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):

"LED's kick-off"

Version 07
07-11-2012

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

>> The following information shall be included here:

1. General operating and implementing framework of PoA
2. Policy/measure or stated goal of the PoA
3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

Key Abbreviations / Terminologies

Abbreviation	Explanation
AMS	Approved small scale baseline and monitoring methodology
CER	Certified Emission Reduction
CFL	Compact Fluorescent Lamp
CPA	CDM Project Activity
GHG	Greenhouse gas
LED	Light Emitting Diode
PoA	Programme of Activities

The following information shall be included here:

1. General operating and implementing framework of PoA

The "LED's kick-off" Programme of Activities (PoA) comprises the distribution of Light Emitting Diode (LED) lighting devices to public, commercial, residential and industrial users. The end-user will receive a significant discount on the initial LED price that can be combined with an attractive payment plan. The CER related revenue generated by the programme will act as the required collateral to access financing and lower the default risks involved in financing the replacement. Without CERs, financing partners would not be willing to lend to customers in South Africa. As in many cases these customers have track records of above average default rates or delayed repayments.

The programme encompasses both the replacement of existing lighting equipment with LEDs (Brownfield) and/or the installation of LEDs on new locations where LEDs are not the common practice (Greenfield). On these new locations the most conservative common practice will act as the baseline. Old lighting equipment collected during the exchange will be scrapped to prevent leakage. The process will be independently verified as is required by the methodology and is described in Figure 5. Direct marketing efforts will be undertaken to ensure that users are aware of the project activity and the financial benefits the programme offers, specific to the energy savings to be achieved. The focus will be on large-scale lighting users in order to quickly gain market access and impact through volumes.

2. Policy/measure or stated goal of the PoA

The goal of the PoA is to contribute to the sustainable development of South Africa and to transform the energy efficiency of South Africa's installed base of lighting applications.

Environmental Sustainability

The programme produces real and measurable reductions in GHG emissions:
The programme will abate greenhouse gas emissions through the avoided electricity use. The programme will utilize an approved methodology[1] to ensure that all measurements of greenhouse gas emission reductions are robust, conservative and verifiable. The program will maintain high standards of monitoring to ensure that any emission reductions claimed are measurable and real.

Supporting the objectives of South Africa, utilizing opportunities for energy efficiency:
Key institutions such as the Department of Minerals and Energy (DME), National Energy Regulator (NERSA), the Central Energy Fund (CEF) and Eskom acknowledge the link between demand side efficiency, reliable power distribution and greenhouse gas emission reductions. Demand-side energy efficiency has been identified by the South African government as one of the key areas to address to aim towards a more reliable power supply.[2]

Lemnis Lighting is a founding participant of the "National Greening Initiative" programme in South Africa, and its LED's Kick Off programme is endorsed by the Ministry of Environmental Affairs in South Africa and recognised as a "Green Goal" initiative by the FIFA football association. The program is also listed under the United Nations Environment Programme (UNEP) global "Green Passport" campaign, which applies the benefits of CER's generated out of these typical projects to offsetting carbon emissions.

Reducing the physical waste flow over the LED lifetime:
The LEDs have a lifetime that is 35 times the lifetime of an incandescent light bulb or 6 times the life time of a Compact Fluorescent Lamp (CFL). This longer lifetime of an LED avoids the physical waste of 35 incandescent light bulbs and the (chemical) physical waste of 6 CFLs. Especially the avoided CFL waste contributes to environmental sustainability. CFLs contain mercury and, although there are collection points for old CFLs, a large number of them still reach the landfills. Studies have shown that between 17% and 40% of the mercury in broken low-mercury fluorescent bulbs is released to the air during a two-week period immediately following breakage.[3]

Economic Sustainability

The PoA will contribute to South Africa's economic sustainability through the more efficient use of electricity:
The resulting energy savings make important contributions to South Africa's economic efficiency and sustainability. In order to meet the rising power demand, Eskom is planning to invest Euro 100 billion by 2026 on new electricity generation infrastructure. With the planned capacity expansion of 40,000MW, the costs per MW capacity are estimated at Euro 2.5 million[4]. Demand-side energy efficiency

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[1] *AMS II.C. "Demand-side energy efficiency programmes for specific technologies", version 13*

[2] *"STRATEGIC PLAN 2010/11 – 2012/13."* Department of Energy 2010 (http://www.energy.gov.za/files/aboutus/au_strategic.html)

[3] Aucott, M., McLinden, M., Winka, M., Release of Mercury from Broken Fluorescent Bulbs, Journal of the Air and Waste Management Association (2003). 53: pp 143 – 151.

[4] ESKOM, World Wide Web; *http://www.eskom.co.za/live/content.php?Item_ID=5981*.

improvements represent a highly cost-effective approach to providing this required capacity. Installing 3 million LEDs will directly reduce pressure on energy infrastructure with capacity savings representing approximately 80 MW[5]. Reducing the pressure on the energy infrastructure with 80 MW results in an avoided generation infrastructure investment of Euro 200 million.

The program results in technology transfer and/or capacity building in energy efficiency technologies:
The project involves the transfer of LED technology to South Africa. This transfer occurs "South-South" (between developing countries), as the LED lamps that are described in the PoA are part-manufactured and assembled in China as well as "North-South" (from developed to developing countries) as key components such as electrical components in the LED lamp come from Europe, the US or developed Asian countries. In addition, there will be a transfer of knowledge and capacity from "North-South". For instance Lemnis Lighting has opened an office in Johannesburg and will in first instance train local employees in the development, implementation and management of energy efficiency projects and in the various requirements of CDM and over time as volumes increase intends to establish a local R&D centre. Significant intellectual property will be transferred from staff in the international Lemnis Lighting group headquartered in The Netherlands to the local South African implementation team and its R&D partners. This intellectual property transfer will create a local hub of highly trained energy efficiency and LED lighting professionals.

The project structure is fully compliant to the Broad Based Black Economic Empowerment (B-BBEE) requirements in South Africa. Small, Medium and Micro Enterprises (SMME) development, and employment creation targeting youth and women are part of the project design. Much of the participation will be in the installation, distribution networks, sales and marketing, monitoring and customer service regarding the LED lights.

Social Sustainability

The program helps to improve quality of life by creating opportunities for jobs and job enhancement
For this PoA, Lemnis Lighting will engage (directly and through partnerships) a large workforce over the short to medium term, and will maintain a core team involved in customer relations, project management and monitoring over the longer term. This team of employees will be trained in CDM project requirements, energy efficiency and customer relations. Lemnis Lighting will create a team of experts that represent a centre of knowledge and experience within South Africa, and the African region in general.

The PoA will generate a number of less measurable social outcomes in education, awareness and collateral energy saving measures:
The SSC-CPAs within the PoA will include a significant public education component by educating "Climate Heroes" in South African school classes. For every 20 LEDs that are installed in the programme, Lemnis Lighting will fund the education of one Climate Hero in South Africa.[6] This programme has started in the Netherlands and has embarked on a worldwide rollout. This education will lead to a strong awareness in energy saving and energy efficiency for the future generations of the region. Furthermore the awareness of energy savings will be promoted through information provided with the LEDs, which will encourage behavioural change, not only in the children themselves but also in people in their direct environment.

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[5] Based on 8 hours of usage of 6W LED lamps vs 60W incandescents and generation load factor (GLF) of 67% as published by ESKOM; http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf

[6] *http://www.glowball.nu/index.php?lang=en*

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

The coordinating entity will voluntarily provide LEDs to each end-user participating in the programme. There are no mandatory requirements in South Africa stipulating the use of such devices, and the PoA requires individual users to take voluntary action to participate in the programme activities.

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

>> The following information shall be included here:

1. Coordinating or managing entity of the PoA as the entity which communicates with the Board
2. Project participants being registered in relation to the PoA. Project participants may or may not be involved in one of the CPAs related to the 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 project participant (YES/No)
Netherlands	Lemnis Lighting B.V.	No
Netherlands	Mabanaft Carbon B.V.	No
Netherlands	Do-inc business B.V.	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Table 1: Participants in LED's kick-off

1. Coordinating or managing entity of the PoA as the entity, which communicates with the Board:

Lemnis Lighting B.V. (From here on Lemnis Lighting). Lemnis Lighting is a forerunner in the field of sustainable lighting solutions, based on Light Emitting Diode technology. In November 2006, Lemnis Lighting introduced the first LED light bulb that can realistically be viewed as an up-to-par replacement of existing lighting equipment. Lemnis Lighting is a company headquartered in the Netherlands with offices in San Francisco, Singapore, Hong Kong and Johannesburg, and is a subsidiary of Tendris Holding. Lemnis Lighting is a founding participant of the "National Greening Initiative" programme in South Africa. The LED's Kick-off programme is endorsed by the Ministry of Environmental Affairs to offset the domestic footprint of the 2010 World Cup over a 10 year period. The LED's kick off programme is officially recognised as a "Green Goal" initiative by the FIFA football association

2. Project participants being registered in relation to the PoA. Project participants may or may not be involved in one of the CPAs related to the PoA:

Mabanaft Carbon B.V. is the carbon trading and CDM development arm of B.V. Mabanaft, which is part of Marquard & Bahls AG, a leading petroleum company; independent and privately owned. Marquard & Bahls has subsidiaries all over the world and Mabanaft has offices in (amongst others) Rotterdam, Mumbai, Hamburg, Houston and Singapore. In the "LED's kick-off" project Mabanaft Carbon B.V. does not fulfil any operational tasks. Mabanaft Carbon B.V. will become part owner of the CERs generated in the project.

Do-inc business B.V. offered consultancy in the development and documentation of the "LED's kick-off" project. Do-inc business B.V. will at least continue to provide guidance to the monitoring plan and the documentation and presentation of the monitoring results to the validator and the UNFCCC.

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

A.4.1. Location of the programme of activities:

Republic of South Africa

A.4.1.1. Host Party(ies):

Republic of South Africa

A.4.1.2. Physical/ Geographical boundary:

>> Definition of the boundary for the PoA in terms of a geographical area (e.g., municipality, region within a country, country or several countries) within which all small-scale CDM programme activities (SSC-CPAs) included in the PoA will be implemented, taking into consideration the requirement that all applicable national and/or sectoral policies and regulations of each host country within that chosen boundary.

The boundary for the programme is the Republic of South Africa as pictured in Figure 1.

Figure 1: Map of the Republic of South Africa

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

Lemnis Lighting is responsible for identifying, registering and managing all SSC-CPAs to be included in the proposed PoA. Participants in the SSC-CPA will be made aware of the nature of the programme, and contractually agree that their activity is subscribed to the proposed PoA and the relevant SSC-CPA. In the contract, an explicit agreement is made between the end user and Lemnis Lighting to cede any claim to the CERs generated to Lemnis Lighting.

All SSC-CPAs under the LED's kick-off Programme of Activities (PoA) comprise the distribution of Light Emitting Diode (LED) lighting devices to public, commercial, residential and industrial users. The end-user will receive a significant discount on the initial LED price possibly in combination with an attractive payment plan. The CER related revenue generated by the programme will act as the required

collateral to access financing and lower the default risks involved in financing the replacement, without which financing partners would not be willing to lend to customers in South Africa, who in many cases have track records of above average default rates or extensively delayed repayments.

The programme encompasses both the replacement of existing lighting equipment with LEDs (Brownfield) and/or the installation of LEDs on new locations where LEDs are not the common practice (Greenfield). On these new locations the most conservative common practice will act as the baseline. Old lighting equipment collected during the exchange will be scrapped to prevent leakage. The process will be independently verified as is required by the methodology and is described in Figure 6. Direct marketing efforts will be undertaken to ensure that users are aware of the project activity and the financial benefits the programme offers. The focus will be on large-scale lighting users in order to quickly gain market access and impact through volumes. All LED lighting will be voluntary provided to each end-user participating in the programme. There are no mandatory requirements in South Africa stipulating the use of such devices, and the PoA requires individual users to take voluntary action to participate in the programme activities.

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

Light Emitting Diodes (LEDs) have several characteristics making them an attractive replacement option for existing lighting equipment. Foremost of these are the lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, greater durability and reliability as well as the lack of mercury when compared to CFLs. LEDs require up to 90% less energy in comparison to incandescent light bulbs, and up to 50% less energy in comparison to CFLs. Lemnis Lighting LEDs have a lifetime that can reach 35 times the lifetime of an incandescent light bulb or 6 times the CFL lifetime. Replacing existing lighting equipment with LEDs, results in significant reductions of electricity use for lighting. All LED equipment will meet the Conformance Mark (CE) EU standards on safety, health and environmental requirements as well as any additional South African standards that may be developed in the course of the project. Lemnis Lighting expects to develop future products that can be utilised in the programme at a later stage. All equipment will be based on LED technology.

Figure 2 gives a non-exhaustive overview of the current product range of Lemnis Lighting. In the future LEDs from other technology suppliers can be included under this programme.

