Location of the programme of activities:

The geographical boundary of the PoA is all regions and provinces of the following East African countries:

1. *Ethiopia*
2. *Uganda*
3. *Rwanda*
4. *Kenya*
5. *Zambia*
6. *Malawi*
7. *Mozambique*
8. *Madagascar*
9. *Zimbabwe*

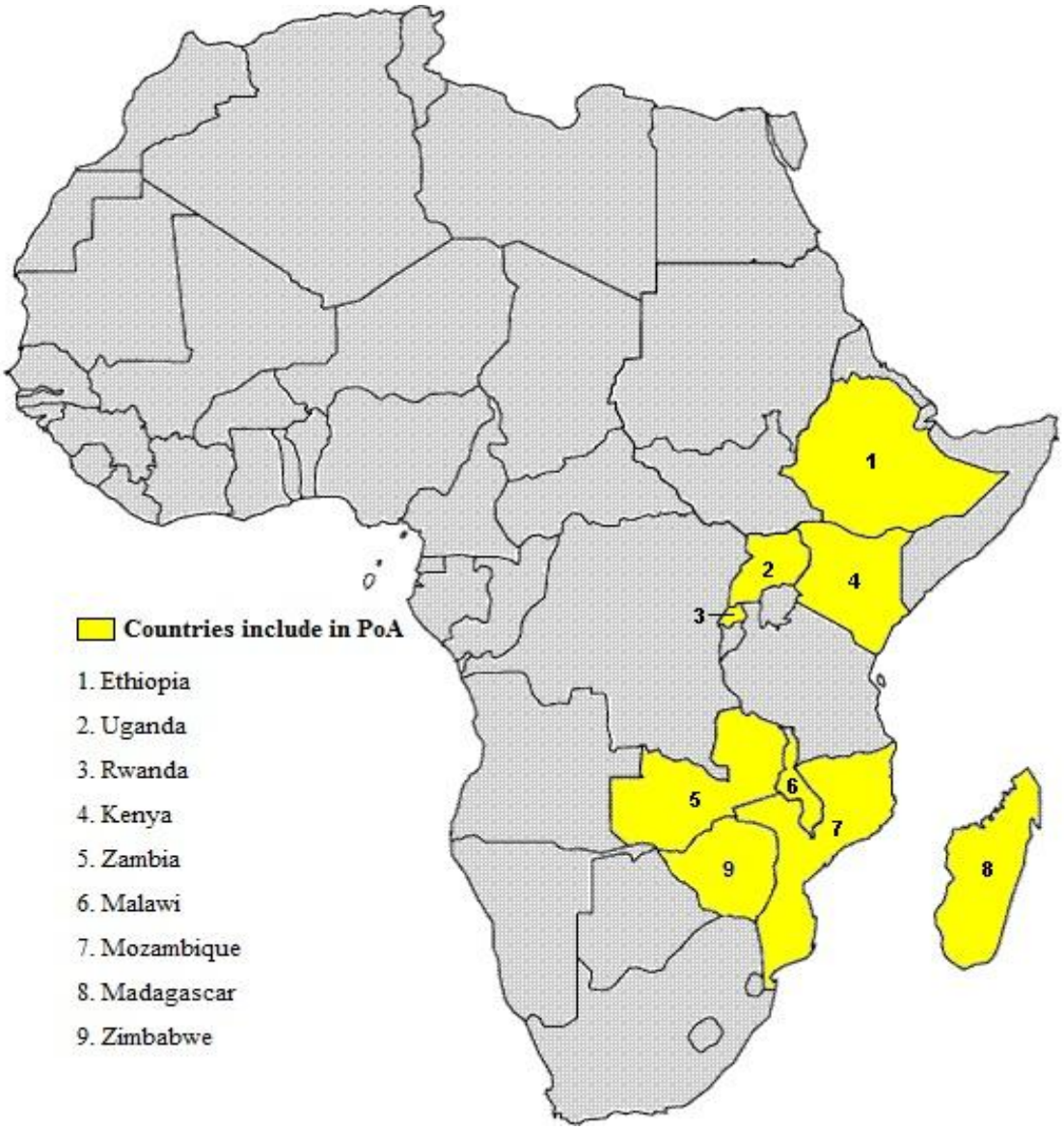
A.4.1.1. Host Party(ies):

1. *Ethiopia*
2. *Uganda*
3. *Rwanda*
4. *Kenya*
5. *Zambia*
6. *Malawi*
7. *Mozambique*
8. *Madagascar*
9. *Zimbabwe*

A.4.1.2. Physical/ Geographical boundary:

The geographical boundary of the PoA includes all regions and provinces of the countries highlighted in the map below, within which all small-scale CDM programme activities (SSC-CPAs) included in the PoA will be implemented.

Figure 1: Highlighted countries in the map represent the geographical boundary of the PoA



A.4.2. Description of a typical small-scale CDM programme activity (CPA):

A typical CPA Project will represent a specific region in one of the countries involved in this PoA. A typical CPA regions will be determined based on population distribution and hence projected demand for LED lamps.

The CPA shall demonstrate that replacing traditional kerosene lamps with Project Lamps can reduce greenhouse-gas savings and improve the quality of life for families through. These may include:

- lower household costs by reducing the need to buy kerosene;
- reduced pollutants created in the home; and

- less danger of household fires.

The benefits of replacing kerosene lamps with a renewable equivalent are tangible. US Department of State research reports for East African countries show that the average per capita income in these countries is very low. For example, the per capita income in Malawi is $280 per annum[4], in Ethiopia it is $365[5] and $465 per annum in Mozambique[6]. In Zimbabwe, the per capita income in 2010 was $460.[7] According to a study carried out in Malawi, the average household spent $2.61 per month on kerosene for lighting.[8]

The financial benefit earned from the sale of Certified Emission Reductions ("CERs") enables the project developer to reduce the unit price of the Project Lamps to ensure they are affordable and obtainable to low-income households in East Africa.

"From Carbon to Light" estimates that 1.5 billion people lack access to electricity. Around 85% of those people are based in rural areas, mainly in Sub-Saharan Africa and South Asia.

Each CPA must adhere to the requirements as described in this PoA.

A.4.2.1. Technology or measures to be employed by the SSC-CPA:

The Project will see the sale of LED lamps to households across the countries involved in the East Africa PoA. Applying the simplified modalities and procedures for small-scale CDM project activities, each CPA Project falls under the following type:

- Type III: Other Project Activities

Portable and ambient lighting technology

Each CPA project will potentially involve the sale of a range of lighting products that meet the quality requirements stipulated in AMS.III.AR.

Project Lamps selected by the CPA project developer shall meet the following technology requirements as per AMS.III.AR version 1:

- LED-based lighting systems shall be used for residential and non-residential applications including ambient lighting, task lighting and portable lighting
- Project Lamps shall have batteries that are charged using:

[4] http://www.state.gov/r/pa/ei/bgn/7231.htm

[5] http://www.state.gov/r/pa/ei/bgn/2859.htm

[6] http://www.state.gov/r/pa/ei/bgn/7035.htm

[7] http://www.indexmundi.com/facts/zimbabwe/gni-per-capita

[8] Off-grid energy services for the poor: Introducing LED lighting in the Millennium Villages Project in Malawi.

a. Charged by renewable energy systems (e.g., photovoltaic systems or mechanical systems such as wind battery chargers)
b. Charged by a standalone distributed generation system (e.g., diesel generator set) or a mini-grid
c. Charged by a grid that is connected to the regional/national grid

- At a minimum, Project Lamps, shall be certified by their manufacturer to have a rate average life of at least 5,000 hours
- The lamp shall have initial light output that will decline by no more than 30%
- Manufacturer certification that the Project Lamp's battery charging efficiency, at the time of the purchase, is at least 50%
- Project Lamps shall have a minimum of a one year warranty
- Each lamp must have a minimum illumination of 20 Lux

Development and improvements in portable and ambient lighting technology is expected to lead to a general reduction in the cost of products and increasing quality. Therefore, over the lifetime of the PoA and each CPA Project the technical features of Project Lamps are expected to change with time.

