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):

>>Sustainability CFL Replacement Programme of Activities in South Africa

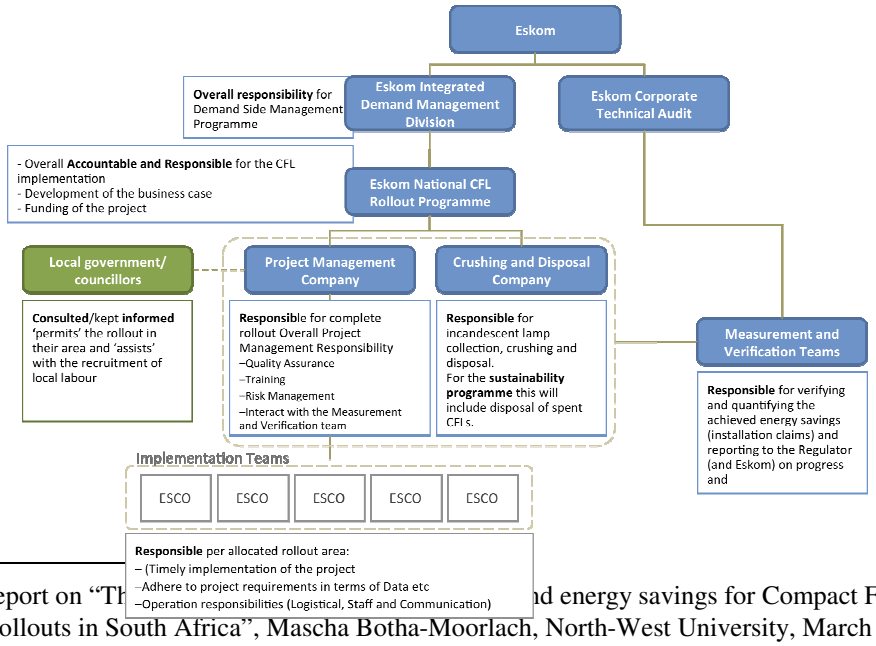
25th July 2011. Version 1

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

1. General operating and implementing framework of PoA

The Programme of Activities (PoA) will consist of a series of projects (CPAs) implemented by Energy Service Companies (ESCOs) under the direction of Eskom Holdings Limited, whom will act as the Coordinating/Managing Entity (CME). The PoA will provide energy efficient light bulbs, in the form of compact fluorescent lamps (CFLs), to replace incandescent lamps (ICLs) or failed CFLs from previous Eskom campaigns in residential properties. By providing CFLs free of charge to each household via direct installation (all possible CFLs in the household) or by exchange (up to 6 CFLs), the programme will abate greenhouse gas emissions, significantly reduce national electricity demand and stress on energy infrastructure, and save individual households money on their electricity bills.

While Eskom has encouraged and supported the adoption of CFLs in residential households, due to the economic capacity of the majority of people in South Africa, CFLs remain an item outside of the household's budget. Current data shows ICLs are still the preferred option for lighting, including the cases where a household previously received CFLs from other Eskom campaigns and those CFLs have reached their end of lifetime and failed.[1]
The PoA will include awareness raising through an information pamphlet provided with the CFLs, as well as targeted media. Such environmental messaging will promote behavioural change, encouraging further energy savings through addressing the use of energy intensive technologies such as electrical appliances.



[1] A Report on "Th nd energy savings for Compact Fluorescent Lamp door-to-door rollouts in South Africa", Mascha Botha-Moorlach, North-West University, March 2009

2. Policy/measure or stated goal of the PoA

The PoA has the objective of maintaining the energy efficiency of South Africa's residential lighting stock achieved by previous Eskon CFL projects, by distributing CFLs free of charge to households across South Africa. These new CFLs will replace both ICLs installed by households or failed CFLs from previous Eskom campaigns. The objective of the PoA is to prevent households reverting back to ICLs once CFLs from previous Eskom programs reach the end of their rated life and begin to fail.

Through the PoA, a variety of mechanisms to distribute the CFLs will be offered including: (i) door to door replacement using direct installation, (ii) gate to gate exchange of up to 6 working ICLs or failed CFLs, (iii) stationary exchange points for replacement of up to 6 working ICLs or failed CFLs.

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

The PoA is a voluntary action initiated by the CME. There are no laws mandating the use of energy efficient lighting technologies in South Africa. All householders participating in SSC-CPAs under the PoA will do so through a voluntary collaboration with the CME, the program's technology partners and local ESCOs.

Contribution of the PoA to Sustainable Development
The PoA makes a significant contribution to Sustainable Development in South Africa. The section below sets out the key program deliverables across economic, social and environmental parameters.