Consumer

- **Pharox candle, Pharox 200, Pharox 300, Pharox 400 and Pharox 500**
- 4 – 8W LED replacements for 15 – 60W incandescents or 8 – 16W CFLs
- Available in Warm White, Soft White and Flame versions
- Dimmable in higher lumen models

Professional

- **Pharox MR-16**
- Dimmable 5W LED replacement for 35 – 50W MR-16 halogen lamps
- **Pharox 800**
- 14W LED replacement for 50 – 100W PAR downlighters

Street

- **Pharox Veronica**
- 15W, 24W, 36W and 56W LED replacements for 30 – 150W street lights (High Pressure Sodium or Metal Halide)
- Available in Mesopic, EcoWhite and MoonLight versions

Figure 2: Current relevant Lemnis Lighting product range[7].

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

>> Here only a description of criteria for enrolling the CPA shall be described, the criteria for demonstrating additionality of CPA shall be described in section E.5

Here only a description of criteria for enrolling the CPA shall be described, the criteria for demonstrating additionality of CPA shall be described in section E.5

The SSC-CPAs must fulfil the criteria as presented in Table 2 to be registered under the PoA "LED's kick-off".

No	Eligibility Criteria	Compulsory answer
1	Does the CPA regard solely distribution within the programme's geographic boundary as defined in the SSC-PoA-DD?	YES
2	Shall the end user locations be uniquely identifiable by address and/or unique location description to avoid double counting of emission reductions?	YES
3	Do the end users of the LED lighting equipment waive all their rights to CERs generated under the CPA to the respective CPA owner(s)?	YES
4	Does the CPA regard the installation of LED lighting equipment, which may or may not include an LED luminaire (including lamp and corresponding power conversion electronics, thermal management, fixture etc.)?	YES

[7] This figure is illustrative only. Lemnis lighting is developing several luminaries and technologies not included in this figure that will be included under the programme.

5	Will the CPA owner ensure that for each installed LED lighting equipment the rated capacity or output or level of service (e.g., lumen output) is not significantly smaller (maximum -10%) than the baseline or significantly larger (maximum + 50%) than the baseline?	YES
6	Has the CPA provided a forecast concerning the CPA start date supported through documentary evidence?	YES
7	Has the CPA Owner confirmed that the CPA under the PoA is a voluntary action and is neither registered as an individual CDM project activity nor included in another registered CDM PoA?	YES
8	Does the CPA comply with the applicability criteria of methodology AMS-II.C "Demand-side energy efficiency activities for specific technologies" (version 13) used in the PoA?	YES
9	Will the CPA meet the requirements pertaining to the demonstration of additionality as specified in EB 63, Annex 24, *Attachment A of Appendix B of the Simplified modalities and procedures for small-scale CDM project activities (Version 08)*?	YES
10	Does the CPA rule out including facilities that are covered by an enforced government policy that includes mandatory adoption of LED lighting equipment?	YES
11	Is the market penetration of LED lighting in South Africa below 33% at the time of inclusion of the CPA?	YES
12	Has the owner of the CPA provided an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance?	YES
13	Does the CPA involve the installation of LED lighting equipment for grid-connected use in publicly, commercially, industrially, otherwise employed locations or residences?	YES
14	Does the CPA comply with the sampling requirements as per the sampling plan of the PoA, in accordance with the Standard and Guidelines for sampling and surveys for CDM project activities and programme of activities - EB 69, Annex 4 Version (03.0) and Annex 5 Version (02.0)?	YES
15	Will the ex-ante energy savings per CPA be capped at 60 GWh/per year?	YES
16	Is the SSC-CPA approved by Lemnis Lighting and the DOE prior to its incorporation into the PoA?	YES
17	Does the SSC-CPA satisfy de-bundling rules for PoA through the fact that each installation accounts for less than 1% of the total energy savings of the SSC-CPA? (These rules are elaborated on in chapter A.4.4.1.)	YES

Table 2: CPA eligibility criteria, expressed as questions with compulsory answers.

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):

>> The following shall be demonstrated here:

(i) The proposed PoA is a voluntary coordinated action;
(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;
(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;
(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

The information presented here shall constitute the demonstration of additionality of the PoA as a whole.

The additionality of the "LED's kick-off" programme is assessed at PoA level. Additionality is demonstrated using the criteria outlined in Attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities. To ensure a well-developed discussion of additionality and substantiate that the access to finance and prevailing practice/common practice barrier are preventing implementation of the project without CDM revenues, elements from the '*Combined tool to identify the baseline scenario and demonstrate additionality' (Version 04.0.0)* are borrowed. Note, as the project is small-scale and pertaining methodology AMS-II.C (version 13), the programme is not obliged to apply the '*Combined tool to identify the baseline scenario and demonstrate additionality' (Version 04.0.0).* Elements of the Combined Tool are borrowed as best practice to complement the additionality analysis.

As per the General Guidelines to SSC CDM methodologies (version_17) the following documents provided additional guidance or guidelines:

a) EB35, Annex 34: Non-binding best practice examples to demonstrate additionality for SSC project activities;
b) EB50, Annex 13: Guidelines for objective demonstration and assessment of barriers.

Given that the LED's kick off PoA implements a small-scale technology, i.e. lighting, EB63 Annex 12: Guidelines on Common Practice (Version 01.0) is not used, since it is considered not applicable to the type of project activity implemented under this programme.

To demonstrate additionality the following steps of the '*Combined tool to identify the baseline scenario and demonstrate additionality' (Version 04.0.0)* are used:

- STEP 0. Demonstration that a proposed project activity is the First-of-its-kind (optional)
- STEP 1. Identification of alternative scenarios;
- STEP 2. Barrier analysis;
- STEP 3. Investment analysis (if applicable);
- STEP 4. Common practice analysis.

STEP 0. Demonstration that a proposed project activity is the First-of-its-kind

This step is optional. It is not applied here.

Step 1: Identification of alternative scenarios

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

Table 3 gives an overview of the different identified alternative scenarios to the proposed CDM activity.

Table 3: Alternative scenarios to proposed CDM activity

No	Number and name of scenario	Description of scenario
1	Business as usual (baseline scenario)	Leave electricity saving through the introduction of innovative energy saving lighting technology completely up to the market without further incentive.
2	Programme without CDM, using different incentive mechanism	Realise electricity saving through the introduction of innovative LED technology without using the Clean Development Mechanism, but with the use of another incentive mechanism.
3	Programme using different technology and different incentive mechanism	Realise electricity saving through the introduction of innovative energy saving lighting technology other than LED with the use of another incentive mechanism.

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

All scenarios, number 1 to 3 comply with mandatory laws and regulations

Step 2: Barrier analysis

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

Table 4: Barrier analysis per scenario

Scenario	Description of scenario	Barrier – and explanation
1. Business as usual	Leave electricity saving through the introduction of innovative energy saving lighting technology completely up to the market without further incentive.	No barrier
2. Programme without CDM using different incentive mechanism	Realise electricity saving through the introduction of innovative LED technology without using the Clean Development Mechanism, but with the use of another incentive mechanism. Three alternative incentive mechanisms are identified; 1. Financial lease	Access to finance barrier. Prevailing common practice sees end-users not investing in energy efficient LEDs, as their capital investment requirements are too high compared to other options. Investment in energy efficiency is not seen as a priority. This is due to the fact that management will prefer projects that increase revenue rather than reduce costs. Increasing revenue is seen as a more important performance indicator.[8] To be more precise about the three alternative incentive

[8] Stated by expert disclosed to validator.

	2. Energy service company 3. Subsidies	mechanisms: 1. Financial lease is prevented since LEDs are not considered to be collateral by financing institutions, due to the fact that the cost of collection of equipment exceeds the value. This lack of collateral will be translated into an interest rate that makes the financial lease unviable.[9] 2. An energy service company should be managed by Eskom as the main utility. Eskom has no intention of doing so considering the more urgent matters that Eskom has to deal with at the time.[10] 3. Demand Side Management (DSM) subsidies by the SA government concerning the uptake of LED lighting are not in place, nor are they planned[11].
3. Programme using different technology and different incentive mechanism	Realise electricity saving through the introduction of innovative energy saving lighting technology other than LED with the use of another incentive mechanism.	Technological barrier - Currently the LED technology is the most advanced energy saving lighting technology. It substitutes CFLs as the most innovative solution by being twice as efficient with the same output and no mercury. There are currently no other technologies on the market that offer equivalent or better energy savings and lifetime than LED technology.

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

Remaining scenario: 1.) Business as usual (baseline scenario)

Barrier preventing the project scenario if not registered under the CDM

As mentioned in Table 4, the main barrier preventing the project scenario without the use of CDM is access to finance. In practise end-users do not invest in energy efficient LEDs, as their capital investment requirements are too high compared to other options. Table 5 illustrates the required extra investment in LEDs. As an example the product range of Lemnis Lighting is compared to the conventional lighting equipment that it replaces[12];

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[9] Stated by expert disclosed to validator.

[10] Stated by expert disclosed to validator.

[11] Stated by expert disclosed to validator.

[12] Assuming electricity price of ZAR 0.60 / kWh, rising with 25% in 2011, 2012 and 2013; 10% afterwards [source: NERSA and Eskom estimates]

Table 5: Payback times, investment, showing current practice and barriers

Conventional equipment (baseline)				
Type	CFL	Spot Light	Down lighter	Streetlight
Lifetime estimate (hours)	4,000	2,000	4,000	18,000
Wattage	18	35	100	150
Investment (Euro) @ZAR 10	EU 1.5	EU 2.5	EU 9	EU 200
Lemnis Lighting LED (project activity)				
Type	Pharox 300	MR16	PAR 38	Streetlight
Wattage	6	5	14	56
Lifetime estimate	35,000	25,000	25,000	80,000
Investment (Euro)	EU 18	EU 35	EU65	EU 350 to EU 500
Payback time				
In Years, at 8 hours per weekday.	**5**	**4**	**4**	**8**

Table 5 illustrates that the implementation of LED lighting equipment presents a considerable financial barrier. In combination with the comparatively low electricity prices in South Africa, the LED replacements have payback periods that are not commercially viable.

In addition investments in energy efficiency are limited due to cash flow restrictions. LEDs will not be implemented due to these restrictions. As mentioned management of organisations will always prefer projects that increase revenue rather than reduce costs. Increasing revenue is seen as a more important performance indicator.

The registration of the CDM project activity will overcome the “Access to Finance” barrier that prevents the proposed project activity from occurring in the absence of the CDM. The LEDs will be offered to the end user at a discounted retail price, made possible by future CER income. This additional future CER income provides a revenue stream that can be monetised and provides hard-currency collateral that lowers the default risks associated with energy efficiency finance. In order to provide these kinds of loans they must be securitised by a “first loss guarantee” that is required to offset the default risks involved. Without this collateral it would not be possible to make the replacement offer to the end user. The CER revenues are a specific requirement of the financing institution to cover the default risk. In Figure 3, a schematic representation is given of the financing structure offered toward the end-user, to lower the access to finance barrier.

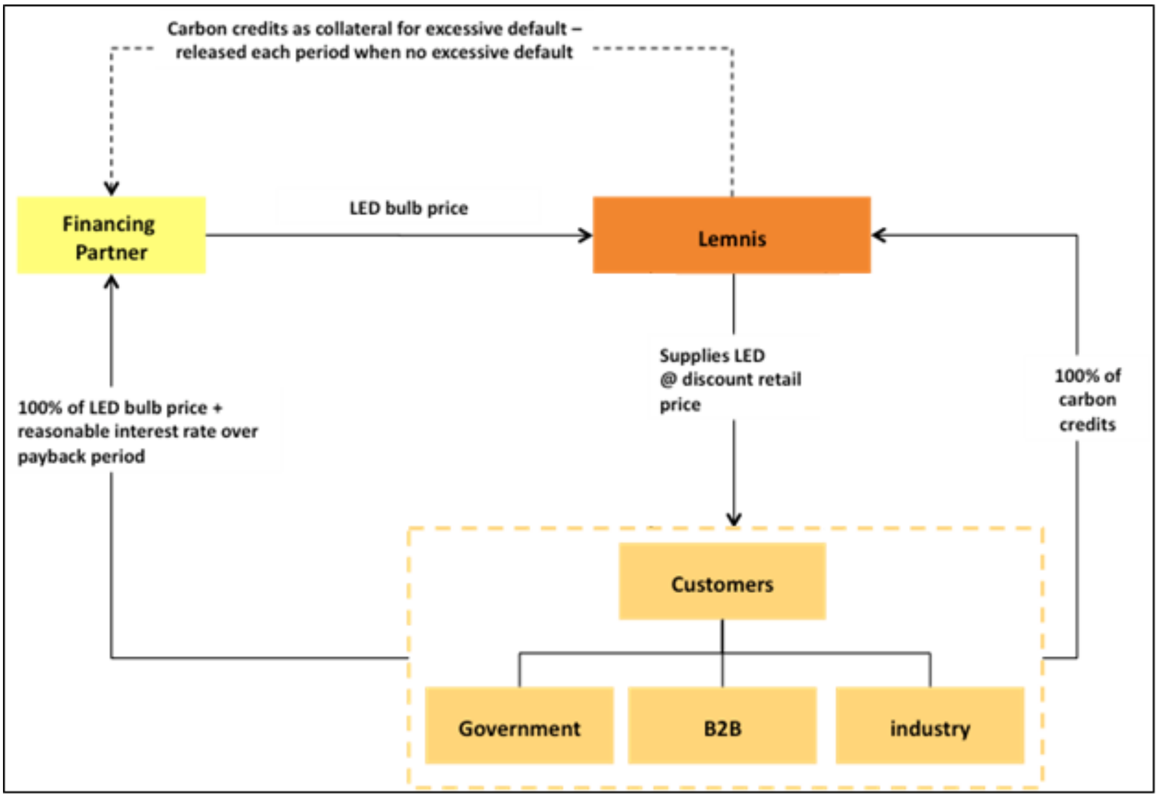

Figure 3: Financial structure including end-user

Step 3: Investment analysis

Not applied. As the use of the "Combined tool to identify the baseline scenario and demonstrate additionality" indicates the investment analysis is not applicable if only one alternative scenario remains (not being the project activity without CDM).