Implementation of CPA projects, with the carbon finance support of the CDM, will create real, rapid and affordable technology transfer that directly and positively affects families across East Africa.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

To be included in this PoA, a CPA project developer shall demonstrate that the proposed CPA Project will meet the following requirements:

- Replace portable fossil fuel based lamps with LED-based lighting systems in residential and non-residential applications
- The Project Lamps shall use rechargeable batteries charged by renewable photovoltaic energy systems
- The manufacturer of the Project Lamps shall certify that the product has an average life of at least 5,000 hours
- The manufacturer shall certify that the Project Lamp's battery charging efficiency is at least 50% at the time of the customer's purchase
- Each Project Lamp shall be provided with a one year warranty which specifically covers free replacement or repair of failed lamps, batteries and where applicable solar panels
- All Project Lamps manufactured carry a unique identification which enables them to be marked as being within the CPA Project. The unique identification mark will also be used to avoid double counting of emission reductions
- If there are current, national laws and regulations in the host country to dispose of batteries through a suitable process
- Detailed technical specification and supporting documentation regarding the Project Lamps shall be made available and specified in the individual CPA-DDs
- No more than five Project Lamps per household shall be recognized for generating emission reductions within the CPA project
- In the absence of the CPA project, the burning of kerosene fuel in lanterns would be used as the primary source of light
- The project lamps will generate electricity and be used onsite and locally by the user.

For a CPA claiming emissions for a period of 7 years the following points also need to be applicable:

- An illumination level of 20 lux at one A4 sheet of writing paper (0.06 m^2) for task and portable lights and 4 Lux at $\alpha \geq 90°$, 1 metre distance for ambient lights
- For appropriate Project Lamps, the daily burn time ("DBT") shall be equal to Autonomous Time after eight hours of charging
- For those Project Lamps charging with a solar PV panel, the minimum Solar Fraction achieved on a monthly basis during the year shall be 100%
- The battery capacity will be such that Autonomous Time of the Project Lamps shall be at a minimum of 150% of DBT

With regard to dust and water tightness, a minimum protection of IP41 is achieved in accordance to IEC 60529 or an equivalent national standard
A CPA Project shall also provide detailed specifications of the Project Lamps such as:

Technical information	**CPA Project lamp information**
Lamp wattage (in Watts) and illuminance (in lux)	
Lamp rated lifetime (in hours)	
Where applicable type and the rated capacity of the renewable energy equipment for charging the battery	
Type and rated capacity of the battery in hours (e.g., NiMH)	
Type of charge controller	
Autonomous Time and Daily Burn Time	
Where applicable, for solar energy systems the maximum, minimum and average monthly Solar Fraction values during the year	
Where applicable, grid charging time	
Physical protection against weather impacts (e.g., rain, heat, insect ingress)	
Project Lamp owners shall have access to replacement batteries of a comparable quality	

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

(i) The proposed PoA is a voluntary coordinated action;

The PoA is a scheme developed independently by CarbonSoft to reduce the use of kerosene consumption for domestic light needs. There are no mandatory requirements that require individuals or families to use LED lamps in the countries included in the PoA

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

In the case of the Project, the baseline scenario is the continued uncontrolled release of greenhouse gas emissions through the use and combustion of kerosene fuel to generate light.

The baseline scenario is set and additionality is demonstrated based on step 3, barrier analysis:

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

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

- **Alterative 1:** The proposed Project Activity undertaken without being registered as CDM project activity
- **Alternative 2:** The present situation of persistent use of kerosene lamps across East Africa

No other realistic alternatives exist. Other options such as widespread electrification of rural areas are unrealistic. Moreover, as fossil fuel prices continue to increase, the affect of any hypothetical government fuel subsidy would promote the use of kerosene lamps (Alternative 1 and Alternative 2).

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

The proposed alternative scenarios comply with relevant mandatory laws and regulations.

Step 3: Barrier analysis

Under this approach we demonstrate that the Project faces barriers which;

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

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

Three specific barriers have been identified and addressed by the project:

1) Investment barrier
2) Prevailing practice
3) Technology costs

Although the PoA is open for all projects replacing burning of kerosene with LED lights (irrespective of charging mechanism), CarbonSoft believes most of the projects that will be registered under this PoA will replace kerosene lamps with Solar LED lights and hence the barriers that are explained below are for replacement of kerosene lamps with Solar LEDs. In the scenario that a particular CPA uses an LED lamp that has some other charging mechanism such as the grid or a DG set, the CPA will demonstrate additionality individually in that CPA-DD. For the scenario that Solar LEDs are used by a CPA the

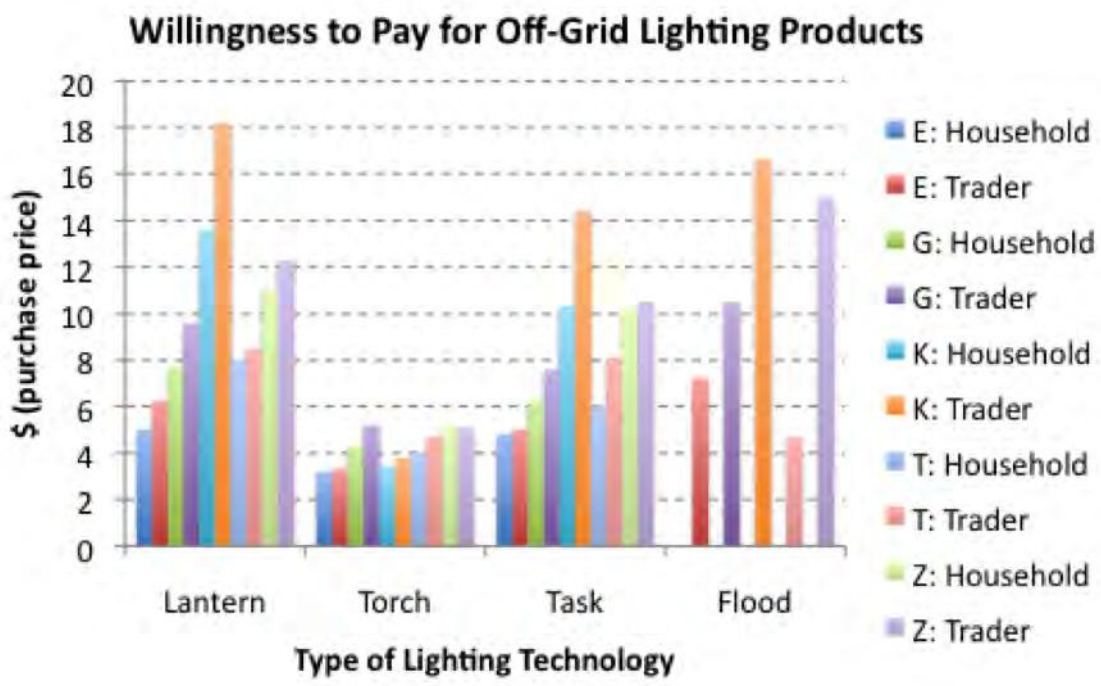
following barriers will stand and the CPAs can supplement this information with further barriers that may be specific to the project.

1) Investment barrier

To date similar LED lamp initiatives have only been implemented with grants or other non-commercial finance terms.