Contribution to national economic development
The PoA will contribute significantly to South Africa's national economic development through encouraging the more efficient use of electricity by residential energy consumers. Energy savings at both individual homes and national levels make important contributions to South Africa's economic efficiency and sustainability, particularly in the context of the rising demand for electricity currently occurring in South Africa. As per the table below[2], residential electricity demand is approximately 35% of national generation capacity, and as such any efficiency gains made in this sector will have significant benefits for the national economy.

Table 1: Current sector energy and demand contributions
(2007 Electricity sales analysis, 2010 (Eskom, 2010) demand and consumption data).

Market Sector	Demand (MW)	% of total	Energy (GWh)	% of total
Residential	12 593	35.1%	45 788	19.7%
Agriculture	1 288	3.6%	9 187	3.9%
Mining	4 173	11.6%	34 542	49.8%
Manufacturing	12 692	35.4%	115 926	14.8%
Commercial	3 307	9.2%	23 743	10.2%

[2] Source: Eskom. (2010). Eskom Annual Report 2010. Johannesburg: Eskom

Traction	635	1.8%	3 627	1.6%
General	1 162	3.2%		
Total	**35 850**	**100%**	**232 812**	**100%**

The Demand Side Management (DSM) programme administered by the national utility, Eskom, has recognized the contribution that lighting can make to achieve national energy efficiency objectives in its Accelerated Energy Efficiency Plan (AEEP)[3]. This plan aims to save 3000MW by 2012 and a further 5000 MW by 2025. Eskom's DSM website states: "The efficient use of electricity has become a national priority, a necessity for the future development of the South African economy and effective provision of electricity." The South African Government has recognized the specific need for energy efficiency in the residential sector since at least 2005, with the publication of the Energy Efficiency Strategy. The strategy links energy sector development with national socio-economic development plans, and sets a target for improved energy efficiency in South Africa residential sector of 10% by 2015. Improving energy efficiency reduces the need to build more electricity generation capacity. This is particularly important given the high cost associated with energy infrastructure, as well as the fact that building such fossil fuel infrastructure 'locks-in' future greenhouse gas emissions in the South African economy.

Finally, the sale of CERs in the international carbon market by the project proponents will have a positive foreign exchange impact for South Africa.

Contribution to social development in South Africa

As well as supporting national energy efficiency policies and delivering macro-economic benefits through reduced energy infrastructure costs, the PoA delivers significant socio-economic benefits for participants through job creation and delivering energy savings to households.

In order to deliver the PoA, Eskom will engage (directly and through partnerships) a large workforce over the short to medium term, to install and distribute the lighting products, as well as manage M&V tasks associated with the CPAs. This will have positive social impacts in terms of employment through the creation of a number of semi-skilled jobs in Energy Services Companies (ESCOs) and skilled jobs in local Universities.

It is expected that the proposed PoA will distribute significant volumes of CFLs and as such can be expected to create similar numbers of jobs within the South African economy. An estimated number of jobs created by the distribution of 20 million CFLs can be found below:

[3] Further details regarding Eskom's DSM program: http://www.eskomdsm.co.za/?q=Programme+Overview

ESCO Resources	Southern Region	Northern Region	Eastern Region	North Western Region	Central Region	Overall Total
Project Managers	47	107	53	0	27	234
Supervisors	157	253	307	0	67	784
Store Managers	50	120	67	0	13	250
Drivers	67	200	40	0	27	334
Field Workers	3,870	5,480	6,720	1,733	1,547	19,350
Admin	53	133	53	0	27	266
Data Capturers	107	253	107	0	67	534
TOTAL	4,351	6,547	7,347	1,733	1,773	21,751

In addition to job creation, the CFLs installed will deliver participating households cost savings on their electricity bills. A 60W ICL exchanged for a 15W CFL will deliver approximately R40 per year in cost savings (based on electricity price of R0.71/kWh). A household exchanging six CFLs will generate annual cost savings in the order to €25. This is a material saving for low and middle-income households, and when delivered at the scale contemplated under the PoA will mean significant gains for the residential sector with flow on benefit across society.

As well as the direct financial benefit to households in terms of savings on their electricity bills each year, the PoA will also generate a range of less tangible social outcomes in education and awareness. This raised awareness creates an opportunity for collective action on climate change, enhancing a sense of community, and empowering individual households.

Contribution to Environmental Sustainability

The introduction of energy efficient lighting in households will reduce the consumption, and hence generation of electricity. In addition to reducing GHGs, the PoA will therefore reduce the harmful gases and particulate matter produced during the burning of fossil fuels to produce electricity. The high dependence on coal and conventional thermal power stations in the electricity generation sector of South Africa means that energy efficiency interventions have a significant positive impact on the sustainability of fossil fuel reserves.