Step 4: Common practice analysis

The Department of Energy and Department of Trade & Industry have quantified the South African lighting market in 2009 based on Eskom data. Their results, illustrated in Table 6, were presented and discussed during the workshop "Phase out of Inefficient Incandescent Lamps", on 18 March 2010 in Tshwane.

Table 6: South African lighting market 2009

Lighting technology	Sales in 2009 in million units
Incandescent	136
CFLs	34
TL	22
Halogen	5
Dichroic Halogen	5
High Intensity Discharge (HID)	2
LED	0
Total	**204**

The results clearly indicate that the current LED market penetration in South Africa is non-existent. To cross-check this assumption a market analysis was conducted on the LED penetration in the South African market place in both the commercial and industrial sector. The following methods of research were included in the analysis:

- Detailed energy efficiency audits of commercial and industrial facilities throughout South Africa
- Communication with people in both the commercial and industrial sector who would be potential buyers of LEDs
- Online research

The market analysis shows that LEDs do not see any significant application throughout both sectors. The current trends in the commercial sector show that fluorescent fittings dominate the market and in the industrial sector High Intensity Discharge (HID) high bay fittings were seen to dominate the market. Through communicating with facility and operational managers on site, it became evident that the general perception is that LED technology has higher capital cost compared to that of regular fittings. Also the general perception towards LEDs is questionable due to the introduction of (South Korean) LEDs with far inferior quality. This inferior quality led to high failure rates, as a consequence of overheating, and the display of unnatural blue light. These issues have damaged the reputation of LED and have proven to be the main barriers for entry of LED lighting in South Africa. The online-based research proved no valid results with penetration figures that were backed by a reputable organisation within South Africa such as NERSA, the DME or Eskom.

This PoA offers direct replacement of existing lighting equipment and save energy with an equivalent of lighting output. The programmes offers high quality LED lighting equipment with lifetime of up to 12 years with a usage of 8 hours a day. Due to this long life, the LEDs are a very suitable retrofit solution for the hospitality sector, the care sector, the mining sector and other scenarios that require a combination of high-quality light and low maintenance. However, the required initial investment is larger than the investments in conventional lighting equipment available in the market.

For the LED's kick off PoA, a threshold for market penetration was set at 33%. Meaning that as long as the market penetration does not reach 33%, LEDs are not regarded common practise. Thus when the threshold is not met, LED technology is still innovative.

The threshold of 33% market penetration is based on Rogers' (1995) Innovation-Decision Process Model and technology diffusion curve, where the innovators represent 2.5% of the market, the early adopters another 13.5% and the early majority 34%. The 33% includes half of the early majority since this category represents all sections of an economy whilst the innovators and early adopters are typically only the younger, higher educated, or better-informed part of the market. See Figure 4 for the distribution of adopter categories within a typical population.

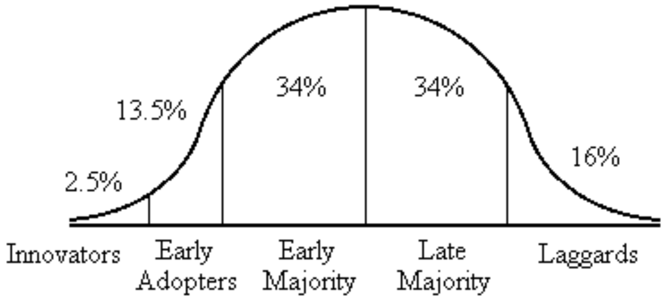

Figure 4: Distribution of adopter categories within a typical population[13]

The threshold of market penetration is included in the eligibility criteria for CPA inclusion, meaning that for each CPA it has to be proven that market penetration is below 33% in order to be included. For each CPA this is to be demonstrated:

a) Publicly available regional or national statistics or
b) Alternatively (if a) is not available) the opinion/statement from at least one independent expert[14]

In conclusion the PoA is deemed additional as the common practise analysis shows that LED lighting is not common practise. This is true for all CPAs at the time of a market penetration still below the benchmark of 33%.

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

A.4.4.1. Operational and management plan:

>> Description of the operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA, including:

(i) A record keeping system for each CPA under the PoA,
(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA,
(iii) The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.
(iv) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;

The 'LED's kick-off' programme involves a range of operational activities in order to effectively implement and manage both the overall PoA as well as each individual CPA. The operational structure of the programme is depicted in Figure 5. An overview of the different parties involved in the programme and their respective responsibilities is given in Table 7.

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[13] Source: Surry, D. W. and Ely, D. P.: Adoption, Diffusion, Implementation, and Institutionalization of Educational Technology. Available at: http://www.usouthal.edu/coe/bset/surry/papers/adoption/chap.htm

[14] Initially it is anticipated that national statistics are not available and expert opinions need to be sought.

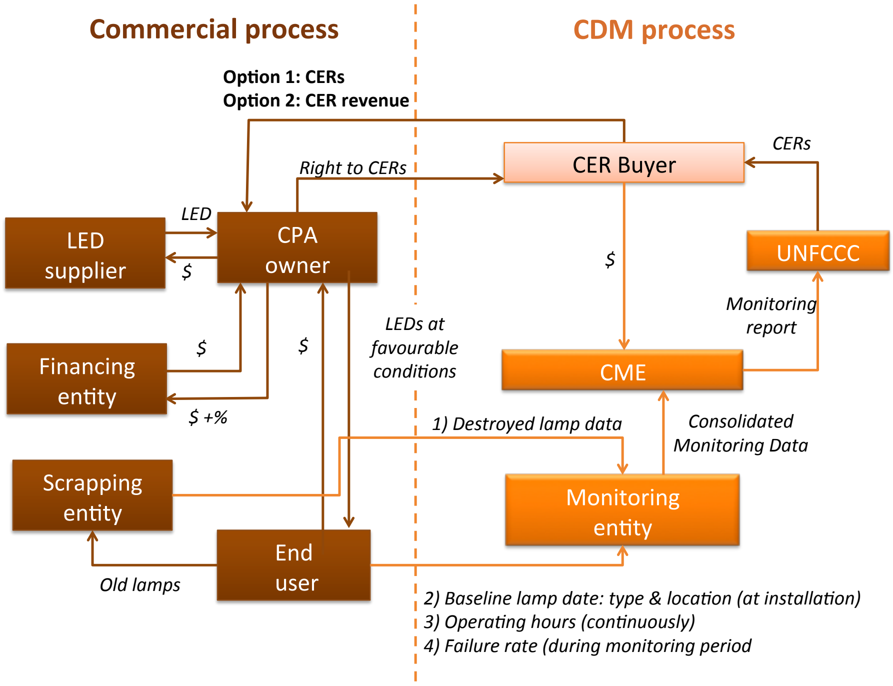

Figure 5: Operational flow within LED's kick-off. (Note that CME Lemnis Lighting B.V is generally also the LED supplier).

Table 7: Description of roles and responsibilities of parties involved in the 'LED's kick-off' programme

Roles under the programme	Responsibilities
Coordinating and Managing Entity	• Overall management and coordination of the PoA, communication with the EB • Approves inclusion of a CPA under the PoA based on the Eligibility Criteria • Operates and supervises central monitoring database • Checks aggregated CPA monitoring datasets to prevent double counting • Compiles monitoring reports per CPA and sends these to DOE for verification • Selects and proposes eligible actors to fulfil the monitoring and scrapping roles under the PoA
CPA Owner	• Enter into sales agreements for LED lighting equipment with end-users • Install or supervise instalment of LED lighting equipment (CPA owner has final responsibility for installation) • Deliver installation data to the actor fulfilling the monitoring actor • Ensure eligibility criteria are fulfilled • Must enter into a contract with monitoring and scrapping actors appointed by the CME to monitor according to the PoA monitoring plan
End User (s)	• Purchase or receive LED lighting equipment from the CPA Owner • Waive all their rights to CERs generated under the CPA to the respective CPA owner • Use the LED lighting equipment with due care
CER buyer	• Purchase CERs from CPA Owner • Payment of PoA management expenses to CME
Monitoring Role	• Implement metered sampling to measure the mean operation time of installed LED lighting equipment

Roles under the programme	Responsibilities
	• Implement non-metered sampling survey to determine the mean failure rate of installed LED lighting equipment • Collect all monitoring data: sampling data, installation data and scrapping data. Deliver the aggregated monitoring data to the CME
Scrapping Role	• Scrapping of replaced lighting equipment according to CDM rules • Deliver scrapping data to monitoring actor fulfilling this role
Financing Role	• If applicable provide financial support to the CPA Owner to implement the CPA.

1. CPA Record Keeping

Each CPA Owner is responsible for monitoring the CPA according to the requirements stipulated in methodology ASM II-C. and the 'LED's kick-off' monitoring plan described in section A.4.4.2 of this SSC-PoA-DD. The monitoring services are to be obtained from a CME approved party. Each CPA will have a unique CPA identification number in the database that is mutually exclusive with the other CPAs. Monitoring is performed at CPA level so that every CPA has its unique and individual set of data (for parameters see Table 9) in the central database.

2. Procedures to Avoid Double Counting

When LED lighting equipment is installed under the CPA, this will be recorded in the CPA data set by the parameter 'exact installation location'. This parameter is a unique address and/or description of the location where LED lighting equipment is installed.
All CPA data sets will be aggregated at PoA level in a central database. At verification, the CME will review the CPA data sets and check whether the parameter 'exact installation location' is unique. This procedure ensures that no double counting occurs within the overall PoA. In case of multiple entries of exact location, a detailed check will be made of that entry, including determination of precise lamp type installed. In case of double entries, the latest entry will be removed from the database.

3. De-bundling

According to 'Guidelines on assessment of de-bundling for SSC project activities' (Version 03.0), a CPA is exempted from performing a de-bundling check if each of the independent subsystems/measures included in the CPA of a PoA is no greater than 1% of the small-scale thresholds defined by the methodology applied. In this programme a single LED lighting equipment unit is the subsystem/measure. An LED lighting equipment unit will not entail more than 1% of the total energy savings of any CPA. Therefore the use of many LED lighting equipment units under one CPA is allowed regardless of the geographical location of the LED equipment units and is not regarded as de-bundling. However, the maximum ex-ante savings of 60 GWh per year as upper limit of a small-scale CPA means that only a limited number of LED equipment units (hereafter LED lighting equipment) can be included within one CPA.

4. Subscription of CPA activity under the PoA

The PoA platform design allows for multiple CPA owners. Each CPA owner will enter into a contractual agreement with the CME in order to subscribe their activity to the 'LED's kick-off' PoA.

A.4.4.2. Monitoring plan:

>> The following information shall be provided here:

(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.

(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

The project participants shall adhere to the General Guidelines for Small Scale Methodologies[15] (version 17) while monitoring the emission reductions from the project activity.