Analysis by Lighting Africa suggests the willingness to pay in East African counties for a solar lamp is approximately $5-6 per unit for entry level products to be used in domestic settings (see figure below). In fuel purchasing terms $5-6 is equal to approximately three weeks worth of kerosene.

Figure 2: Willingness to pay for solar light products[9]



Where consumers are using solar lights in commercial settings they have a greater willingness to pay for lighting products.

To achieve an acceptable product price that is affordable to consumers in East Africa the key following tasks have to be obtained:

- **Raise suitable, low cost finance**: The ability to finance a private-sector energy project in East Africa is predicated on an expensive cost of capital. According to recent reports certain East African countries

[9] As expressed in "Lighting Africa" 2009

rely on international aid for 40% of their budget[10]. Moreover, the solar lamp market in the developing world is still in an incubation phase, where the products being sold or in development are still evolving to meet customers needs and pricing requirements. Consequently, early stage capital, for a new private-sector business model is expensive and scarce. In order to raise suitable capital to establish such a business debt providers require to link their debt to the only asset CarbonSoft can provide: revenues generated from the sale of carbon credits. Without this it would be impossible to finance a business in a manner that would enable product pricing to be in line with customer's willingness to pay.

- **Revenue from the sale of carbon credits**: Carbon finance is essential to completing the business proposal. Specifically, carbon finance enables the solar light distribution company to sell solar lamps at a pricing point that customers can reasonably afford. "*Carbon to Light*" highlights the ability of CERs, at 2009-2010 pricing of $15.00, to enable a solar lamp to pay for itself over a 10-year period (equal to approximately $2.00 per year). Under AMS.III.AR CarbonSoft will generate either two years or seven years worth of carbon credits per lamp distributed. CarbonSoft's financial model assumes a two-year delay before any revenue is earned from the sale of CERs. CarbonSoft's financial model also assumes that with continuing market uncertainty and regulatory changes over time, debt providers and financiers may choose to discount the full value of the CERs to around $5.00[11]. Consequently, whilst carbon finance completes the business proposition, the initial capital remains expensive.

- **Maintain low management and corporate costs**: CarbonSoft is striving to maintain the lowest management costs possible, to ensure that project developers do not face significant carbon finance costs that would otherwise prohibit them from participating in the carbon markets. This should further ensure that early-stage establishment costs experienced by project developers as they enter the East African market, are minimised and therefore limited in their pass through to solar lamp unit pricing (or minimal internal costs where solar lamps are distributed free through charitable channels)

As economies of scale improve, and carbon financing is established, CarbonSoft aims to support project developers to reduce the cost of solar lamps to meet target price points.

2) Prevailing practice

There are a wide number of existing and emerging solar lamp projects; many of the more commercial ventures have or will seek CDM registration. However, if you remove the potential for carbon financing support through accessing the CDM, the prevailing practice across Africa is for families to continue to use their original kerosene lamps. The baseline technologies are so inexpensive to produce that even with rising fuel prices being felt, they remain the cheapest option for many families. For example, the price of a "tin" lamp is $0.20; whilst a high quality "hurricane" lantern could only cost around $5[12].

Finally, the likelihood that families would connect to a local power grid remains small given the extremely high costs for getting a connection as compared to the average gross income in Africa[13].

[1010] http://www.bbc.co.uk/news/world-africa-14154485 (Accessed on 28th July 2011)

[11] CarbonSoft financial model

[12] "Carbon to Light"

[13] http://www.fias.net/advisory-services/regulatory-simplification/doing-business-reform-advisory/upload/5-Carolin-Geginat-Getting-Electricity-World-Bank.pdf

3) Technology costs

While LED lighting products have emerged as a positive "disruptive technology" with real potential, across the African continent, serious product quality issues remain. Indeed most current commodity LED systems are low-price/low-quality products[14]. The large market potential has attracted a range of different products to market. Consequently, high quality products are currently on the market for an average price of around $15-$20.

For a real, disruptive technology to affect the communities it has to be:

- Built with its local environment and purpose of use in mind
- Made of high quality components
- Have a meaningful guarantee
- Provide clear instructions for use and maintenance
- Have a committed company to back up the product, ensure quality, and adapt to community's needs as they evolve

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives

Alternative 1: The Proposed Project activity undertaken without being registered as a CDM project activity.

Alternative 1 is addressed in *Step 3a*

Alternative 2: The present situation of persistent use of kerosene lamps across East Africa

The barriers listed above do not affect Alternative 2.

Step 4: Common practice analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity

There are a number of LED lamp projects underway in Africa. CarbonSoft has identified two significant market participants, described below:

- **D.light** has established a presence to sell solar lamps in East Africa. D.light is an international consumer products company providing high quality solutions for people without access to reliable electricity (for more information see, www.dlightdesign.com)

- **Solar Aid** established its East African enterprise in 2008 in response to the need for renewable energies. The company's approach has been to train poor people in rural Tanzania in the business and marketing tools necessary to become entrepreneurs for the business. These people are known as

[14] Mills, E., and A. Jacobson. 2008. "The Need for Independent Quality and Performance Testing for Emerging Off-grid White-LED Illumination Systems for Developing Countries." Light & Engineering 16(2):5–24.

"SunnyMoney entrepreneurs". There are currently 16 active entrepreneurs with their own independent and sustainable micro-solar businesses (for more information see, http://www.solar-aid.org/)

According to a report prepared for the UNFCCC[15], one quarter of humanity obtains illumination by directly burning fuels emitting 200 million tonnes of CO2 per year. Off-grid renewable lighting solutions offer a compelling and game changing market opportunity to reduce greenhouse gas ("GHG") emissions and improve quality of life.

Given the identified potential and massive demand for affordable solar lighting there are likely to be many new entrants into this market. An increase in improved products and greater competition will only benefit customers and the environment.

CarbonSoft is seeking to distribute the lowest-priced solar lamp product to low-income families and in substantial volumes. This can only be achieved through the additional financial benefits leveraged from accessing the CDM and the carbon market. To date, no other similar business has been successful in achieving this goal in the targeted areas in Africa.

Sub-step 4b: Discuss any similar Options that are occurring

As per sub-step 4, given the identified potential and massive demand for affordable solar lighting there are likely to be many new entrants into this market. Many of these new projects have the potential to seek CDM accreditation. Existing examples include; D.Light, which has already one registered CDM solar lamp project in India and expects to register further projects in the future,[16], Solar Aid, which has sought voluntary carbon market registration of their solar lamp project through the Gold Standard Verified Emission Reduction ("VER").[17] An increase in improved products, greater competition and greater use of the CDM will only benefit customers and the environment. Therefore, the existence of similar project activities compliment the barrier analysis proposed by the Project.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

The Coordinating Coordinating/ Managing Entity of the PoA shall be "CarbonSoft Corporation Limited" (CarbonSoft).

The Coordinating Coordinating/ Managing Entity will maintain an electronic database with the following information per CPA subscription to the PoA:

- Name of the CPA
- Implementation entity of the CPA
- Installed capacity of the CPA
- Location of the CPA (region as described and depicted on a map of Africa)

[15] "Carbon to Light"

[16] http://cdm.unfccc.int/Projects/DB/TUEV-SUED1245158196.62/view

[17] http://solar-aid.org/about/2009/03/gold-standard-approved.html

- Total MW established based on total sale of Project Lamps within the CPA (to ensure that it does not exceed the 15 MW threshold)
- The KW capacity of the individual sub-system (i.e., Project Lamp)

This information shall be provided by the Coordinating Coordinating/ Managing Entity to the Designated Operational Entity ("DOE").