It is estimated that in 2009 electricity generation in South Africa led to the emission of 1.87Mt SO_2, 2,801 tNO_x, 10 tonnes of Mercury and 55,600 tonnes of particulates[4]. Each SSC-CPA within the PoA will reduce electricity consumption by up to 60 GWh/year making a significant contribution to a reduction in these harmful gases. The table below lists the estimated annual emission reductions of these pollutants based on 60 GWh of electricity savings per year:

[4] Sources: Eskom Annual Report, 2009; and "Emissions of mercury associated with coal fired power stations in South Africa, 2010", South African Department of Environmental Affairs & Tourism

Table A.1 Pollutant Emission Reductions from 60 GWh electricity savings

Pollutant	Annual Emission Reductions from 60GWh electricity saving
NOx	0.70 tonnes
SO_2	466 tonnes
Mercury	2.5 kg
Particulates	13.83 tonnes

Source: Calculations are based on data provided in Eskom Annual Report, 2009

The Programme of Activities is not expected to have a material impact on the biodiversity of ecosystems.

Technology Transfer
The Programme of Activities will facilitate the transfer of leading energy efficiency lighting technology into South Africa. This transfer largely occurs "South-South" (between developing countries), as the products to be used in the PoA are manufactured in China. By removing key barriers, the PoA will increase demand for, and provide access to, leading clean technologies and products.

Further transfer of knowledge is also made possible through the education and awareness-raising aspects of the PoA. Individual households will receive information regarding the benefits (financial and environmental) of energy efficiency. This information will empower these households who will better understand how their consumption behaviour and purchasing decisions relating to energy impact on their financial position.

Finally, by its very nature, the PoA provides a framework for replication of projects creating an inherent sustainability to the technology the implementation of CFLs in South Africa.

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

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

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Republic of South Africa	Eskom Holdings Limited	No

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 a project participant (Yes/No)
Republic of South Africa	Eskom Holdings Limited	No
France	BNP Paribas Limited	No

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:

>> The boundary of the PoA is defined as the geographical area within which all the implemented small scale CDM programme activities (SSC-CPAs) included in the PoA will occur. CFL equipment in the CPAs included in the PoA will be installed in households within the borders of the Republic of South Africa. Therefore, the boundary of the PoA is defined as Republic of South Africa.

For each SSC-CPA, the project boundary will be defined by the specific location of the installed lamps. The project boundary also includes the electricity grid to which the homes are connected.

The Programme of Activities aims to distribute between 20 to 40 million CFLs to households in the following provinces (in brackets the nearest city or town is provided):

- Eastern Cape (Port Elizabeth)
- Free State (Bloemfontein)
- Gauteng (Johannesburg)
- KwaZulu-Natal (Durban)
- Limpopo (Polokwane)
- Mpumalanga (Nelspruit)
- North West (Rustenburg)
- Northern Cape (Kimberley)
- Western Cape (Cape Town)

Figure 1. Geographical boundary of the PoA – South Africa.

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

Each SSC-CPA will involve the distribution and installation of CFLs for use by South African households. CFLs will be made available via the following distribution mechanisms:

Door to door installation

Door-to-door (direct) installation will be conducted by Energy Service Companies (ESCOs) staff, upon receiving agreement to do so by the householder. All working ICLs and/or failed CFLs from previous Eskom campaigns will be replaced by their equivalent CFL providing equal or better luminosity.

Gate to Gate Exchange

The gate-to-gate exchange will be conducted by ESCO staff at the door step of the householder when not granted permission, by the householder, to enter the premises and proceed with a direct installation. Up to six working ICLs or failed Eskom CFLs will be exchanged for free of charge.

Stationary Point Exchange

A large number of distribution points will be located within the area covered by the PoA. Residents will come to distribution points with their old ICLs or failed Eskom CFLs and exchange them for up to 6 CFLs free of charge. All exchanges will occur as detailed above. Each stand will have a computer with a data management system collecting the information (name, address, contact details) of each household as well as the wattages and number of ICLs exchanged for CFLs.

The distribution process will be supported by an education campaign to ensure households are aware of the project activity, and that distribution occurs relatively quickly. The method of distribution and associated awareness-raising campaigns will focus on providing the majority of CFLs to low income households.

In all cases, a data form has to be filled and signed by the household. The data from these forms will be captured within a data management system (DMS) within 48 hours of CFLs being installed/exchanged.

ICLs collected during the exchanges will be destroyed to prevent leakage. This process will be independently verified.

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

>>The PoA will provide energy efficient light bulbs, in the form of compact fluorescent lamps (CFLs), to replace incandescent light bulbs in residential properties.

CFLs require up to 80% less energy than incandescent bulbs to produce an equivalent lumen output, and last up to 10 times longer than standard incandescent bulbs. Replacing ICLs with CFLs results in significant reductions in electricity use for lighting, thereby reducing energy demand, cutting greenhouse gas emissions associated with the production of electricity, and saving households money on their electricity bills.