Para 17	General Guidelines for SSC-CDM methodologies	LED's kick-off
a	Electronically archive all data [….] for a period of two years from the end of the crediting period;	Aggregated data will be stored in the central database for at least two years after the crediting period or the last issuance of CERs to the programme, whichever occurs first.
b	Data variables that are most directly related to the emission reductions […] should be measured or calculated at least once a year;	The most crucial data variable for the establishment of the emission reductions is operating hours. This variable is metered continuously for the applicable strata
c	Measuring equipment should be certified to national or IEC standards and calibrated according to the national standards and reference points or IEC standards and recalibrated at appropriate intervals according to manufacturer specifications, but at least once in three years;	The used measurement equipment determines if a lamp is turned on or off. This is a) transmitted via a digital signal to the monitoring actor, or b) read out manually. This binary measurement is calibrated according to manufactured specifications, and recalibrated at least once in three years.
d	The measured data with high levels of uncertainty or without adequate calibration should be compared with location/national data and commercial data to ensure consistency;	The variable operating hours has no high level of uncertainty
e	Wherever a statistical sample is proposed for monitoring, the. *General guidelines for sampling and surveys for small-scale CDM project activities.* <http://cdm.unfccc.int/Reference/Guidclarif/ssc/index_guid.html> and the *Standard for sampling and surveys for CDM project activities and PoAs* shall be referred.	The project activity applies the stratified random sampling method and refers to the General guidelines for sampling and surveys for small-scale CDM project activities.

Table 8: Overview of monitoring requirements

[15] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid06.pdf

Monitoring Procedures

A central verification system will be implemented at PoA level to determine the amount of emission reductions achieved under the programme. The verification system consists of a central database that aggregates and stores all monitoring data collected throughout the programme. It is operated and supervised by the CME or an entity assigned by the CME.

Monitoring itself is performed at CPA level. That means that a separate data set and a respective monitoring report will be compiled per CPA. The data sets of all CPAs will be aggregated and stored within the central database at PoA level. Monitoring at CPA level is deemed advantageous in case of the 'LED's kick-off' PoA, since the programme is designed to offer a marketing platform for LED lighting equipment. This implies that various different LED lighting equipment producers/retailers and different LED equipment types can be included under the overall PoA. In case of monitoring at CPA level, CERs issued are exclusively influenced by the nature of the specific CPA. Thus, monitoring at CPA level increases robustness of the dataset, lowers the margin for errors (this is a conservative approach and strengthens data reliability).

Four data streams can be distinguished with respect to the data collected during implementation and execution of the individual CPAs. These are:

1. Installation data including the details of lamp installation in particular the number and wattage of replaced (brownfield) or avoided (greenfield) equipment and the number and wattage of newly installed LED lighting equipment.
2. Scrapping data including the record on replaced and subsequently scrapped old lamp equipment
3. Sampling data including the mean operating hours (metered samples) of the newly installed lamps and their failure rate (non-metered survey).
4. If the devices installed replace existing devices (brownfield locations), the number and power of a representative sample of the replaced devices shall be recorded in a way to allow for a physical verification by DOE.

An overview of the recorded data is presented in Table 9, showing the relevant monitoring parameters to be included in the database and the respective CPA monitoring reports.

Parameter	Explanation	Symbol
End-user	Exact name(s) of end-user participating in the CPA	
Contact details	Address of end-user participating in the CPA	
Exact replacement location	Unique address and/or description of location where lamp installation takes place. Optional use of GPS data.	
Date of replacement	CERs will be earned starting the day after the installation of the LED lighting equipment, under the condition that the day of installation is after start of the crediting period.	
Quantity of old equipment or avoided equipment	Counted number of replaced old equipment (brownfield) and avoided equipment (greenfield). Data is used to determine the baseline scenario.	n_i
Wattage of old equipment or avoided equipment	Nameplate data of replaced equipment. In case of avoided equipment (greenfield) the most conservative current practice is taken into account. Data is used to determine the baseline scenario.	p_i
Quantity of installed LED lighting equipment	Counted number of installed LED lighting equipment. Data is used to determine the project scenario.	n_k
Wattage of installed LED lighting equipment	Nameplate data. Data is used to determine the project scenario.	p_k
Lamp Classification of installed	The Lamp Classification defines the strata for the sampling.	

Parameter	Explanation	Symbol
LED lighting equipment		
Sample size of metered sample	Number of LED lighting equipment that is equipped with a monitoring meter in order to monitor the mean operating hours of the installed LED lighting equipment. Meter can be installed at the last point of control. Data is used to determine whether the sample size is statistically robust.	$S_{metered}$
Sample size of non-metered sample	Number of LED lighting equipment that are considered in the non-metered sampling survey in order to monitor the mean lamp failure rate and the outage factor. Data is used to determine whether the sample size is statistically robust.	$S_{non\text{-}metered}$
Location monitoring samples	Unique address or unique description of location of the LED lighting equipment equipped with a monitoring meter (meter can be installed at the last point of control). Optional use of GPS data.	
Operating hours of installed LED lighting equipment	Measured operation time of the LED lighting equipment in the metered sample. For each monitoring period a mean value is calculated; this value is used for the operating hours of all LED lighting equipment within the respective stratum.	o_k
Failure rate of installed LED lighting equipment (in %)	Measured failure rate of the LED lighting equipment in the metered sample. Failure rate is measured annually by means of a non-metered survey. The resulting value is used as the average failure rate of all LED lighting equipment within the respective stratum.	$r_{failure}$
Outage factor	Maintenance turn-around time from LED failure to replacement (downtime of equipment)	of_y
Scrapping data	Number and wattage of scrapped lighting equipment. Scrapping data is used to double-check the installation data (replaced equipment).	
Sample for verification by DOE	If the devices installed replace existing devices, the number and power of a representative sample of the replaced devices shall be recorded in a way to allow for a physical verification by DOE (paragraph 12 of AMS II.C. Demand-side energy efficiency activities for specific technologies, v13). The number and "power" of the replaced equipment to be recorded for physical verification is based on the identified samples within the metered sampling survey ($\mathbf{S_{metered,k}}$). That means, if a meter is installed the replaced lamp is collected and stored for verification.	

Table 9: Parameters to be monitored

As is required by methodology AMS-II.C. Demand-side energy efficiency activities for specific technologies (version 13), the number of LED lighting equipment installed must correspond with the number of old equipment units collected and with the number of old equipment units scrapped plus the number of avoided lighting equipment units. In the event that there is a discrepancy between the total of replaced and avoided lamps and the number of newly installed LED lighting equipment, there are deemed to be leakage emissions. In this case, the lower of the two numbers is used to calculate the emission reduction for that CPA. The same applies to the total number of old equipment replaced (brownfield) and the number of old equipment collected and scrapped. Again, in case of a discrepancy between the numbers, the lower of the two numbers is used to calculate the emission reduction calculations for that specific CPA.

Both installation data and scrapping data are point measurements that are recorded once during the installation of new LED lighting equipment and the scrapping of replaced equipment, respectively. Installation data is provided by the CPA owner who is responsible for the installation of LED equipment

under his CPA. Scrapping data is provided by the actor responsible for handling the replaced lamps. Sampling data is a continuous measurement. Individual CPA owners purchase monitoring sampling services from a dedicated actor responsible for monitoring appointed by the CME. The monitoring actor is responsible for collecting the installation data from the CPA owner, the scrapping data from the scrapping actor and for sampling both operating hours and failure rate of the installed LED equipment. The monitoring actor subsequently sends the aggregated monitoring data (installation, scrapping and sampling data) to the CME who compiles a monitoring report per CPA, which is then stored in the central database.

During installation of LED Lighting Equipment, it is the responsibility of the CPA owner to store (keep safe) the number and power of a representative sample of the baseline lighting equipment for each site, to allow for a physical verification by DOE.

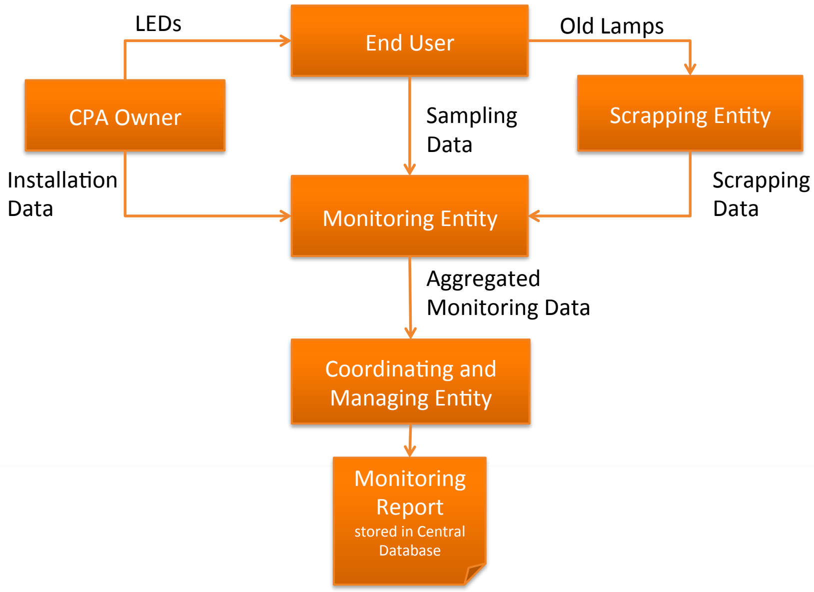

Figure 6: Monitoring Process

The central database shows the emission reductions realised by the entire PoA and the individual data sets attributed to each CPA. Verification of the data compiled will occur at the end of each monitoring period. The programme database will record the start and end dates of each monitoring period, and record the emission reductions attributable to each monitoring period per CPA. This process is depicted in Figure 6.

Sampling Plan

The purpose of sampling is to obtain unbiased and reliable estimates of the mean value of parameters used in the calculations of greenhouse gas emission reductions. 'Unbiased' in this case indicates that the sampling will not systematically underestimate or overestimate the mean value determined. In the design of the sampling plan the Standard and Guidelines for sampling and surveys for CDM project activities and programme of activities - EB 69, Annex 4 Version (03.0) and Annex 5 Version (02.0) were used.

The sampling plan below contains the required information relating to: (A) sampling design; (B) data to be collected; and (C) implementation plan.

Sampling will occur on a CPA level. For each CPA the sample sizes need to be determined in line with the guidance as laid down in the PoA-DD. Detailed guidance can be found under Annex 4.

A: Sampling design

(i) Objectives and Reliability Requirements

The reduction in energy use is the product of the following variables:

a) Difference in wattage between the replaced equipment/avoided equipment and the newly installed LED lighting equipment (based on the name plate data). This is a point measurement, as it will be recorded once at the actual physical replacement
b) Operating hours of the installed LED lighting equipment. This is a continuous measurement undertaken at the sample group LED lighting equipment.
c) Failure rate of the installed LED lighting equipment. This is a survey conducted on the non-metered sample group LED lighting equipment.
d) Grid emission factor of the country the programme is implemented in. This is an ex-ante calculation based on the installed power base. It is not a project-specific variable.

Sampling is necessary to establish variables b and c in the calculation of the reduction in energy use (see bullets above). Hence it will result in mean annual values over the crediting period per sampling stratum for:

- Lamp operating hours (h); and
- Lamp failure rate (%)

The minimum desired precision of the sample group is a sampling error of 10% and a confidence level of 90%[16].

(ii) Target Population

Under the LED's kick-off PoA LED lighting equipment can be divided into two categories: indoor and outdoor. Further these can be sub-divided - as per the power mentioned on the nameplate data of the LED lighting equipment - into high power and low power. See Table 10 for the division into classifications. These classifications will termed strata, as is explained under (iii) Sampling method.

Table 10: Lamp classification

Indoor		Outdoor	
Low power	High power	Low power	High power
<40 Watt	≥ 40 Watt	<20 Watt	≥ 20 Watt
IL (Indoor Low)	IH (Indoor High)	OL (Outdoor Low)	OH (Outdoor High)

[16] Standard for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 4 Version (03.0).

Hence, all LED lighting equipment under the CPAs that are included PoA will fall into one of the four strata: IL, IH, OL, OH identified above. Equipment cannot fall in more than one stratum. These strata (classifications) are to be applied for the metered and non-metered sample groups.

The different strata as described above represent the target populations for sampling under the programme. If a CPA does not include LEDs in one or more of the strata, these strata are logically not used to select a sample group from.

(iii) Sampling Method
The best sampling approach is Stratified Random Sampling (II B in EB 69 Annex 5 page 3[17]) as stratified random sampling is most applicable to situations where there are obvious groupings of population elements whose characteristics are more similar within groups than across groups. The sub-populations are collectively exhaustive and mutually exclusive, i.e. no population element is excluded but every element in the population is assigned to only one sub-population. Within the strata Simple Random Sampling is applied (II A in EB 69 Annex 5 page 3[18]).

(iv) Sample Size
See Annex for detailed guidance on the determination of the sampling size.

(v) Sampling Frame
See Annex for detailed guidance on the determination of the sampling frame.

B: Data
(i) Field measurements
Lamp operating hours will be determined by means of a metered sampling survey. The LED lighting equipment in the sampling group is equipped with run time meters that measure the exact number of operating hours. The data from these run time meters is digitalized by the monitoring actor and sent to the CME. The sampling data is extrapolated for the respective sub-population that the sample group represents.