According to Paragraph 10 of Annex 13 of EB 54, *"If each of the independent subsystems/measures (e.g., biogas digester, solar home system) included in the CPA of a PoA is no larger than 1% of the small-scale thresholds defined by the methodology applied then that CPA of PoA is exempted from performing de-bundling check (i.e., considering as not being a de-bundled component of a large-scale activity)".*

Here the capacity of the individual subsystem (i.e., a Project Lamp) is a light which is significantly smaller than even 1% of the 15 KW limit specified by the small-scale methodology. Hence, the DOE is not required to perform a review to determine status as a de-bundled component of a large-scale activity. The average capacity of each Project Lamp will be confirmed by the CarbonSoft in the individual CPA.

A.4.4.2. Monitoring plan:

The monitoring plan will be designed by the Implementation Entities for individual CPAs, and will include such information required, depending on which of the following options they choose:

Option 1: *Project Lamps are assumed to operate for two years after project lamp distribution to end-users. Therefore, emission reductions can only be claimed for two years;*

Option 2: *Project Lamps are assumed to operate for seven years after project lamp distribution to end-users, and thus emission reductions can be claimed for up to seven years per project lamp.*

For CPAs going with Option 1 of the methodology the Project Activity will record the following data:

1. *Number of lamps distributed to end users under the project activity, identified by the type of project lamps (lamp wattage, battery type, charging method, the date of supply).*

The Sales Record (SR) database has been established and shall contain the following information;

- Number of LED Lights sold since the project began
- Serial number of lamp
- Date of sale of the LED light
- Distributor or dealer
- Customer details (where provided)
- Customer mobile telephone number (or landline number, where applicable)Place of sale of the LED lightManufacturer's details of the LED lights (this data should be common for the lights in a CPA)

For CPAs going with Option 2 of the methodology the Project Activity will record the following data:

1. *Number of lamps distributed to end users under the project activity, identified by the type of project lamps (lamp wattage, battery type, charging method, the date of supply).*

2. *Number of lamps in use and operational within the CPA boundary*

In addition to maintaining sales records as mentioned above, since the Project Proponents are going with Option 2 (the lamps will generate CERs for a period of 7 years), monitoring surveys will be conducted at the CPA level to determine the percentage of Project Lamps distributed to end users that are operating and in service during the third year of the crediting period.

The data will be gathered by the CPA project proponents (Implementing agencies) and will be provided to the Coordinating/ Managing Entity, where it will be aggregated. Data will be collected and made available to DOEs for all dates and sales of solar lamps. Data collected will be attributed to a single CPA. Such detailed data can be verified, because all units will be individually identified by their identification number. This will either be a unique number or unique barcode. Identification numbers will be allocated to Project Lamps based on their location of sale (i.e., within a specific CPA).

Because data will be fully transparent, data sampling will be at the discretion of the DOE.

A detailed description of all parameters has been in Section E.7.1 and E.7.2. The Coordinating/ Managing Entity will store all data in an electronic database. Primary data will be stored by the implementing entities.

A.4.5. Public funding of the programme of activities (PoA):

The PoA does not receive public funding.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

10/10/2011

B.2. Length of the programme of activities (PoA):

28 Years

SECTION C. Environmental Analysis

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C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at SSC-CPA level ■

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

Environmental impacts shall be addressed at the CPA Project level

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

Environmental impact assessments and pertinent laws and regulations shall be addressed at the CPA Project level.

SECTION D. Stakeholders' comments

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D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at SSC-CPA level ■

The Local Stakeholder Consultations will be held at a CPA level, taking into consideration the differences of circumstances and opinions of each and every community in which each CPA is located. The goal of hosting local stakeholder consultations is to ensure that customers and affected persons will be able to share their opinions of the project and be provided with essential feedback on the CPAs proposed activities.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

Not applicable.

D.3. Summary of the comments received:

Not Applicable

D.4. Report on how due account was taken of any comments received:

Not Applicable

SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical SSC-CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form, which is used to define and include a SSC-CPA in this PoA (PoA specific CDM-SSC-CPA-DD).

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

The methodology AMS.III.AR *"Substituting fossil fuel based lighting with LED lighting systems"* (version 1) is chosen and applicable to all CPAs.

AMS.III.AR offers project proponents two options for generating emission reductions based upon the LED Lamp's Effective Useful Life. Each CPA will choose one of the following options to claim Certified Emissions Reductions:

Option 1*:* Project Lamps are assumed to operate for two years after project lamp distribution to end-users. Therefore, emission reductions can only be claimed for two years

Option 2*:* Project Lamps are assumed to operate for seven years after project lamp distribution to end-users, and thus emission reductions can be claimed for up to seven years per Project Lamp.

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

AMS.III.AR requirement	**SSC Qualification / Justification**
Replace portable fossil fuel based lamps with LED based lighting systems in residential and non-residential applications	As demonstrated in "Carbon to Light" the use of portable, cheap kerosene lamps is prevalent across populations across East Africa. The project developer will replace consumers kerosene lamps with Project Lamps in accordance with AMS.III.AR version 1
The Project Lamps shall use rechargeable batteries charged by one of the following: *i) renewable energy systems* *ii) standalone distributed generation systems* *iii) grid connected to the regional or national grid*	The project developer will demonstrate that all Project Lamps shall use one or more of the following options for recharging batteries: *i) renewable energy systems* *ii) standalone distributed generation systems* *iii) grid connected to the regional or national grid*
The manufacture of the Project Lamps shall certify the products has an average rated life of at least 5,000 hours	All Project Lamps shall have suitable manufacturer certification that the units have an average life more than the minimum average life specified by the methodology
The manufacture shall certify that the LED lamps' battery charging efficiency is at least 50% at the time of the customer's purchase	Manufacturer certification shall provide a battery charging efficiency of at least 50% at the time of purchase
Each Project Lamp shall by provided with a one year warranty which specifically covers free replacement or repair of failed lamps, batteries and where applicable solar panels	All Project Lamps shall be sold with a one year warranty for full repair or full replacement
All LED lamps carry identification which enables them to be marked as being within the CPA Project and avoid double counting	All Project Lamps shall have a unique identification so that it is marked as being within the CPA Project
The disposal of batteries shall be in compliance with the regulations of the host country	The CPA Project shall demonstrate and ensure compliance with prevailing regulations pertaining to the use and disposal of batteries

Detailed technical specification and supporting documentation of the Project Lamps are made available and in the PDD	The CPA shall provide clear information about the technical specification of the Project Lamps. Supporting documentation shall be provided to the DOE on request
No more than five Project Lamps per household or business location shall be recognized for generating emission reductions within the CPA Project	A maximum of five Project Lamps per household or business location shall be recognized as Project Lamps within the CPA Project
In the absence of the CPA Project, the burning of kerosene fuel in lanterns would be used as the primary source of light	As demonstrated in "Carbon to Light" the use of portable, cheap kerosene lamps is prevalent across populations across East Africa. CarbonSoft will replace consumers kerosene lamps with project lamps in accordance with AMS.III.AR version 1
The project lamps will generate electricity and be used onsite and locally by the user	The Project Lamps will generate electricity that shall be used onsite and locally be the user

E.3. Description of the sources and gases included in the SSC-CPA boundary

	Source	Gas	Included?	Justification / Explanation
Baseline Activity	GHG emissions generated from the combustion of kerosene fossil fuel	CO_2	Included	Main emission source
Project Activity	GHG emissions from emissions due to charging of batteries (if non renewable source of energy is used)	CO_2	Included	Main emission source

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

According to methodology AMS.III.AR "Substituting fossil fuel based lighting with LED lighting systems" (version 1), there are default baseline values that may be applied to the CPA Project unless alternative values or parameters can be determined (using adequate research/monitoring and documentation) and provided by the project proponent. Suitable supporting documents include strategic surveys and research conducted by national or local organisations, international organisations, non-governmental organisations or reliable and comprehensive data collected by the project proponent.