CFLs for the PoA may be supplied to the CME from one or several international lighting suppliers. All bulbs utilised in the project will meet international manufacturing and labelling standards and comply with Efficient Lighting Initiative (ELI) Guidelines. ELI, operated by the ELI Quality Certification Institute, is an international program for certifying the quality and efficiency of lighting products.

As per AMS-II.J (v.04), the total lumen output of the CFL should be equal to or more than that of the ICL being replaced (AMS-II.J, point 2).All CFLs will be available on B22 and E27 cap-bases and are for 22-240-grid voltage.

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

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The eligibility criteria for the PoA have been determined using the latest procedure set out by the Executive Board at EB63 – *Standard for the development of eligibility criteria for the inclusion of a project activity as a CPA under the PoA (version 01.0).*

No.	Eligibility Criteria	Status
1	The SSC-CPA involves the distribution of CFLs to households within the geographical boundary of South Africa.	**Yes / No**
2	The SSC-CPA complies with the established procedures for avoiding double counting set out in the PoA-DD and CPA-DD (generic): – check of CDM database to confirm project is not registered as an individual CDM activity or part of another registered PoA; – unambiguous identification of households participating in the CPA within the database management system; and – data collection and signing of forms from participating households as to asign the rights to claim CERs for the project activity.	**Yes / No**
3	For each CFL participating in the SSC-CPA the total lumen output should be equal to or more than that of the ICL being replaced; lumen output of ICL and CLF shall be determined in accordance with relevant national or international standards.	**Yes / No**
4	The start date of the SSC-CPA has been confirmed through the provision of a document with regards to the date on which distribution of compact fluorescent light bulbs commences as wells as entries into the Data Management System.	**Yes / No**
5	The SSC-CPA will implement the baseline and monitoring methodology AMS-II.J. *'Demand-side activities for efficient lighting technologies' v.04.*	**Yes / No**
6.	The SSC-CPA is additional because it is able to demonstrate the existence of one or more of the barriers set out in *Attachment A of Appendix B* and in accordance with *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* including an explanation on any of the following questions: – Is there a less technologically advanced alternative to the project activity that involves lower risks due to performance uncertainty that will lead to higher emissions? – Is there a prevailing practice that will lead to the implementation of a technology with higher emissions? – Is there a technology that requires less up front capital from	**Yes / No**

	households in order to be implemented that will lead to higher emissions?	
7.	The SSC-CPA has satisfied all requirements stipulated by the CME for with regards to local stakeholders consultations and environmental impact analysis.	**Yes / No**
8.	The SSC-CPA involves the distribution of compact fluorescent lightbulbs to residential households using either door-to-door, gate-to-gate or exchange points.	**Yes / No**
9.	The contact details of the households participating into the SSC-CPA are recorded in a data management system for future selection to participate in Ex Post Monitoring surveys in a random and representative manner.	**Yes / No**
10.	The aggregate energy savings by the SSC-CPA will not exceed the equivalent of 60 GWh per year.	**Yes / No**
11.	The SSC-CPA satisfies de-bundling rules for PoA, and is not a de-bundled component of a large-scale CPA or CDM project.	**Yes / No**
12.	The CME confirms that any funding from an Annex I party involved in the implementation of the SSC-CPA does not result in a diversion of official development assistance for the purchase of CERs, and is separate from and is not counted towards the financial obligations of those Parties.	**Yes / No**

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):

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SUMMARY

As the proposed PoA is a voluntary and coordinated action of a series of Small Scale projects, the assessment and demonstration of additionality will follow the requirements set in the *Standard for Demonstration of Additionality of GHG Emission Reductions Achieved by a Programme of Activities (Version 1).*

Section III/8 mentions that "*PoAs that will include one or more small-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of Attachment A of Appendix B of the "Simplified modalities and procedures for small-scale CDM project activities*".

This approach has been confirmed and approved by the Gold Standard Foundation; furthermore information is presented regarding previous announcements and no use of Overseas Development Assistance.

By using revenues from the sale of CERs, the PoA aims to overcome the barriers to the uptake of CFLs. The CME will use carbon finance to recoup costs associated with the purchase and free distribution of CFLs. Energy efficient lighting in residential houses faces a number of barriers, which the PoA will help to overcome, including: access to finance, technological barriers and barriers due to prevailing practices. The provision of free CFLs, possible only through the use of carbon finance, helps to overcome these barriers.

Voluntary Coordinated Action
The PoA is a voluntary coordinated action initiated by the CME. There are no laws mandating the use of energy efficient lighting technologies in South Africa. All householders and lighting technology providers participating in SSC-CPAs under the PoA will do so through a voluntary collaboration with the CME.

Additionality Tool
There are significant, demonstrable barriers to the take-up of energy efficient lighting in residential properties across South Africa. The PoA will use a small-scale methodology, and as such, will assess additionality against one or more of the barriers listed in Attachment A to Appendix B of the *"Simplified modalities and procedures for small-scale CDM project activities"*.

Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;
b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The discussion below constitutes the demonstration of additionality for the PoA as a whole. SSC-CPAs able to demonstrate that such barriers are present will be considered to be additional. This is included in the Eligibility Criteria table, point number 6.

The project participants have selected the following barriers to demonstrate the additionality of the PoA:

Technology barrier

The Project Participant has estimated that the penetration of CFLs in South Africa (considering all previous Eskom Demand Side Managemnt Programs) remains no higher than 20%, including all residential and commercial data. This information has been calculated using available data from annual sales figures of incandescent and compact fluorescent lightbulbs of 5 years.[5]

Several reports confirm the low uptake of energy efficiency products in South Africa. In a report by Accenture titled "Understanding consumer preferences in energy efficiency – South Africa", one of the key findings states that "Consumers are unwilling to undertake more significant changes on the demand side" due to the fact that the costs associated with CFLs are the biggest barrier for the uptake of this

[5] Department of Energy and Department of Trade and Industry, Phase out of Incandescent Plans 2010 Report

technology.[6] It is estimated that without the implementation of this PoA, the total penetration of CFLs in South Africa will remain low. In a report from North West University in 2009, it is estimated that only 6.3% of people within the sample group had bought CFLs outside of Eskom DSM programs.[7]

Other perceptions such as flickering of the light from fluorescent tubes, slow start rates, "cold" light only options and lack of availability for fixtures and sizes have contributed to the low uptake of compact fluorescent lightbulbs worldwide[8] . Most of these perceptions however are being addresed with the newer generations of compact fluorescent lightbulbs however it takes time, research and investment form households to remove preconceptions on technological solutions.

Barrier due to prevailing practice

There are no laws or regulations preventing the continued use of existing inefficient lighting technologies by South Africa householders.

In South Africa, as in many developed country settings, householders' understanding of the benefits of energy efficiency remains rudimentary[9]. The South African government continues to provide information regarding the economic and environmental benefits of investing in energy efficient technologies, however, as demonstrated by the case of CFLs, uptake remains low in the absence of free distributions such as the proposed PoA.

Lack of Information
Barriers to obtaining and applying information relating to energy efficiency are significant, including:

i. Time lag between energy consumption and payment of energy bills. Energy price information is divorced from the time at which it is consumed. This time lag can impact the efficacy of price information in influencing consumer awareness and behaviour with regard to household energy use. In this regard many "consumers act as if they have no control over their electricity bill, and the limited feedback they receive is often too late for them to respond."[10]
ii. Aggregated energy prices may limit householders' understanding of the individual appliance use and its impact on energy bills. Consumers are not aware of which particular appliance or equipment is contributing to the total price they ultimately pay for electricity for a given period, militating against behaviour change, demand response and investment in energy efficient technologies such as CFLs.

Transaction/search costs
Even where a consumer is able to obtain information that is accurate, current and complimentary, they must still spend time to identify and assimilate it. There is an opportunity cost associated with the use of

[6] Understanding Consumer Preferences in Energy Efficiency, Accenture, 2010
[7] A Report on "The Factors that influence the demand and energy savings for Compact Fluorescent Lamp door-to-door rollouts in South Africa", Mascha Botha-Moorlach, North-West University, March 2009
[8] Compact Fluorescent Lights (CFLs) Primer Enlightening Facts, Hinkle Charitable Foundation
[9] Department of Minerals & Energy, South Africa. *Energy Efficiency Strategy for the Republic of South Africa 2005.*
[10] Productivity Commission, *The Private Cost Effectiveness of Improving Energy Efficiency,* 2005, p.105.

one's time to undertake these tasks. In a Californian study by Sathaye et al (2004)[11], it was estimated that if consumers were aware that CFLs could save them money, they would need to take 45 minutes to accurately assess potential savings and locate a shop that sold these lamps. If individuals valued their time at $20/hour, this would more than double the price of the first purchase of this lamp type.

Other Barriers – Access to finance

Scaling-up investment in energy efficiency is essential to achieving significant reductions in energy related emissions. However, despite energy efficiency's recognised advantages as an investment with immense climate change mitigation benefits, most of energy efficiency opportunities remain unrealised due largely to the significant "investment gap" that exists between the theoretical returns that energy efficiency investments can provide, and the limited capital that is available to make those investments[12]. This investment gap can be particularly pronounced at the level of households in developing countries such as South Africa where CFLs are more expensive than ICLs.