Lamp failure rate is determined by means of the same non-metered sampling survey on an annual basis. The sample group will be identified by the monitoring actor on the basis of random sampling. The operating hours are corrected by the percentage of LEDs replaced ($r_{failure,k,y}$) times the down time (per stratum) for each type of LED lighting equipment ($of_{k,y}$).

Table 11: Parameters to be sampled

Parameter to be sampled	How sampled?	Confidence level	Monitoring ID
Operating hours (h)	Metered	90/10	o_k
Lamp Failure Rate (%)	Survey on non-metered sample	90/10	$r_{failure,k,y}$

(ii) Quality Assurance/Quality Control:

[17] Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 5 Version (02.0).

[18] Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 5 Version (02.0).

The programme has the following Quality Assurance/Quality Control procedures in place.

Table 12: QA/QC

Parameter to be sampled	How sampled?	Quality Assurance/Quality Control
Operating hours (h)	Metered	All data entries will be checked on validity and correctness using dedicated software. A procedure has been developed to correct for non-valid data entries
Lamp Failure Rate (%)	Survey on non-metered sample	The survey will consist of identifying LED lighting equipment that is installed and operating, based on their 'exact installation location'. The exact installation location is the entry in the database that allows for a unique identification. While LED lighting equipment replaced as part of a regular maintenance or warranty program can be counted as operating, LED lighting equipment cannot be replaced as part of the survey process and counted as operating.

The CPA owner is responsible for the LED lighting equipment installation. The monitoring actor is responsible for the correct installation of the sample Meters, the execution of the sampling survey and the gathering and digitalization of the respective sampling data.

C: Implementation

The CME will select one (or more) specialised and experienced monitoring actor(s) who will provide the monitoring service to the CPA owners. In this way potential mistakes during the sampling process can be minimised. The monitoring actor, contracted by the individual CPA owners who purchase its services, will be responsible for all sampling activities (installation of meters, survey execution, reading and processing of sampling data). Dedicated meters that will be installed at the sample lamp base measure the exact operation time of the respective sample. The data is sent to the monitoring actor who processes the data by means of a dedicated monitoring software to produce daily usage data. This digitalised sampling data is then sent to the CME who collects and stores the data over time (central database) and issues the overall monitoring report (see Figure 6). Each CPA will be sampled individually to prevent statistical bias.

It is important to guarantee a uniform distribution of the monitoring samples throughout the defined strata (sub-populations). The monitoring actor in charge shall ensure that the sample selection will not display any pattern which would potentially threaten randomness.

Verification

Based on the data gathered in the central database, a written monitoring report per CPA will be provided by the CME to the verifying DOE to demonstrate compliance with the monitoring requirements corresponding to the preceding monitoring period. Apart from the aggregated data, the monitoring report includes the outcome of the following internal checks of procedures:

1. The single basic check; to ensure that replacement procedures are being followed, at least one spot check at a replacement location will be done;
2. The number check; to ensure that the number of LED equipment installed corresponds with the number of old equipment collected and avoided equipment;

3. The single visual check; in order to establish that collection of old equipment has been undertaken correctly, one physical spot check will be conducted of the replaced equipment prior to their destruction;
4. The double check; to ensure that no leakage occurs, either a certificate of scrapping is presented and checked or an independent party will be present at scrapping and testify the old equipment is indeed scrapped;

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

No public funding will be used for this programme of activities.

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

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

02/09/2012

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

28 years

SECTION C. Environmental Analysis

>>

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 X
2. Environmental Analysis is done at SSC-CPA level ☐

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

The PoA involves the distribution and installation of LED lighting equipment in South Africa. These items have the Conformance Mark (CE) by which the technology supplier declares that the LED products meet EU and South African safety, health and environmental requirements and are RoHS compliant.

Furthermore the use of LED lighting equipment does not entail significant environmental impacts. The South African Government does not require that environmental impact assessments should be undertaken for the PoA.

There are no statutory environmental requirements on LED disposal. LEDs itself do not contain harmful substances so there is no need for analysis of the environmental impacts, including trans-boundary impacts as a result of this PoA. The primary environmental impact of the PoA is the physical waste created by the replaced lighting equipment. The methodology requires that this is collected and scrapped to prevent leakage. In many instances, base materials of old equipment (e.g. glass and metals from light bulbs) can be recycled, most products for at least 90%. Where possible, the PoA will work with local

businesses to implement a recycling strategy. The mercury from the CFLs collected will be treated as hazardous waste and stored and processed accordingly.

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),:

The South African Government does not require that environmental impact assessments should be undertaken for each SSC-CPA.

SECTION D. Stakeholders' comments

>>

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 X
2. Local stakeholder consultation is done at CPA level ☐

The choice for PoA level is informed by the fact that all potential installations of LEDs have similar features at national and subnational level. As the distribution of the programme is throughout South Africa, so the stakeholders are also based across South Africa. Therefore the Local Stakeholder Consultation organised at PoA level has captured all relevant stakeholders.

Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

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

Local stakeholder consultation took place on January 27th, 2011 in Freedom Park, Pretoria, South Africa. Invitees were from a broad range of stakeholders. In total, 19 stakeholders were present.

During the stakeholder consultation Mr. Francois van Tonder briefed the stakeholders about the objective, project description, environmental impacts and benefits, applicability of technology, global and local benefits, contribution towards sustainable development, and status of the project activity.

After the introduction, a detailed open discussion took place with the identified stakeholders.
All stakeholders have issued their approvals/consents/licenses for setting up the project and no substantial negative comments were received on the project. The stakeholder's minutes of the meeting report are furnished to the DOE (Designated Operational Entity) for validation.

D.3. Summary of the comments received:

No negative comments were received from the stakeholders. The few queries raised were answered in a satisfactory manner by the project participants, see the summary below.

Q: With regards to retrofitting – do the lumens or lux (lx) match? In certain areas a minimum luminance level is required.
A: In some instances, equivalent Lux levels differ, because of the mesopic spectrum Lemnis LED technology operates in (in outdoor lighting). Our products are developed to achieve at least the minimum

lighting standard applied to the specific application of light, and where this is not possible, alternate lighting designs are suggested.

Q: Are the commercial product and programme rollout linked?
A: Yes, every Pharox LED sold will contribute to the reduction of the project emission reduction target until achieved.

Q: How do you calculate the CO2 footprint?
A: We take the emission factor of electricity of the grid and multiply this by the energy savings per installed lamp (compared to the equipment it replaces) and the operational hours.

Q: Did you use the ESKOM factor to calculate the footprint?
A: No, not at all. We used our own calculations as reflected in our PoA.

Statement: Vapours need to be taken out for recycling health, it gets crushed, vapours goes into a container (mercury) and then to a licensed landfill dump.
A: The programme ensures strict management of waste from all lamps, including mercury containing lamps.

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

No negative comments or concerns were raised during the consultation with stakeholders. The clarifications requested by the stakeholders have been addressed during the consultation process, which are captured in the Minutes of the meeting. They have been circulated to all the stakeholders who attended the meeting. Hence no actions were necessary in order to take due account of comments.

The local stakeholder consultation process with respect to the identification of local stakeholders, seeking their views and taking due account of any comments was conducted in a transparent manner. Further, as required by the CDM modalities and procedures, the PDD has been published by the Designated Operational Entity (DOE) on the CDM web site for global public comments.

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 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 project scope is:
Scope 3. Energy Demand / TA 3.1 Energy Demand

The approved small-scale baseline and monitoring methodology used is:

- AMS-II.C. *Demand-side energy efficiency programmes for specific technologies (Version 13)*

The project will utilise the following tools:

- *Combined tool to identify the baseline scenario and demonstrate additionality (Version 04.0.0)*
- *Tool to calculate the emission factor for an electricity system (Version 2.0)*

The project will utilise the following standards and guidelines:

- *Standard for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 4 Version (03.0)*
- *Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 5 Version (02.0).*
-
- *General guidelines for SSC CDM methodologies (Version 17.0)*
- Non-binding best practice examples to demonstrate additionality for SSC project activities, EB35, Annex 34.
- Guidelines for objective demonstration and assessment of barriers, EB50, Annex 13.

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

The methodology AMS-II.C. Demand-side energy efficiency activities for specific technologies (version 13) is applicable since the project activities fulfil the following criteria:

b) The programme entails activities that promote the adoption of energy efficient equipment through the distribution and installation of LED lighting equipment, creating demand-side energy savings and reductions in greenhouse gas emissions - at many sites. LED lighting equipment may replace existing equipment (Brownfield) or be installed at new sites (Greenfield);

c) The aggregate ex-ante energy savings by a single programme activity may not exceed the equivalent of 60 GWh per year for electrical end use energy efficiency technologies.

d) The light output of every replaced lighting equipment will not be significantly smaller (maximum -10%) or larger (maximum +50%) than the baseline.

e) Leakage associated with SSC-CPAs will be accounted for through the independent verification of scrapping of the old equipment.

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

Source		Gas	Included?	Justification / Explanation
Baseline	Power plants servicing the electricity grid	CO_2	Yes	Main source of emission.
		CH_4	No	Excluded for simplification. Minor source of emission. Conservative.
		N_2O	No	Excluded for simplification. Minor source of emission. Conservative.
Project Activity	Power plants servicing the electricity grid	CO_2	Yes	Main source of emission.
		CH_4	No	Excluded for simplification. Minor source of emission. Consistent with baseline.
		N_2O	No	Excluded for simplification. Minor Source of emission. Consistent with baseline.

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

The energy efficiency measure of the installation of LED lighting equipment saves electricity; therefore the emission baseline is determined as the product of the electricity consumption of the old equipment replaced (in case of brownfield) or the electricity consumption of the equipment avoided (in case of greenfield) and the emission factor for the electricity displaced.

Type II and III Greenfield projects (new facilities): may use a Type II and Type III small- scale methodology provided that they can demonstrate that the most plausible baseline scenario for this project activity is the baseline provided in the respective Type II and Type III small-scale methodology. The baseline scenario for Greenfield actvities is determined in the following steps.

Step 1:
In this step the various alternatives available to the project proponent that deliver comparable level of service including the proposed project activity undertaken without being registered as a CDM project activity are identified, see Table 13.

Alternative	Name of alternative
1	Business as usual
2	Same programme without use of CDM, with use of a different incentive mechanism
3	Programme achieving the same results with different technology without use of CDM, with use of a different incentive mechanism

Table 13: Alternatives to the project activity

Step 2:
All identified Alternatives are in line with host country's legislation.

Step 3:
Under this step the Alternatives are ranked taking into account barrier tests specified in attachment A to Appendix B of the simplified modalities and procedures of SSC CDM, see Table 14.

Alternative	Barrier
1	No barrier
2	Investment and technology barrier (see section A.4.3)
3	Currently the LED technology is the most advanced energy saving lighting technology. There are currently no other technologies on the market that offer equivalent or better energy savings and lifetime than LED technology.

Table 14: Existing barrier preventing the alternatives

Step 4:
As only one Alternative remains, namely business as usual, and that is not the proposed project activity undertaken without being registered as a CDM project activity. And furthermore this corresponds to one of the baseline scenarios provided in the methodology AMS-II.C. Demand-side energy efficiency activities for specific technologies (version 13); then the project activity is eligible under the methodology.

Hence the baseline scenario for Greenfield activities is business as usual use of lighting equipment. In order to be conservative the most conservative common practice will be taken as the baseline scenario, to determine the installed lighting equipment that otherwise would have been installed (avoided equipment).

The most conservative common practice is defined here as the least electricity consuming available non-LED lighting equipment producing light output service levels, in the amount of Lux, as required for the application in question by national standards and/or codes. This is to be supported for each site by documentation of representative locations, where baseline lighting equipment are already installed in the same region as the project.

The baseline energy consumption is the product of the power consumption, the operating hours and the quantity of equipment replaced (brownfield) and avoided equipment installed (greenfield). Quantity and wattage of replaced or avoided equipment is a one-point measurement that is delivered by the CPA owner who is responsible for LED lighting equipment installation. Each LED lighting equipment installation will be recorded in a respective data sheet, containing location, quantity and wattage of both newly installed LED as well as replaced or avoided non-LED lamp.
The operating hours are measured by monitoring the sample LED lighting equipment after installation. It is assumed that the replaced equipment had an equal amount of operating hours as the LED lighting equipment that replaces this equipment.

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): >>

Additionality is demonstrated at PoA level.

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

Additionality is demonstrated at PoA level.

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

Additionality is demonstrated at PoA level.

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:

The methodological choices that will be applied in relation to each of the CPAs to be developed under this PoA are as follows:

Determination of Baseline Emissions
Energy displaced in the baseline is electricity. Therefore, the baseline is the level of electricity consumption by the baseline lighting systems. Baseline emissions are calculated by multiplying the electricity consumption by these baseline lighting systems with the grid emission factor for electricity in South Africa. The grid emission factor for the electricity displaced is determined in accordance with the applied baseline and monitoring methodology. Operating hours in the baseline activity will be determined based on monitoring meter records recorded by the electricity meters installed in the project sample group. The baseline emissions are adjusted for average annual technical grid losses (transmission and distribution) for the grid serving the location where the devices are installed, expressed as a fraction.