The project proponents have aggregated 3rd party surveys/Studies, government reports and pilot studies to calculate the baseline values for fuel consumption in the project countries of East Africa.

The various data available on kerosene consumption is listed below in a tabular form:

Value (Litres per hour)	Report/Study/Source[18]
0.053	Floresta Pilot Study in Tanzania
0.050	Report on Off-Grid lighting products by Kiristen Radecsky (May 2009)
0.056	UN DESA report on Sustainable Energy Consumption in Africa
0.034	United Nations Industrial Development Organisation document published during Lighting Africa Conference 2010:
0.051	Malawi Pilot Study
0.047	United Nations Commission on the Status of Women published in March 2011.
0.041	Report by Tanzania Solar energy Association
0.056	Gerhad Meir, OSRAM publication during Lighting Africa Conference 2010
0.0485	**Average for East African countries**

Taking an average of the values reported by independent, third-party, reliable data sources, kerosene consumption in the East Africa region has been calculated as 0.0485 litres per hour, per kerosene lamp. We, therefore, assume for all CPAs in the PoA a value of 0.0485 litres per hour, per kerosene lamp. Alternatively, project developers may choose to use the default value provided in AMS.III.AR.

Pre-existing fuel-based technology

The pre-existing technology is the prevalent use of kerosene lamps, which consume significant amounts of fuel and cost a major portion of a family's monthly income. With reference to the default values presented in AMS.III.AR the following values are applied accordingly:

- **Utilization (hours/day)**: Whilst presently there is limited data on hours-per-day utilization of fuel-based lighting a fixed value of 3.5 hours per day is assumed
- **Utilization (days/year)**: a default value of 365 days is assumed
- **Fuel emissions factor (kilograms CO2 /litre)**: we have selected a conservative value of 2.4 kg CO2 per litre of kerosene
- **Leakage factor**: 1.0
- **Number of fuel-based lamps replaced per project lamp**: 1.0
- **Leakage factor (persistence in use of fuel-based light source)**:
- **Number of fuel-based lamps replaced per LED**: whilst well-designed LED lamps may be able to replace multiple fuel-based lamps, we assume a conservative default assumption of 1:1

[18] The reports/studies have been provided to the DOE.

The project proponent has only identified one value that deviates from the default values defined in AMS.III.AR:

- ***Fuel-use rate (litres/hour)****: 0.0485 Litres per/hour*

The determination of the default emissions factor has occurred at the PoA level. Consequently, this factor shall be used by all CPAs.

Ambient and portable LED lighting replacement technology

In order to demonstrate that the CPA Project meets the "additionality" and AMS.III.AR requirements the following assumptions have been taken:

- **Service life (years)**: all electric lighting products experience a reduction in light output over time, a process called "lumen depreciation." If the project developer chooses Option 2, they will demonstrate 0.that the luminous flux does not reduce more than 30% over a useful life of 5,000 hours
- **Net-to-Gross factor:** this value is assumed to be 1 (100%)
- **Power conversion losses (for grid charging)**: if Project Lamps are charged through Renewable energy sources or DG sets, no power conservation losses are taken. If they are charged through the grid, national standards for power conservation losses will be assumed.
- **Replaceable battery**: the AA batteries supplied are good for 500 charges. The battery compartment of the units can be simply opened by the user enabling them to be replaced. Thereafter, the organisation selling the LED lights at the CPA level will also sell replacement batteries at suitably low price to ensure that they are affordable enough to extend the general life of the unit
- **Warranty or insurance**: Project Lamps come with a minimum of a one-year manufacturer warranty as per AMS.III.AR requirements

Technology factors

- **Baseline fuel and technology**: existing data suggests that 90% of lighting needs in Africa are provided by kerosene lamps. Therefore, we have chosen the default baseline fuel as kerosene
- **Charging strategy**: the LED lights can be charged via renewable sources (such as solar etc), the grid, or DG sets.

Quality Assurance

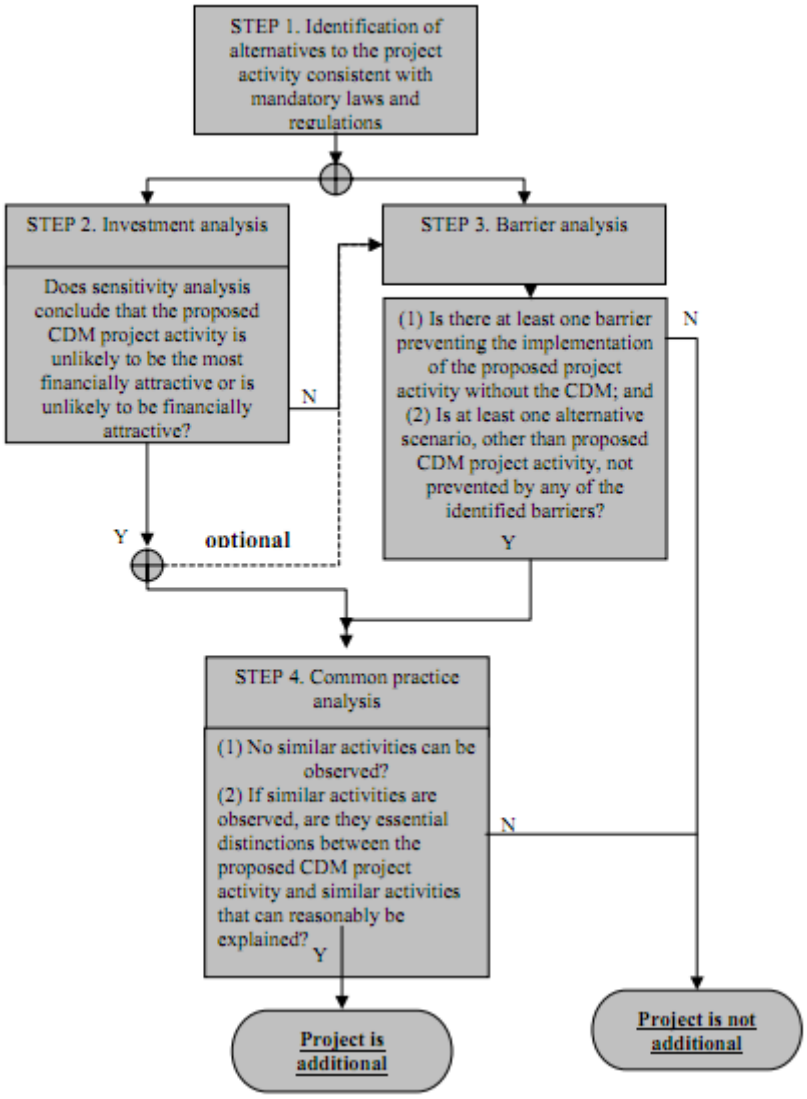
- **Quality certified**: The Project Lamps will seek quality certification as part of its expanding business. At present the project lamp units and LED components have manufacturer-specified certificates

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

A CPA shall demonstrate additionality as per the latest guidance from the CDM Executive Board and the "Simplified modalities and procedures for small-scale CDM project activities".

According to the "Tool for the demonstration and assessment of additionality", the CPA will demonstrate additionality using the following steps:



Where,

Step 1: Identification of alternatives to the project activity
Step 2: Investment analysis to determine that the proposed project activity is either (a) not the most economically or financially attractive or (b) not economically or financially feasible;
Step 3: Barrier analysis
Step 4: Common practice analysis

Replacement of Kerosene lamps is most likely to be done with Solar LED lights under the PoA and hence section A.4.3 proves additionality for such a project. In the scenario that a CPA replaces kerosene lamps with LED lights not charged with solar energy, the CPA will demonstrate additionality individually.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

Key criteria for assessing additionality have been demonstrated at the PoA level. This has been done for a scenario where the Kerosene lamps are replaced by Solar LED lights. If the CPA is using other source of energy to charge the LED lights, they will provide any further information (for example, credible data or suitable their-party reports), that may further substantiate the additionality assessment.