The International Energy Agency estimates that the buildings sector is responsible for close to 30% of today's world energy consumption, and is a source of considerable untapped efficiency potential[13]. Based on Eskom data, the residential sector in South Africa consumes 19.7% of electricity generated, equivalent to 45,788GWh per year[14], or 46.7MtCO2 of emissions. Lighting contributes a significant proportion of this consumption, however, due to financial barriers, many households are unable to invest in CFLs in an effort to reduce their consumption and associated emissions. This efficiency potential should be an attractive investment opportunity, as energy efficiency measures in the buildings sector generally have net-negative cost abatement opportunities. In the case of CFLs in South Africa, the payback on investment for those purchasing a CFL is relatively short. However, it is the higher upfront costs, and additional financing requirements that they bring, that acts as a considerable barrier to the take up of energy efficiency opportunities. In the context of residential energy efficient lighting, access to finance barriers come in a number of interrelated forms which the PoA helps to overcome:

1. A lack of available capital to make required investments in CFLs;
2. The perception that energy efficiency investments are high-risk which discourages deployment of any available capital (as discussed in previous section – Technology Barrier); and
3. Split incentives which mean that those responsible for paying for efficient lighting may not be the beneficiaries of cost savings.

Access to Capital
Particularly relevant to households in South Africa is the fact that CFLs are more expensive than incandescent light bulbs. In the process of prioritising household expenditure towards basic requirements such as food, healthcare and education, there may be very little opportunity for spare capital to be targeted towards investments in energy efficiency. Despite the financial savings delivered by energy

[11] Sathaye, J et al, 2004. *Market Failures, Consumer Preferences and Transaction Costs in Energy Efficiency Purchase Decisions,* California Energy Commission, Berkley

[12] International Energy Agency, 2010. "Money Matters – Mitigating risk to spark private investment in energy efficiency". Information Paper, Energy Efficiency Series. Paris, September, 2010.

[13] International Energy Agency (2008), Energy Technology Perspectives Paris: OECD/IEA.

[14] Analysis of 2007 Eskom sales data, Eskom Annual Report, 2010.

efficiency improvements, the upfront capital requirement acts as a significant barrier to their uptake by households.

Discount Rates
In addition to the inability of households to access capital, studies of consumer behaviour towards investments in energy efficient technologies also draw attention to the high discount rates applied, with consumers placing more emphasis on the upfront purchase cost than whole-of-life costs. A range of studies have estimated implicit discount rates applied by consumers to energy efficiency investments range from 25% to 300% across a range of technologies[15].

Split Incentives
Split incentives occur when two participants in an economic exchange have different or even competing goals or incentives. In the context of energy efficient lighting in households, such split incentives occur when building owners are required to pay for building equipment upgrades, but it is the tenants that are required to pay for electricity bills. In this situation, the entity making the investment (landlord) receives no benefit (energy cost savings), because such benefits accrue to the building occupants (tenants). Tenants are also unlikely to make the investment themselves because they ultimately will not own the equipment installed in the building, and may leave the house before enough energy savings have accrued to pay for the initial investment in efficient lighting equipment.

Based on the above analysis of alternative scenarios, barriers and common practice, the PoA is considered to be additional.

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

A.4.4.1. Operational and management plan:

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Operational Activities

The table below summarises the range operational activities of the PoA required to implement and manage each SSC-CPA. The coordinating entity has divided these operations into five broad categories and has defined the management responsibilities for each as detailed in the table below.

Table A.3 Operation and Management of the PoA

Operational Category	Management Responsibilities & Arrangements
Product Supply	– Maintain existing relationships with suppliers – Ensure timely production and supply of CFLs for each SSC-CPA
Transport & Storage Logistics	– Arrange transport of CFLs from supply partner – Arrange storage prior to distribution – Delivery of CFLs to distribution hubs
Distribution to Households	– Management of ESCOs and stationary distribution points; stock; customer transactions and staff

[15] Stansad, A, Hanemann, W, and Auffhammer, M (2006), *End-use Energy Efficiency in a "Post-Carbon" California Economy*, 2006. See also, Ruderman, H. et al, (1987) "The Behaviour of the Market for Energy Efficiency in Residential Appliances including Heating and Cooling Equipment", Energy Journal 8(1):101-124.

	– Household data collection
Baseline Technology	– Collection of ICLs from distribution points and ESCO teams – Undertake independently verified destruction of ICLs
Monitoring Emission Reductions	– Selection of sample group households – Periodic collection of survey monitoring data – Preparation of monitoring reports for emission reduction verification

(i) SSC-CPA Record Keeping

Each SSC-CPA will follow the record keeping and monitoring requirements stipulated in ASM II.J. and detailed in Section E.7.2 below. In summary, the CME must ensure that each SSC-CPA will maintain appropriate records documenting the following variables:

- Geographical location of each CPA
- Name of household (name and surname)
- The address (street number, name and suburb) of household
- Meter number of household
- Date of distribution or direct installation of CFLs
- Specifications of ICLs replaced, including: number replaced, power rating or wattage
  Specifications of failed Eskom CFLs replaced, including: number replaced, power rating or wattage
- Specifications of CFLs installed, including: number installed, CFL purchase/dispatch records, power rating or wattage
- Date of return and destruction of ICLs replaced
- Date of return and disposal of failed Eskom CFLs replaced
- A household signature accepting to transfer all the carbon credits to Eskom.