Determination of Project Emissions

Energy consumed in the project is electricity. Therefore, electricity consumption in the project is multiplied with the grid emission factor for electricity to determine project emissions. The grid emission factor for electricity is determined in accordance with the applied baseline and monitoring methodology. Operating hours in the project activity will be determined based on monitoring meter records recorded by the electricity meters installed in the project sample group. The project emissions are adjusted for average annual technical grid losses (transmission and distribution) during year y for the grid serving the location where the devices are installed, expressed as a fraction..

Leakages
Leakages will be avoided because the replaced equipment will be scrapped. Independent monitoring of the scrapping of replaced equipment will be implemented in compliance with the requirements of the applied baseline and monitoring methodology.

According to requirements of methodology AMS-II.C. Demand-side energy efficiency activities for specific technologies (version 13), the monitoring will include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment are equal and no leakage occurs. For this purpose scrapped equipment will be stored until such correspondence has been checked. The scrapping of replaced equipment will be documented and independently verified.

Calculation of Emission Reductions
Emission Reductions are calculated by subtracting project emissions from baseline emissions.

Metered Sample Group
The values for operating hours used for calculating baseline- and project emissions are determined through a metered sampling process per stratum at CPA level. The size of the project sample group used for arriving at these values is determined taking into consideration the guidance as per this PoA-DD. The CME will work to ensure that, to the extent feasible, the LEDs included will be randomly selected from the database of participating LEDs. The results obtained from the sampling process will be directly extrapolated across the entire population of LEDs installed in that stratum in the respective CPAs.

Non-metered Sample Group
A group of non-metered LED lighting equipment will be randomly identified on basis of the project database and will be subject to annual check to determine the mean failure rate of the installed equipment.

Partners in monitoring
Project proponent had identified and agreed with competent partners to implement scrapping and monitoring activities. Documented evidence has been submitted to the validator.

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

Because this PoA displaces electricity, the first step in determining the baseline and project emissions is to determine the emission factor of the electricity system that feeds the project sites. For the "LED's kick-off" PoA the grid emission factor is calculated for the host country, South Africa. The emission factor is fixed for the lifetime of the PoA. If at time of (a) inclusion of PoA or (b) at the time of the renewal of a crediting period of each CPA, the fixed emission factor is deviating more than 10% from the emission factor calculated at the start or at the previous renewal of the CPA's crediting period, a re-calculated emission factor needs to be used. This emission factor checking will guarantee that each CPA will use an emission factor following the development of the South African electricity market.

A. GRID EMISSION FACTOR

The methodological tool to calculate the emission factor for an electricity system determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system[19]. This is done by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin reflects the power units whose construction would be affected by the proposed CDM project activity.

The tool follows six steps in order to calculate the operating margin, build margin and the combined margin:

Step 1: Identify the relevant electric power system
Step 2: Select an operating margin method
Step 3: Calculation of the operating margin emission factor
Step 4: Identify the cohort of power units to be included in the build margin
Step 5: Calculate the build margin emission factor
Step 6: Calculate the combined margin emission factor

Step 1: Identify the relevant electric power system

The National Energy Regulator (NERSA) publishes the latest energy supply statistics for the year 2005[20]. In this year 96% of the national grid electricity was generated by Eskom.
Two assumptions are made to calculate the conservative electricity baseline:

- The 4% remaining capacity are private or municipal power generation. It is assumed that excluding the 4% is, apart from simplicity, a conservative approach. The smaller and older generation plants that make up this 4% are expected to have lower efficiencies.
- Eskom generates, transmits, and distributes electricity to industrial, mining, commercial, agricultural, and residential customers, and also to redistributors. The regional generation and consumption of Eskom transmission grids are interlinked and no distinction can be made between provincial or sectoral generation and consumption. For example: Cape Town, although located close to a nuclear power station, receives electricity via the transmission line from coal-fired power stations in Mpumalanga. The whole transmission system is taken as a homogenous mix of electricity supply by all generators.

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

Under this step project participants may choose whether to include off-grid power plants to calculate the operating margin and build margin emission factor. It is decided to not include off-grid power plants in the "LEDs kick-off" PoA, since these play a very minor role in South Africa's overall power generation.

[19] "Tool to calculate the emission factor for an electricity system". Version 2.2.0

[20] *"Electricity supply statistics of South Africa, 2005"* Retrieved from the Nersa website.

<u>*Step 3: Select an operating margin method*</u>

In accordance with the tool, the calculation of the operating margin emission factor (EFgrid,OM,y) must be based on one of the following methods:

1. Simple OM, or
2. Simple adjusted OM, or
3. Dispatch data analysis OM, or
4. Average OM.

Of these four methods any can be used; however the simple OM method can only be used if low-cost/must-run resources constitute less than 50 % of total grid generation. The Tool states that:

"Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants."

Figure 7 shows that hydro and nuclear power generation, both classified as low-cost and must-run power plants, constituted 5% of the national grid in 2005 and therefore the Simple OM method can be applied[21]. Figure 7 also indicates that in 2005 the coal-fired power stations constituted 93% of the South African generation capacity. Together with the 5% for nuclear and hydro, this leaves 2% for alternative power generation options. The South African government has recently abandoned the construction of highly efficient pebble bed nuclear reactors, in favour of coal fired power stations.

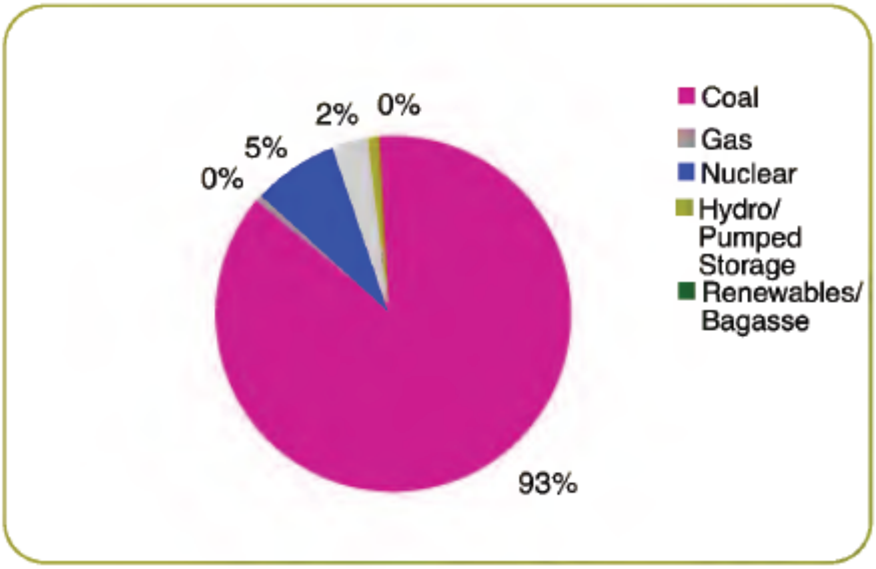

Figure 7: power generation in South Africa

For the Simple OM the emission factor can be calculated using either of the two following data vintages:

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[21] *"Electricity supply statistics of South Africa, 2005"* Retrieved from the Nersa website.

1. Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
2. Ex post option: The year in which the project activity displaces grid electricity, required emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1, or y-2) should be used throughout all crediting periods.

The emission factor for this programme is calculated using the ex ante option: 3-year average.

The latest data available from the Eskom website (March 2012) are the electricity generation and fuel consumption from coal fired power plants for the years 2008/9, 2009/10 and 2010/11. This data is available from the CDM calculations webpage provided on the Eskom website[22].

The electricity generation data presented by Eskom is assumed to be net values because the values quoted on NERSA website (for previous years up to 2005) were slightly higher than the values for the correspondent years on the Eskom website[23].

Definitions;

$$Gross = \frac{Electricity\ generation + Parasitic\ load}{Fuel\ consumption}$$

Equation 1

$$Net = \frac{Output\ electricity\ generation}{Fuel\ consumption}$$

Equation 2

Step 4: Calculation of the operating margin emission factor

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units (Option A1 of the methodological tool). This option utilizes equations 6 and 7.

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Equation 3

[22] *http://www.eskom.co.za/live/content.php?Item_ID=4226*

[23] *"Electricity supply statistics of South Africa, 2005"* Retrieved from the Nersa website.

Where;

$EF_{grid,OMsimple,y}$	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power plant/unit m in year y (MWh)
$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	All power plants/units serving the grid in year y except low-cost/must-run power plants/units
y	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

And,

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Equation 4

Where;

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power plant/unit m in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) fossil fuel type *i* in year y (GJ/mass or volume)
$EF_{CO2,i,y}$	CO^2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	All power plants/units serving the grid in year y except low-cost/must-run power plants/units
i	All fossil fuel types combusted in power plant/unit m in year y
y	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

The simple operating margin was calculated based on the ex-ante option. The information was available from the Eskom website for the years 2008/9, 2009/10 and 2010/11 and the calorific values for these years were taken from the Eskom annual report, 2011[24]. The power plants not included were low-cost/must-run which were identified as nuclear, hydro, low-cost biomass and solar generation. The power plants to be evaluated were coal-fired and liquid fuel power stations. The liquid fuel power stations however constituted 2% of the total generation and were therefore excluded. This exclusion is because the emissions associated with the liquid fuel power stations were considered negligible, and the specific data per station for 2008/9, 2009/10 and 2010/11 are not available. The 3-year average energy generation is used for the calculation of the generation-weighted average CO_2 emissions per unit of electricity generated.

Table 15 presents an overview of the data for the Operating Margin Emission factor.

[24] *"Eskom annual report 2011"* Retrieved from the Eskom website.

Table 15: OM emission factor

Power Station Name	Generation (*3 year average*) *MWh / year*	Weight %	EF_i t CO_2/MWh	$EF_{OM,simple,y}$ t CO_2/MWh
Arnot	12,470,008	5.8%	0.96	0.06
Duvha	21,539,408	10.0%	0.95	0.09
Hendrina	12,126,062	5.6%	1.06	0.06
Kendal	24,265,563	11.2%	1.11	0.12
Kriel	17,422,804	8.1%	0.95	0.08
Lethabo	24,867,765	11.5%	1.28	0.15
Matimba	27,461,083	12.7%	0.95	0.12
Majuba	23,216,530	10.8%	0.99	0.11
Matla	21,774,119	10.1%	1.04	0.10
Tutuka	20,139,839	9.3%	0.96	0.09
Camden (re-instated '2005-06)	7,157,328	3.3%	1.12	0.04
Grootvlei (re-instated '2007-06)	2,484,246	1.2%	1.08	0.01
Komati	1,025,388	0.5%	1.14	0.01
TOTAL	**215,950,144**	**100.0%**		**0.98**

The resulting emission factor of the operating margin is 0.98 tCO_2/MWh

Step 5: Identify the cohort of power units to be included in the build margin

The sample of power units used to calculate the build margin consists of:

- the set of five power units that have been built most recently, or
- the set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and have been built most recently.

Project participants should use the set of power units that comprises the larger annual generation, which in South Africa is the first option. For the purpose of calculating the emission factor, the five power units that have been built most recently are:

- Majuba, commissioned in 1996
- Kendal, commissioned in 1988
- Matimba, commissioned in 1987
- Lethabo, commissioned in 1985
- Tutuka, commissioned in 1985

If the commissioning data is taken into consideration, the Tutuka power plant should be replaced by the Palmiet pump storage facility. This facility is instated in 1988, but the necessary recent production data is not provided by Eskom. Replacing Palmiet with Tutuka is a conservative measure because including the Palmiet data will increases the emission factor of the build margin. Although the emissions of Palmiet are zero it is a small power unit in comparison to the other units in the build margin. Including Tutuka, being a large power unit with a relatively low emission factor, has a strong effect on lowering the overall emission factor of the build margin. Palmiet, due to its small size, does not have this effect.

Step 6: Calculate the build margin emission factor

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available. This is calculated with equation 8.

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Equation 5

Where;

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

The CO_2 emission factor of each power unit m ($EL_{EL,m,y}$) should be determined as illustrated in step 4 of the guidance for the simple OM, using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

If for a power unit *m* data on fuel consumption and electricity generation is available the emission factor ($EF_{EL,m,y}$) should be determined using equation 9.

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Equation 6

Where;

$EF_{EL,m,y}$	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) fossil fuel type *i* in year y (GJ/mass or volume)
$EF_{CO2,i,y}$	CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	Net electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	All power plants/units serving the grid in year y except low-cost/must-run power plants/units
i	All fossil fuel types combusted in power plant/unit m in year y
y	Most recent historical year for which power generation is available

Table 16 presents an overview of the data for the Build Margin Emission factor.