NOTE: Information provided here shall be incorporated into the PoA specific CDM-SSC-CPA-DD, and shall be included in documentation submitted by project participants at registration of PoA.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

Each CPA shall apply the following calculation approach:

Equation 1, Baseline Emissions:

$$BE_y = DV \times GF_y \times DB_y$$

Parameter	Unit	Description	Source
BE_Y	tCO2e	Default emissions factor	
GF_Y	Number	Number of consumers supplied with Project Lamps	As defined in AMS.III.AR
DB_Y	%	*Option 1:* = 1.0 in the absence of relevant information *Option 2:* = 1.0 + FFG. FFG is defined as the documented national growth rate of kerosene fuel use in lighting from the preceding 3 or 5 years (depending on the availability of reliable data)	As described in later sections.

Equation 2, Project Emission:

According to the small scale methodlogy AMS III.AR, Project Emissions (PE_y) will depend on the project lamp charging mechanism utilized.

The methodology states that PE_y= Zero (0) in the case of Project Lamps whose batteries are charged by:

(a) renewable energy system (e.g. photovoltaic systems or mechanical systems such as wind battery chargers)

(b) standalone distributed generation system (e.g. a diesel generator set) or a mini-grid, if the mini grid or distributed generation system is entirely powered by renewable energy generation unit(s).

However, there will be project emissions if the project lamps are charged by:

(a) a grid that is connected to regional/national grid, or

(c) a standalone distributed generation system (e.g. a diesel generator set) or a mini-grid if the minigrid or distributed generation system is not entirely powered by renewable energy generation unit(s).

The Project Emissions per LED lamp in this case will be calculated as:

$$PE_{y,i,j} = W_i \times EF_{CO2,ELEC,y,j} \times \left(1/Eff_{i,j}\right) \times \left(D \times H\right) \times \left(1 + TD_y\right) \times 10^{-6}$$

Where,

$PE_{y,i,j}$	Average project Emissions in year *y* (tCO_2e) per Project Lamp
I	Type of Project Lamp
J	Type of charging mechanism as per paragraph 2
W_i	Wattage of project lamps distributed to end users, of type *i* (Watts)
$Eff_{i,j}$	Battery charging efficiency of lamps distributed to end users, as documented by lamp manufacturer, of type *i* for charging type *j*
D	Days of operation of project lamps per year, take 365
H	Hours of operation of project lamps per day, take 3.5
$EF_{CO2,ELEC,y}$	Grid Emission Factor in year *y* calculated in accordance with the provisions in AMS-I.D "Grid connected renewable electricity generation" or AMS-I.F "Renewable electricity generation for captive use and mini-grid" depending on the charging mechanism *j* (tCO_2/MWh)
TD_y	Average annual technical grid losses (transmission and distribution) during year *y* for the grid serving the locations where the devices are installed, expressed as a fraction. This value shall not include non-technical losses such as commercial losses (e.g. theft/pilferage). The average annual technical grid losses shall be determined using recent, accurate and reliable data available for the host country. This value can be determined from recent data published either by a national utility or an official governmental body. Reliability of the data used (e.g. appropriateness, accuracy/uncertainty, especially exclusion of non technical grid losses) shall be established and documented by the project participant. A default value of 10% shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable

Equation 3, Emission Reduction:

According to the methodology AMS-III.AR., the annual emissions reductions are calculated as :

$$ER_y = \sum_{i,j} N_{i,j} \times \left(BE_{y,i} - PE_{y,i,j}\right) \times \left(OF_{y,i,j}\right)$$

Parameter	Unit	Description	Value	Source
$N_{i,j}$	Quantity	Number of Project Lamps distributed to end users of type i, with charging method '*j*' The emissions reductions shall be considered from the date of completion of distribution of the project lamps to end users	Recorded by CPA and the distributer	CPA reporting and monitoring
$OF_{y,i,j}$	%	Percentage of Project Lamps distributed to end users that are operating an in service in year, *y*	Assumed to be 100%	Assumed based guidance from AMS.III-AR

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

Data / Parameter:	*FUR* (**ID 1**)
Data unit:	Litres/hour
Description:	Observed hourly kerosene fuel use rate by families in East Africa
Source of data used:	Various sample studies and reports from the region
Value applied:	Observed hourly kerosene fuel use rate by families in East Africa (See table above)
Justification of the choice of data or description of measurement methods and procedures actually applied:	The data collected from a range of reliable, independent, third-party sources that specifically report household kerosene use across East Africa. Additionally, it should be highlighted that kerosene consumption recorded across a range of East African countries consistently produces similar values.

Any comment:	

Data / Parameter:	DV **(ID 2)**
Data unit:	tCO2e
Description:	Emissions factor
Source of data used:	Calculated based on FUR (ID 1)
Value applied:	Value will be based on each country, in case data is not found we will use value for all of East Africa.
Justification of the choice of data or description of measurement methods and procedures actually applied:	This value is calculated in accordance with AMS.III.AR calculation for the DV parameter: = ((FUR) x 3.5 (h) x 365 (d) x 2.40 (EFker))/1000
Any comment:	

Data / Parameter:	DB_j **(ID 3)**
Data unit:	Value
Description:	Dynamic baseline factor
Source of data used:	PDD
Value applied:	5%
Justification of the choice of data or description of measurement methods and procedures actually applied:	To be conservative an annual growth rate of 5% will be applied to this value to reflect rising consumption of kerosene in East Africa. It has been highlighted that typically, kerosene use exceeds income[19]. **Country** / **Conservative Economic growth** Malawi[20] 6.4% Kenya[21], 5.5 % Ethiopia[22] 10% Zambia [23] 6.7% Zimbabwe [23] 8.2%

[19] Mulugeta, E. 2004. "The Demand for Kerosene and per Capita Income in Ethiopia." Ethiopian Journal of Economics 13(2) http://ajol.info/index.php/eje/article/view/39807)

[20] http://www.africaneconomicoutlook.org/en/countries/southern-africa/malawi/

[21] http://www.africaneconomicoutlook.org/en/countries/east-africa/kenya/

[22] http://www.africaneconomicoutlook.org/en/countries/east-africa/ethiopia/

[23] http://www.africaneconomicoutlook.org/en/countries/southern-africa/zambia/

[23] http://www.africaneconomicoutlook.org/en/countries/southern-africa/zimbabwe/

[24] http://www.africaneconomicoutlook.org/en/countries/southern-africa/mozambique/

[25] http://www.africaneconomicoutlook.org/en/countries/east-africa/rwanda/

	Mozambique [24]	7.7%
	Rwanda [25]	6.5%
Any comment:		

Data / Parameter:	*h* **(ID 4)**
Data unit:	Hours/day
Description:	Utilization rate: average operating hours are the average operational hours of kerosene lamps in the baseline
Source of data used:	AMS.III.AR (version 1)
Value applied:	3.5
Justification of the choice of data or description of measurement methods and procedures actually applied:	This value is fixed for the duration of the project; unless observed data further qualifies this value
Any comment:	

Data / Parameter:	*d* (**ID 5**)
Data unit:	Days
Description:	The number of days the lamp operates for
Source of data used:	AMS.III.AR (version 1)
Value applied:	365
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is a fixed value.
Any comment:	