The Coordinating/Managing Entity (CME) will be responsible for the management of records and data associated with each SSC-CPA. Data will be stored in secure project databases for the duration of each SSC-CPA crediting period, plus two years. The information stored in the databases will be used as the basis of the production of monitoring reports used to quantify emission reductions and claim CERs.

The diagram below summarises the Quality Control Process post installation:

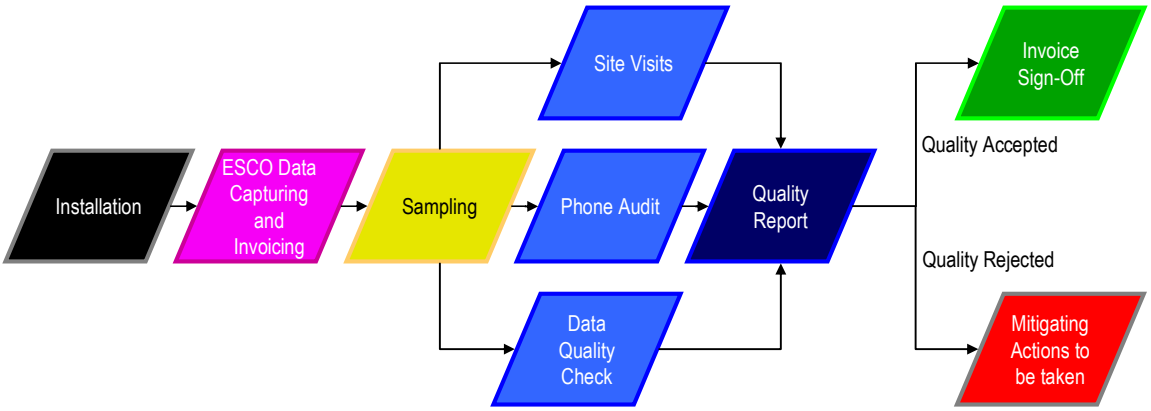
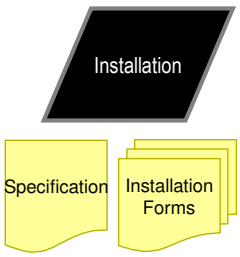


Figure 2: Quality Control Process

a. Installation

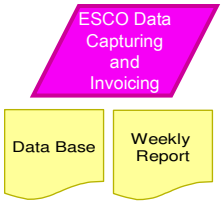


The ESCO will provide the Eskom & Karebo Project Team with an installation plan. The Eskom Project Team will only interface with the ESCO and not with any subcontractor. The ESCO will carry all risks associated with installation.