Table 16: BM emission factor

Power Station Name	Generation 2010/2011 MWh / year	Fuel use 2010/2011 Ton coal / year	Weight %	EF_i t CO_2/MWh	$EF_{BM,simple,y}$ t CO_2/MWh
Majuba	24,632,585	13,020,512	20.0%	0.96	0.19
Kendal	25,648,258	15,174,501	20.9%	1.08	0.22
Lethabo	25,500,366	17,774,699	20.7%	1.27	0.26
Tutuka	19,067,501	10,191,709	15.5%	0.97	0.15
Matimba	28,163,040	14,596,842	22.9%	0.94	0.22
TOTAL	**123,011,750**	**70,758,263**	**100.0%**		**1.05**

The resulting emission factor of the build margin is **1.05 tCO_2/MWh**

Step 6: Calculate the combined margin emission factor

The combined margin emission factor is determined with equation 10.

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

Equation 7

Where;

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

The following default values should be used for wOM and wBM:

- Wind and solar power generation project activities: wOM = 0.75 and wBM = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.
- All other projects: wOM = 0.5 and wBM = 0.5 for the first crediting period, and wOM = 0.25 and wBM = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Considering that the "LED's kick-off" programme does not involve wind and solar power generation the default value used for wOM and wBM is 0.5. The resulting emission factor of the combined margin is:

$EF_{grid,CM,y}$ = 0.98 x 0.5 + 1.05 x 0.5 = 1.01 tCO_2/MWh

B. BASE LINE EMISSIONS

The baseline energy consumption of the equipment replaced in the PoA is measured during the distribution of LEDs by recording the number and power rating of each device replaced. In addition, the operating hours are measured by monitoring the distributed LEDs ex-post in a representative sample of participants in the PoA, and each SSC-CPA.

$$BE_y = E_{BL,y} \times EF_{CO2,ELEC,y}$$

Equation 8

$$E_{BL,y} = \Sigma i \ (n_i \times p_i \times o_i)/(1 - l_y)$$

Equation 9

Where;

BE_y	Baseline emissions in monitoring period *y* (tCO_2e)
$E_{BL,y}$	Energy consumption in the baseline in monitoring period *y* (kWh)
$EF_{CO2,ELEC,y}$	Emission factor in monitoring period *y* calculated in accordance with "Tool to calculate the emission factor for an electricity system". (tCO_2/MWh)
Σi	The sum over the group of "i" devices replaced (brownfield) and "i" devices avoided installation (greenfield), for which the substituted energy efficient equipment is operating during the monitoring period of the project.
n_i	The number of devices of the group of "i" devices replaced (brownfield) and "i" devices avoided installation (greenfield), for which the substituted energy efficient equipment is operating during the monitoring period.
p_i	The power of the devices of the group of "i" devices replaced (brownfield) and "i" devices avoided installation (greenfield).
o_i	The average operating hours during the monitoring period of the devices of the group of "i" devices replaced (brownfield) and "i" devices avoided installation (greenfield).
l_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. A default value of 0.1 shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable.

C. PROJECT ACTIVITY EMISSIONS

The project energy consumption of each SSC-CPA is measured during the distribution of LEDs by recording the number and power rating of each LED placed under the SSC-CPA. In addition, the utilization hours are measured by monitoring the distributed LEDs ex-post in a representative sample of participants in the SSC-CPA.

$$PE_y = E_{P,y} \times EF_{CO2,ELEC,y}$$

Equation 10

$$E_{P,y} = \Sigma k \ (n_k \times p_k \times o_k)/(1 - l_y)$$

Equation 11

Where;

PE_y	Project emissions in monitoring period *y* (tCO_2e)
$E_{P,y}$	Energy consumption due to the project in monitoring period y (kWh)

$EF_{CO2,ELEC,y}$	Emission factor in monitoring period *y* calculated in accordance with "Tool to calculate the emission factor for an electricity system". (tCO_2/MWh)
Σk	The sum over the group of "k" energy efficient equipment that is operating during the monitoring period of the project.
n_k	The number of devices of the group of "k" energy efficient equipment that is operating during the monitoring period. This parameter will be corrected with the monitoring data on failure of devices throughout the monitoring period.
p_k	The power of the devices of the group of "k" energy efficient equipment that is operating during the monitoring period.
o_k	The average operating hours during the monitoring period of the devices of the group of "k" energy efficient equipment.
l_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. A default value of 0.1 shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable.

D. EMISSION REDUCTION

The emission reduction achieved by the project activity shall be determined as the difference between the baseline emissions and the project emissions and leakage.

$$ER_y = (BE_y - PE_y) - LE_y$$

Equation 12

Where;

ER_y	Emission reductions from avoided electricity consumption in year *y* (tCO_2/y)
BE_y	Baseline emissions from electricity consumption in year *y* (tCO_2/y)
PE_y	Project emissions from electricity consumption in year *y* (tCO_2/y)
LE_y	Leakage emissions in year *y* (tCO_2/y). The leakage effect of the use of the replaced equipment in another activity can be neglected if the replaced equipment is scrapped[25].

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

Data / Parameter:	$EF_{CO2,ELEC,y}$
Data unit:	$kgCO_2$/kWh
Description:	Emissions factor for electricity displaced from the grid relevant to the project boundary.
Source of data used:	Eskom CDM resource data.

[25] As described in the monitoring section, if equipment is not scrapped, there will be deemed to be no emission reductions for the equipment not destroyed

Value applied:	1.01
Justification of the choice of data or description of measurement methods and procedures actually applied :	Project coordinator has obtained latest data from government sources and applied calculation methodology specified in "Tool to calculate the emission factor for an electricity system" version 2.2.0. Details of calculations are provided in E.6.2. "Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA".
Any comment:	$EF_{CO2,ELEC,y}$ is fixed for the lifetime of the PoA. If at time of (a) inclusion of PoA or (b) at the time of the renewal of a crediting period of each CPA, the fixed emission factor is deviating more than 10% from the emission factor calculated at the start or at the previous renewal of the CPA's crediting period, a re-calculated emission factor needs to be used. This emission factor checking will guarantee that each CPA will use an emission factor following the development of the South African electricity market.

Data / Parameter:	l_y
Data unit:	%
Description:	Average annual technical grid losses (transmission and distribution) during year y for the grid serving the locations where the devices are installed.
Source of data used:	Eskom year report 2011 (page 324)
Value applied:	8.3%
Justification of the choice of data or description of measurement methods and procedures actually applied :	A default value of 0.1 shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable. The Eskom year report 2011 reports line losses of 8.3%. This data is considered to be accurate and reliable, and is thus applied.
Any comment:	l_y is fixed for the lifetime of the PoA. If at time of (a) inclusion of PoA or (b) at the time of the renewal of a crediting period of each CPA, the fixed grid losses are deviating more than 10% from the grid losses calculated at the start or at the previous renewal of the CPA's crediting period, a re-calculated grid loss needs to be used. This grid loss checking will guarantee that each CPA will use an grid loss following the development of the South African electricity market.

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

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

Data / Parameter:	n_i
Data unit:	Number
Description:	Number of replaced equipment collected (brownfield) and number of avoided equipment installed (greenfield) in the baseline. The SSC-CPA implementer will make a distinction between brownfield and greenfield in the database entry which allows for allocation in a later stage. For the calculation of the emission reduction both brownfield and greenfield are placed under the same parameter for simplicity.
Source of data to be used:	SSC-CPA implementer
Value of data applied	To be determined for each CPA

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	At the time of the exchange/installation a record will be kept of the number of replaced equipment (brownfield) and the avoided equipment installed (greenfield). The SSC-CPA implementer will make a distinction between brownfield and greenfield in the database entry, which allows for allocation in a later stage. For the calculation of the emission reduction both brownfield and greenfield are placed under the same parameter for simplicity. Each employee involved in the project will work with an electronic handheld device (PDA) that updates this database automatically ensuring an accurate record keeping. Industry standard software, databases, infrastructure and backup procedures will allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misreported, overwritten or lost. Data entry occurs decentralised at point of replacement, with the full database stored at a central location. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate names and addresses, and a valid and accurate number of replaced equipment. As per AMS.II.C. an independent auditor will be required to verify the collection and subsequent destruction of the replaced equipment. All data will be stored in the project database for at least two years after the crediting period or the last issuance of CERs, for this programme, whichever occurs later.
QA/QC procedures to be applied:	A CME representative will perform spot-checks on data entries by the CPA-owner in order to minimise data entry errors.
Any comment:	All data will be stored in the project database for at least two years after the crediting period or the last issuance of CERs, for this programme, whichever occurs later. As per paragraph 12 of AMS II.C. Demand-side energy efficiency activities for specific technologies (v13) a representative sample of the replaced devices (including the number and "power") will be recorded to allow for physical verification by the DOE. The number and "power" of the replaced equipment to be recorded for physical verification is based on the identified samples within the metered sampling survey ($\mathbf{S_{metered,k}}$). That means, if a meter is installed the replaced lamp is collected and stored for verification.

Data / Parameter:	$\mathbf{n_{scrapped}}$
Data unit:	Number
Description:	Number of replaced equipment collected (brownfield) that is scrapped under the SSC-CPA
Source of data to be used:	Database SSC-CPA
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A; available only *ex-post*.
Description of measurement methods and procedures to be	As per the methodology AMS-II.C Demand-side energy efficiency programmes for specific technologies (version 13) replaced equipment (old lamps) must be scrapped, in order to prevent leakage and ensure correct disposal. The contracted

applied:	scrapping entity will provide independently verified data on the scrapped equipment. This allows for a check whether the number of project activity equipment distributed by the SSC-CPA and the number of scrapped equipment correspond with each other. The scrapping of replaced equipment will be documented and independently verified
QA/QC procedures to be applied:	A CME representative will perform spot-checks on data entries by the CPA-owner in order to minimise data entry errors.
Any comment:	-

Data / Parameter:	$\mathbf{n_k}$
Data unit:	Number
Description:	Number of operational LED equipment in the project
Source of data used:	SSC-CPA implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	To be determined for each CPA
Description of measurement methods and procedures to be applied:	At the time of the exchange a record will be kept of the number of LED equipment. This information will be stored in the project database. Each employee involved in the project will work with a PDA that updates this database automatically ensuring an accurate record keeping. Industry standard software, databases, infrastructure and backup procedures will allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misreported, overwritten or lost. Data entry occurs decentralised at point of replacement, with the full database stored at a central location. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate names and addresses, and a valid and accurate number of installed LED equipment. When installed the monitoring of the sample group will provide the information regarding failure rate back to the centralised database. This information will then be extrapolated throughout the total installed LED population.
QA/QC procedures to be applied:	All data will be stored in the project database for at least two years after the crediting period or the last issuance of CERs, for this programme, whichever occurs later.
Any comment:	-

Data / Parameter:	$\mathbf{p_i}$
Data unit:	Watts
Description:	The power of the replaced equipment (brownfield) or the most conservative common practice power of the avoided equipment installed (greenfield) in the baseline.
Source of data to be used:	Nameplate data
Value of data applied	To be determined for each CPA

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	At the time of the exchange a record will be kept of the wattage of replaced equipment (brownfield) or the most conservative common practice power of the avoided equipment installed (greenfield). This information will be stored in the project database. Each employee involved in the project will work with a PDA that updates this database automatically ensuring an accurate record keeping. Industry standard software, databases, infrastructure and backup procedures will allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misreported, overwritten or lost. Data entry occurs decentralised at point of replacement, with the full database stored at a central location. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate names and addresses, and a valid and accurate wattage of replaced equipment.
QA/QC procedures to be applied:	A CME representative will perform spot-checks on data entries by the CPA-owner in order to minimise data entry errors.
Any comment:	All data will be stored in the project database for at least two years after the crediting period or the last issuance of CERs, for this programme, whichever occurs later. As per paragraph 12 of AMS II.C. Demand-side energy efficiency activities for specific technologies (v13) a representative sample of the replaced devices (including the number and “power”) will be recorded to allow for physical verification by the DOE. The number and “power” of the replaced equipment to be recorded for physical verification is based on the identified samples within the metered sampling survey ($\mathbf{S}_{\mathbf{metered,k}}$). That means, if a meter is installed the replaced lamp is collected and stored for verification.