Data / Parameter:	EF_{CO2} **(ID 6)**
Data unit:	KgCO2 / litre
Description:	Kerosene fuel CO2 emission factor of fuel type
Source of data used:	AMS.III.AR (version 1)
Value applied:	2.4
Justification of the choice of data or description of measurement methods and procedures actually applied:	

Any comment:	

Data / Parameter:	*L* **(ID 7)**
Data unit:	Value
Description:	Leakage factor
Source of data used:	AMS.III.AR
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	*N* **(ID 8)**
Data unit:	Value
Description:	Number of fuel-based lamps replaced per Project Lamp
Source of data used:	AMS.III.AR
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	*N-G* **(ID 9)**
Data unit:	Value
Description:	Net-to-gross factor
Source of data used:	AMS.III.AR
Value applied:	1.0
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	W_i **(ID10)**

Data unit:	Watts
Description:	Wattage of project lamps distributed to end users, of type *i*
Source of data used:	Lamp Manufacturer
Value applied:	The value will be sourced from the lamp manufacturer and will depend on the lamp type used by the particular Project Activity
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	$EF_{CO2,ELEC,y}$ (ID11)
Data unit:	tCO_2/MWh
Description:	Grid Emission Factor in year *y*
Source of data used:	The Grid Emissions factor is calculated with the provisions in AMS-I.D "Grid connected renewable electricity generation" or AMS-I.F "Renewable electricity generation for captive use and mini-grid" depending on the charging mechanism *j*
Value applied:	The value is calculated in case the Grid is used to recharge the batteries of the lamps
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	$Eff_{i,j}$ **(ID12)**
Data unit:	-
Description:	Battery charging efficiency of lamps distributed to end users
Source of data used:	Lamp Manufacturer
Value applied:	The battery charging efficiency is used to calculate the project emissions from recharging the battery in case a grid is used of combustion of fossil fuel takes place
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	TD_y (ID13)
Data unit:	-
Description:	Average annual technical grid losses (transmission and distribution) during year *y*
Source of data used:	The average annual technical grid losses shall be determined using recent, accurate and reliable data available for the host country. This value can be determined from recent data published either by a national utility or an official governmental body. This is used in case the lamp battery is charged using the grid
Value applied:	A default value of 10% shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable. This is used in case electricity from the Grid is used to charge batteries
Justification of the choice of data or description of measurement methods and procedures actually applied:	Reliability of the data used (e.g. appropriateness, accuracy/uncertainty, especially exclusion of non technical grid losses) shall be established and documented by the project participant
Any comment:	

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Data / Parameter:	n_1 **(ID14)**
Data unit:	Quantity
Description:	Number of units sold
Source of data to be used:	CPA Project
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Project developer database
Description of measurement methods and procedures to be applied:	The sales date is determined as the date the LED lamp is sold by the distributor.
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	This sales data, in its detailed form, is considered by project developers to be commercially sensitive information. The information will be provided to the DOE, and as required aggregated data can be made available. CarbonSoft will treat all detailed sales data as commercially confidential information.

Data / Parameter:	D_{intro} **(ID 15)**
Data unit:	Date
Description:	The date that the Project Lamp was purchased, rounded to the 1st of the month following. This number is required to conservatively calculate the emission reductions for a verification period.
Source of data to be used:	GI (ID 12)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	E.g., 01/03/2011
Description of measurement methods and procedures to be applied:	Data will be automatically rounded based on the exact date of the sale being input to the database.
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	

Data / Parameter:	*GI* **(ID 16)**
Data unit:	1) Quantity of LED lamps sold 2) Serial number of each lamp 3) Date of sale of the LED light 4) Name of distributor or dealer 5) Customer details (where provided) 6) Place of sale of the LED light 7) Manufacturer's details of the LED lights (this data should be common for the lights in a CPA)
Description:	**General information** ("*GI*") is a database that contains basic information on all Project Lamps sold
Source of data to be used:	Project Developer Database.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Various.
Description of measurement methods and procedures to be applied:	All information will be collected locally by the project developer in provided in CarbonSoft templates.
QA/QC procedures to	Data will be collected by the project developer. CarbonSoft will be responsible to

be applied:	store the data for the crediting period and an additional two years.
Any comment:	

Data / Parameter:	*UL* **(ID 17)**
Data unit:	Hours
Description:	Useful life of LED lamps
Source of data to be used:	Data provided by manufacturer of the LED lamp.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The useful life of the lamp as provided by the manufacturer is 5,000 hours.
Description of measurement methods and procedures to be applied:	The useful life is well above the useful life specified by the methodology of 5,000 hours. The CPA may choose either Option 1 (claiming emission reductions for 2 years) or Option 2 (claiming reductions for 7 years). When claiming CERs under Option 2, the minimum useful life for a lamp should be 10,000 hours.
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	

Data / Parameter:	$\Phi_v(t_0)$ **(ID 18)**
Data unit:	Lumen
Description:	Initial Luminous flux of the lamp distributed in the CPA
Source of data to be used:	Measurements provided by LED lamp manufacturer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Data will be provided by the lamp manufacturer
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each SSC-CPA:

Data / Parameter:	n_1 **(ID14)**
Data unit:	Quantity
Description:	Number of units sold
Source of data to be used:	CPA Project
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Project developer database
Description of measurement methods and procedures to be applied:	The sales date is defined as the date of completion of distribution of the Project Lamps to the customers.
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	

Data / Parameter:	D_{intro} **(ID 15)**
Data unit:	Date
Description:	To be conservative, the date that the Project Lamp was purchased, rounded to the 1st of the month following. This number is required to conservatively calculate the emission reductions for a verification period.
Source of data to be used:	GI (ID 12)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	E.g., 01/03/2011
Description of measurement methods and procedures to be applied:	Based on the exact date of sale being input to the database, data will be automatically rounded up to the 1st of the following month.
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	

Data / Parameter:	*GI* **(ID 16)**
Data unit:	1) Quantity of lamps sold 2) Serial number of each lamp 3) Date of sale

	4) Name of distributor or dealer 5) Customer details (where provided) 6) Place of sale of the LED light 7) Manufacturer's details of the LED lights (this data should be common for the lights in a CPA)
Description:	**General information** ("*GI*") is a database that contains basic information on all Project Lamps sold
Source of data to be used:	Project developer database.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Various.
Description of measurement methods and procedures to be applied:	All information will be collected locally by project developer staff, project partners and stored in the project developer database.
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	This sales data, in its detailed form, is considered by project developers to be commercially sensitive information. The information will be provided to the DOE, and as required aggregated data can be made available. CarbonSoft will treat detailed sales data as commercially confidential information.

In addition to these parameters if the CPA is claiming CERs for a period of 7 years, the following additional parameters will also be monitored:

Data / Parameter:	*UL* **(ID 17)**
Data unit:	Hours
Description:	Useful life of Project Lamps
Source of data to be used:	Data provided by manufacturer of the Project Lamp.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Option 1: the minimum useful life of the lamp as provided by the manufacturer is 5,000 Option 2: at a minimum, Project Lamps must be certified by their manufacturer to have a useful life of 10,000 hours.
Description of measurement methods	Option 1: project developers shall demonstrate Project Lamp meets the minimum useful life of 5,000 hours.

and procedures to be applied:	Option 2: project developers shall demonstrate that within the 10,000 hours time span, the relative luminous flux shall not reduce by more than 30%
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\Phi_v(t)$ **(ID 18)**
Data unit:	Lumen
Description:	Luminous Flux after time t
Source of data to be used:	Third party testing using applicable standard and testing protocol
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The value is provided by a 3rd party after testing the sampled lamps using a standard testing protocol
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	*TP* **(ID 19)**
Data unit:	Hours
Description:	Test Period
Source of data to be used:	3rd party testing using applicable standard and testing protocol
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Option 1: project developers will supply suitable third-party certificates to demonstrate the Project Lamp meets the minimum useful life of 5,000 hours. Option 2: project developers will demonstrate third-party testing certificates for either: i) 10,000 hours; or ii) 2,000 hours
Description of measurement methods and procedures to be applied:	Testing of the Project Lamp shall be confirmed by a third-party testing organisation using an applicable standard and testing protocol. As an alternative to long-term measurement of light output over the full lifetime of the lamp, a shortened measurement period of 2,000 hours may be chosen. If a 2,000 hour test period is used, the relative luminous flux shall not decrease by more than 10% during the 2,000 hours of continuous operation. If the average life

	value is not available ex-ante it shall be made available for verification.
QA/QC procedures to be applied:	
Any comment:	For a test period of 10,000 hours the luminous flux $\Phi_v(10,000)$ should be greater than or equal to 70% of the initial luminous flux. For a test period of 2,000 hours the luminous flux $\Phi_v(2,000)$ should be greater than or equal to 90%.

Data / Parameter:	n_o **(ID 20)**
Data unit:	Quantity
Description:	Number of units in operation and in service
Source of data to be used:	Option 1: CPA Project sales records Option 2: Survey to determine number of Project Lamps in year 3 of lamp being used. The sampling survey should employ the following principles: • 90% confidence interval • a minimum of 100 participants • random distribution of target population (e.g., size and location) • method to select respondents is random • Conducted by site visits • Only persons above 12 years old are interviewed • The CPA Project shall contain design details of the survey Sampling survey results shall be utilised as the operating assumptions for years 4,5,6 and 7 for Project Lamps in the CPA.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Project developer database
Description of measurement methods and procedures to be applied:	The number of units in operation and in service is found through monitoring
QA/QC procedures to be applied:	Data will be collected by the project developer. CarbonSoft will be responsible to store the data for the crediting period and an additional two years.
Any comment:	

Data / Parameter:	IL **(ID 21)**
Data unit:	Lux
Description:	Illumination level
Source of data to be used:	The illumination level is confirmed by a third-party testing organisation based on sample test of Project Lamps using applicable national standards
Value of data applied	

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	SF **(ID 22)**
Data unit:	Percent (%)
Description:	Amount of energy required by the Project Lamp divided by the total energy required.
Source of data to be used:	The solar fraction is confirmed by a third-party testing organisation based on sample test of project lamps using applicable national standards. The value should stipulate the maximum, minimum and average monthly solar fraction values during the year.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	100 %
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	This shall only be request where applicable (i.e., for solar energy charging systems)

Data / Parameter:	AT **(ID 23)**
Data unit:	Hours per day
Description:	Autonomous time or maximum Possible burn time
Source of data to be used:	The autonomous time is confirmed by a third-party testing organisation based on sample test of Project Lamps using applicable national standards
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods	

and procedures to be applied:	
QA/QC procedures to be applied:	
Any comment:	

E.7.2.	Description of the monitoring plan for a SSC-CPA:

According to the methodology AMS-III.A.R the parameters monitored by an individual CPA will depend on which of the following options they go with:

Option 1: *Project Lamps are assumed to operate for two years after project lamp distribution to end-users. Therefore, emission reductions can only be claimed for two years;*

Option 2: *Project Lamps are assumed to operate for seven years after project lamp distribution to end-users, and thus emission reductions can be claimed for up to seven years per project lamp.*

For CPAs going with Option 1 of the methodology the Project Activity will record the following data:

1. *Number of lamps distributed to end users under the project activity, identified by the type of project lamps (lamp wattage, battery type, charging method, the date of supply).*

The following database will be operated and maintained to ensure completeness and accuracy of monitoring information:

- **Sales record (SR)**: Project Lamp systems deployed sales records
- **Sample database** (**DB i,a**): sample database for deployed LED lights

Each Project Lamp sold will only be eligible to generate CERs for a period of two years from the date of sale. Monitoring will be ongoing throughout the Project; and will take account of verification periods.

The table below shows the main characteristics of each database: parties involved, periodicity and format.

	LED lights deployed sales records (SR)
Parties involved	Primary data collection: project developer
	Database maintenance: project developer
Periodicity	Continuous
Format	Paper or electronic for primary data
	Electronic database
Data saving	All data shall be saved for the whole crediting period, plus an additional two years

The Sale Record (SR)

The Sales Record (SR) database has been established and shall contain the following information:

- Lamps sold
- Serial number of lamp
- Date of sale
- Distributor or dealer
- Customer details (where provided)
- Customer mobile telephone number (or landline number, where applicable)

The purpose of SR database is to provide enough information to enable full monitoring for each monitoring period.

For CPAs going with Option 2 of the methodology the Project Activity will record the following data:

1. *Number of lamps distributed to end users under the project activity, identified by the type of project lamps (lamp wattage, battery type, charging method, the date of supply).*
2. *Number of lamps in use and operational within the CPA boundary*

The following database will be operated and maintained to ensure completeness and accuracy of monitoring information:

- **Sales record (SR)**: LED light systems deployed sales records
- **Sample database** (**DB i,a**): sample database for deployed LED lights
- ***Periodic check A (SG i,v)**: regular review of sample group for monitoring of deployed LED Lamps*

A sales record will be kept similar to the one described above (for CPAs using Option 1).

In addition to this since the Project Proponents are going with Option 2 and the lamps will generate CERs for a period of 7 years, monitoring surveys will be conducted in the third year of the CPA Activity, at the CPA level to determine the percentage of Project Lamps distributed to end users that are operating and in service during the third year of the crediting period.

The following principles will be followed during periodic monitoring of Lamps sold under Option 2:

1. Only project lamps with an original unique marking can be counted as operating and in service
2. While project lamps replaced as part of a regular maintenance or warranty program can be counted as operating, project lamps cannot be replaced as part of the survey process and counted as operating
3. The sampling size is determined by minimum 90% confidence interval and the 10% maximum error margin; the size of the sample shall be no less than 100
4. The survey will be conducted by site visits
5. Only persons over age 12 will be interviewed

6. The CPA design document will describe in detail the survey design for gathering the above information
7. The survey has a random distribution and is representative of target population (e.g., size, location)
8. The method to select respondents for interview is random

In addition to the above, lights claiming credits for 7 years must meet the following requirements;

- Operating life of 7 years
- Rechargeable batteries which are charged by renewable (e.g., photovoltaic) energy systems, distributed generation systems (e.g., diesel generator) or a power grid
- Certified to have a useful life of 10,000 hours by the manufacturer An average rated life of at least 5,000 hours, certified by the manufacturer
- Battery charging efficiency is at least 50% at the time of the customer's purchase, certified by the manufacturer (for the a 2 year crediting period)
- Luminous flux shall not reduce by more than 30%. This shall be demonstrated by third-party testing
- The daily burn time shall be equal to autonomous time after eight hours of charging
- The battery capacity will be such that the autonomous time of the lamps shall be a minimum of 150% of daily burn time
- Units shall have dust and water tightness of a minimum protection of IP4I (in accordance with IEC 60529) or an equivalent national standard
- A one year warranty for full repair or full replacement
- A unique identification mark (such as a sticker), indicating the lamp to be part of [company's] CDM Project. This is necessary to avoid double counting for generation of CERs.
- A maximum of five LED lights can be used per household to earn CERs.

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

Date: 10/09/2011
Name: Mr.Sebastian Foot
Organisation: CarbonSoft Corporation Ltd.

Annex 1

CONTACT INFORMATION ON COORDINATING/COORDINATING/ MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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