Data / Parameter:	$\mathbf{p_k}$
Data unit:	Watts
Description:	The power of the installed LED equipment in the project.
Source of data to be used:	Nameplate data
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined for each CPA
Description of measurement methods and procedures to be applied:	At the time of the exchange a record will be kept of the wattage of installed LED equipment. This information will be stored in the project database. Each employee involved in the project will work with a PDA that updates this database automatically ensuring an accurate record keeping. Industry standard software, databases, infrastructure and backup procedures will allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misreported, overwritten or lost. Data entry occurs decentralised at point of replacement, with the full database stored at a central location. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate names and addresses, and a valid and accurate wattage of installed LED equipment.
QA/QC procedures to	All data will be stored in the project database for at least two years after the

be applied:	crediting period or the last issuance of CERs, for this programme, whichever occurs later. A CME representative will perform spot-checks on data entries by the CPA-owner in order to minimise data entry errors.
Any comment:	-

Data / Parameter:	$S_{metered}$
Data unit:	Number
Description:	Total sample size of metered equipment used for monitoring operating hours failure rates of project devices. Whenever a meter is installed, the replaced lamp is collected and stored for verification. This is in line with the requirements of paragraph 12 of AMS-II.C. The increase in sample size for the PoA will be identified and documented before the start date of crediting period of each SSC-CPA.
Source of data to be used:	Sample size will be determined based on the; • Population Size • Confidence • Precision • Variability Confidence-Precision ratio of 90-10 is in line with the requirement of *Standard for sampling and surveys for CDM project activities and programme of activities (Version 02.0)*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined for each CPA
Description of measurement methods and procedures to be applied:	Sample size is determined with a confidence precision ratio of 90/10. This is in line with the requirements listed in the Standard and Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 4 Version (03.0) and Annex 5 Version (02.0). The PoA uses a stratified sampling procedure, the population is first partitioned into disjoint classes (the strata) which together are exhaustive. Thus each population element should be within one and only one stratum. Then a simple random sample is taken from each stratum. For the LED's kick-off PoA the following strata are identifed in the table below: **Indoor** – Low power: <40 Watt, IL (Indoor Low); High power: ≥ 40 Watt, IH (Indoor High) **Outdoor** – Low power: <20 Watt, OL (Outdoor Low); High power: ≥ 20 Watt, OH (Outdoor High) $S_{metered}$ is defined per stratum. If $\mathbf{n_k}$ does not include LEDs in one or more of the strata, these strata are logically not used to select a sample group from. The sample size is to be calculated for every stratum of each CPA using equation provided in Annex 4.

Strata table (from the cell above):

Indoor		**Outdoor**	
Low power	High power	Low power	High power
<40 Watt	≥ 40 Watt	<20 Watt	≥ 20 Watt
IL (Indoor Low)	IH (Indoor High)	OL (Outdoor Low)	OH (Outdoor High)

QA/QC procedures to be applied:	To ensure there are proper QA/QC in places for the monitoring of the operating hours, the CME will need to approve the monitoring entity hired by the CPA owner. The monitoring entity will install the meters and monitor the operating hours.
Any comment:	See Annex 4 for further details.

Data / Parameter:	$S_{non\text{-}metered}$
Data unit:	Number
Description:	The managing entity will identify and document a sample group of non-metered equipment which will be subject to annual checks to ensure that the LEDs installed are still operating.
Source of data to be used:	Sample size will be determined based on the; • Population Size • Confidence • Precision • Variability Confidence-Precision ratio of 90-10 is in line with the requirement of *Standard for sampling and surveys for CDM project activities and programme of activities (Version 02.0)*
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be determined for each CPA
Description of measurement methods and procedures to be applied:	Sample size is determined with a confidence precision ratio of 90/10. This is in line with the requirements listed in Standard and Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 4 Version (03.0) and Annex 5 Version (02.0). The PoA uses a stratified sampling procedure, the population is first partitioned into disjoint classes (the strata) which together are exhaustive. Thus each population element should be within one and only one stratum. Then a simple random sample is taken from each stratum. For the LED's kick-off PoA the following strata are identifed in the table below: **Indoor** — Low power: <40 Watt, IL (Indoor Low); High power: ≥ 40 Watt, IH (Indoor High) **Outdoor** — Low power: <20 Watt, OL (Outdoor Low); High power: ≥ 20 Watt, OH (Outdoor High) $S_{non\text{-}metered}$ is defined per stratum. If $\mathbf{n_k}$ does not include LEDs in one or more of the strata, these strata are logically not used to select a sample group from. The sample size is to be calculated for every stratum of each CPA using equation provided in Annex 4.
QA/QC procedures to	To ensure there are proper QA/QC in places for the non-metered sampling

Strata table:

Indoor		Outdoor	
Low power	High power	Low power	High power
<40 Watt	≥ 40 Watt	<20 Watt	≥ 20 Watt
IL (Indoor Low)	IH (Indoor High)	OL (Outdoor Low)	OH (Outdoor High)

be applied:	survey, the CME will need to approve the monitoring entity hired by the CPA owner. The monitoring entity will execute the non-metered sampling survey
Any comment:	See Annex 4 for further details.

Data / Parameter:	$\mathbf{o_k}$
Data unit:	Hours
Description:	The average annual operating hours of LED equipment distributed.
Source of data to be used:	Periodic readings of monitoring equipment.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Product type dependent.
Description of measurement methods and procedures to be applied:	Electronic metering equipment installed in monitoring sample group. This equipment will feed monitoring information/operating hours back to a centralised database.
QA/QC procedures to be applied:	No additional QA/QC procedures need to be planned.
Any comment:	All data will be stored in the project database for at least two years after the crediting period or the last issuance of CERs for this programme, whichever occurs later.

Data / Parameter:	$\mathbf{r_{failure}}$
Data unit:	%
Description:	Mean annual failure rate of the installed LED equipment.
Source of data used:	Periodic non-metered sampling survey(s).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A; available only *ex-post*.
Description of measurement methods and procedures to be applied:	Annual survey of non-metered sampling group for each stratum. Data will be aggregated and stored in the central database.
QA/QC procedures to be applied:	The survey will consist of identifying LED lighting equipment, based on their 'exact installation location' that are installed and operating. The exact installation location is the entry in the database that allows for an unique identification. While LED lighting equipment replaced as part of a regular maintenance or warranty program can be counted as operating, LED lighting equipment cannot be replaced as part of the survey process and counted as operating.
Any comment:	The number of LEDs to be included under the survey, per stratum is defined

	under $S_{non\text{-}metered,k}$

Industry standard software, databases, infrastructure and backup procedures will allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misreported, overwritten or lost. Data entry occurs decentralised at the point of LED lighting equipment installation. The full database is stored centrally.

Aggregated data will be stored in the central data base for at least two years after the crediting period or the last issuance of CERs to the programme, whichever occurs last.

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

Monitoring is conducted on PoA level.

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)

The final draft of this baseline section has been completed on 23/04/2012 by Mr. Kim van der Leeuw, Ms. Claudia Doets, Mr. Edwin Dalenoord and Ms. Katrin Heer.

The baseline and monitoring methodology has been prepared by Do-inc business B.V.

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Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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Annex 3

BASELINE INFORMATION

Plant names	Installed capacity (MW)	Commissioning date	Fuel type	Fuel consumption	UoM	2008/9	2009/10	2010/11
Arnot	1980	9/21/71	Coal	30,114,258	tonnes/year	6395805	6794134	6525670
Duvha	3450	1/18/80	Coal	54,903,663	tonnes/year	11393553	11744606	10639393
Hendrina	1895	5/12/70	Coal	32,986,509	tonnes/year	7122918	6905917	7139198
Kendal	3840	10/1/88	Coal	74,010,300	tonnes/year	15356595	13866514	15174501
Kriel	2850	5/6/76	Coal	49,175,255	tonnes/year	9420764	8504715	9527185
Lethabo	3558	12/22/85	Coal	79,732,564	tonnes/year	16715323	18170227	17774699
Matimba	3690	12/4/87	Coal	62,281,318	tonnes/year	13991453	14637481	14596842
Majuba	3843	4/1/96	Coal	31,204,762	tonnes/year	12554406	12261833	13020512
Matla	3450	9/29/79	Coal	65,352,916	tonnes/year	12689387	12438391	12155421
Tutuka	3510	6/1/85	Coal	35,024,656	tonnes/year	11231583	10602839	10191709
Camden	1600	12/21/66	Coal	390	tonnes/year	3876211	4732163	4629763
Grootvlei	1200	6/30/69	Coal	0	tonnes/year	674538	1637371	2132979
Komati	1000	6/30/69	Coal	0	tonnes/year	0	664497	1271010

	Electricity generation MWh/ year		
	2008/9	2009/10	2010/11
Arnot	11987281	13227864	12194878
Duvha	21769489	22581228	20267508
Hendrina	12296687	12143292	11938206
Kendal	23841401	23307031	25648258
Kriel	18156686	15906816	18204910
Lethabo	23580232	25522698	25500366
Matimba	26256068	27964141	28163040
Majuba	22676924	22340081	24632585
Matla	21863400	21954536	21504422
Tutuka	21504122	19847894	19067501
Camden	6509079	7472070	7490836
Grootvlei	1249556	2656230	3546952
Komati	0	1016023	2060141

		2008/09	2009/10	2010/11
NCV (Eskom Annual Report 2011)	GJ/t Coal	18.51	19.1	19.22

EF (IPCCC default)	tCO_2/GJ	0.0946

"Eskom annual report 2011"
World Wide Web; http://www.eskom.co.za/c/article/236/cdm-calculations/ *CDM resource page.*

Annex 4

MONITORING INFORMATION

Confidence/precision

As per EB 69, Standard and Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 4 Version (03.0) and Annex 5 Version (02.0) -as there is no specific guidance in the applicable methodology (*AMS -II.C. Demand-side energy efficiency activities for specific technologies*) *version 13* - project proponents shall use 90/10 confidence/precision as the criteria for reliability of sampling efforts for small-scale project activities.

Sample frame

The sampling approach chosen is Stratified Random Sampling (II B in EB 69 Annex 5 page 3[26]), within the strata Simple Random Sampling is applied (II A in EB 69 Annex 5 page 3[27]). Strata are presented in Table 17.

Table 17: Overview of strata

Stratum	IL	IH	OL	OH
Location	Indoor	Indoor	Outdoor	Outdoor
Power	Low power (<40 Watt)	High power (≥ 40 Watt)	Low power (<20 Watt)	High power (≥ 20 Watt)

All equipment in $\mathbf{n_k}$ is allocated to a stratum and within the stratum sample groups $S_{metered}$ and $S_{non\text{-}metered}$ are selected randomly. If one or more of the strata remain empty, these strata are logically not used to select sample groups from.

Sample size determination

To determine the sample size of $S_{metered}$ and $S_{non\text{-}metered}$ for each stratum under a CPA is to be determined following the formulas presented under EB 69, Annex 5 Version (02.0) page 22 (18)[28].

$$n \geq \frac{1.645^2 \times NV}{(N-1) \times 0.1^2 + 1.645^2 V}$$

[26] Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 5 Version (02.0).

[27] See footnote 26

[28] See footnote 26

Where:

$$V = \left(\frac{SD}{mean}\right)^2$$

equation 18 of EB 69, Annex 5

n	Sample size
N	Total number of LEDs installed within a stratum
1.645	Represents the 90% confidence required
0.1	Represents the 10% relative precision
SD	Is the overall Standard Deviation
mean	Is the overall mean

Following EB 69 Annex 5 (version 2.0) Appendix A - Best practice examples for sample size calculations article 41[29] if SD and mean are not known these parameters can be can be estimated using different ways:

a) We may refer to the result of previous studies and use these results;
b) In a situation where we do not have any information from previous studies, we could take a preliminary sample as a pilot and use that sample to provide our estimates;
c) We could use 'best guesses' based on the researcher's own experiences.

Note that following EB 69 Annex 5 (version 2.0) Appendix A - Best practice examples for sample size calculations article 42[30] if the standard deviation is unknown but the range (maximum - minimum) is known then a rough 'rule of thumb' is that the standard deviation can be estimated as the range divided by 4.

With the estimates from SD and mean equations 18 can subsequently filled out. A sample size calculator has been built to determine the sample size of $S_{metered}$ and $S_{non\text{-}metered}$ for each stratum under a CPA [31].

According to EB 69 Annex 4 (version 3.0) page 15 Section IV Sampling Requirements article 12 a minimum sample size of 30 shall be chosen if the sample size calculation returns a value of less than 30 samples[32]

[29] Guidelines for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 5 Version (02.0).

[30] See footnote 29

[31] Submitted to validator

[32] Standard for sampling and surveys for CDM project activities and programme of activities EB 69, Annex 4 Version (03.0).

Operation time LEDs

The operation time of the LED lighting equipment in the metered sample will be measured. For each monitoring period a mean value is calculated; this value is used for the operating hours of all LED lighting within the respective stratum

The meter to be used is designed to measure electrical parameters of LED lighting equipment. The measured data is stored and a) relayed to Central Server digitally or b) obtained by manual read out. It is possible to down load data on a computer using an interface cable.

The figure below illustrates a typical screenshot showing the typical sampling data, the responsible monitoring actor received from an installed meter. The meter precisely records the date of switch on and switch off of the sample and calculates the duration of each operation sequence. Summed up over the entire day, the responsible monitoring actor can then calculate the daily operation time of the equipment.