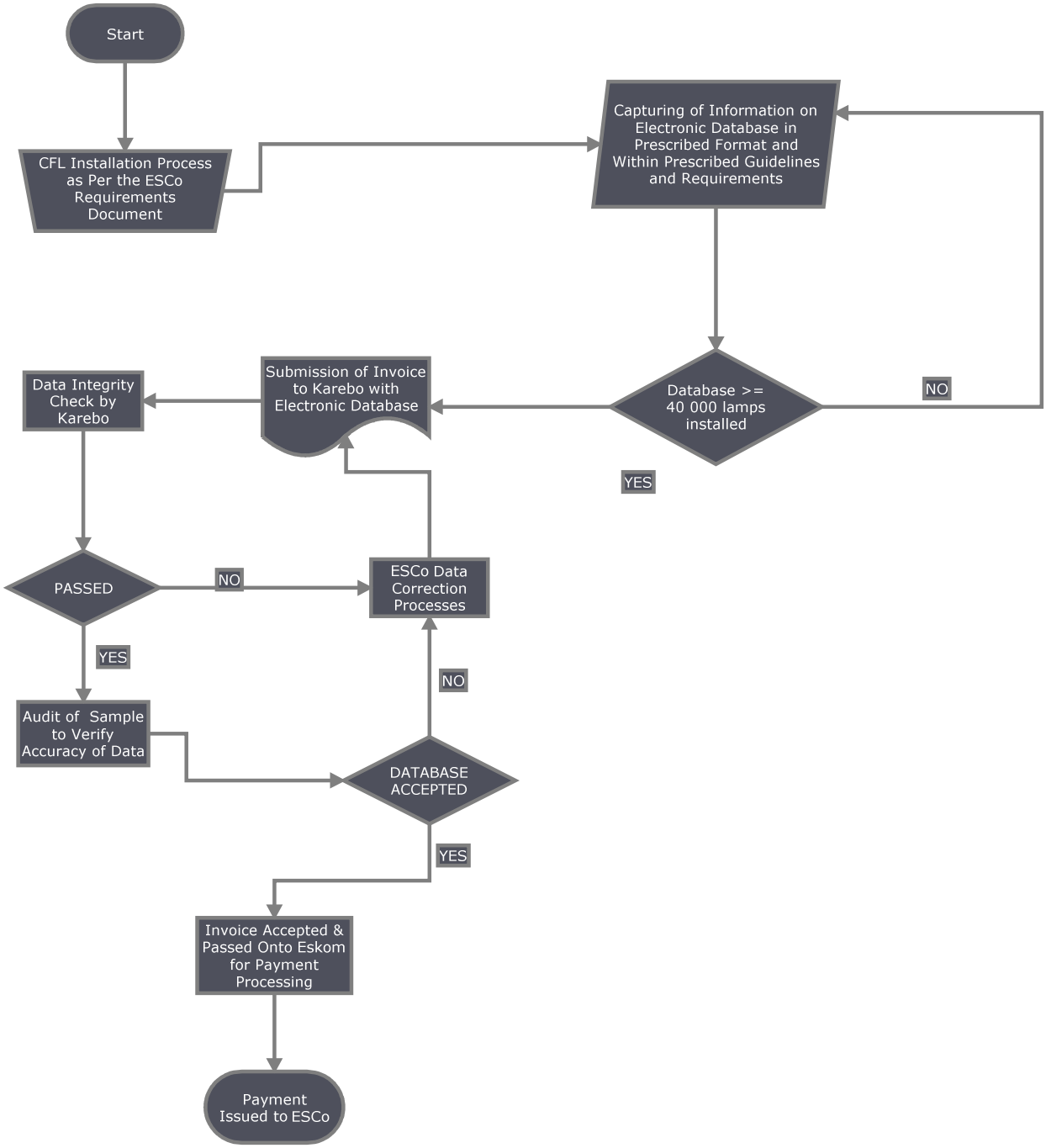
The ESCO will receive a Specification Document (ESCO Requirements) outlining the basic requirements.

Installers are required to complete installation forms for each and every installation. The forms must be filed and submitted to Eskom where they will be stored for audit purposes.

b. ESCO Database and Invoicing



Installation data will be captured by the ESCO/s in a prescribed database template. Weekly Reports and Invoices will be derived from the database. Weekly Reports, Invoices and databases must be submitted (Dates for submitting will be provided).

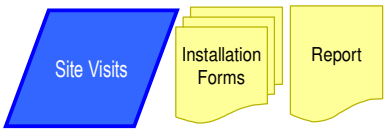

Start
CFL Installation Process as Per the ESCo Requirements Document
Capturing of Information on Electronic Database in Prescribed Format and Within Prescribed Guidelines and Requirements
Database >= 40 000 lamps installed
NO
YES
Submission of Invoice to Karebo with Electronic Database
Data Integrity Check by Karebo
PASSED
NO
ESCo Data Correction Processes
YES
NO
Audit of Sample to Verify Accuracy of Data
DATABASE ACCEPTED
YES
Invoice Accepted & Passed Onto Eskom for Payment Processing
Payment Issued to ESCo

c. Sampling

The Project Team will take a weekly sample from each of the Databases submitted for that week.
a) Minimum of 0.85% of the total installations will be submitted for site visits.
b) Minimum of 0.15% of the total installations will be submitted for a Telephone Audit.

Random samples will be generated, utilizing the "Random" function on Microsoft Excel. Planning for the Audit will be derived from the Planning submitted by the ESCO/s.

d. Site Visits

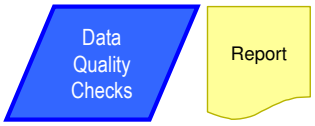


Karebo Systems will be conducting site visits. They might also be accompanied by a Eskom DSM representative. During the site visit Karebo Systems will complete a form and they will capture the data after the installation in the site visit report.

e. Phone Audits

This function will also be conducted by Karebo Systems by the aid of the sample data (including telephone numbers). The audit results will be captured in a report.

f. Data Quality Checks



Data purity will be checked during site visits and Phone Audits. "Sanity Checks" will also be done from time to time to ensure the quality of data. Should issues occur, a report will be drafted and submitted to the relevant ESCO. Any irregularities will result in non-payment of invoices.

g. Quality Report

A Weekly Quality Report will be submitted with the invoices to Eskom for sign-off. The Report will summarize the findings of the site visits, phone audit and data purification reports and note the approval or rejection of the invoice submitted by the ESCO.

(ii) System to Avoid Double Counting

Prior to registering a new SSC-CPA within the proposed PoA, the coordinating entity will check the CDM project database to establish whether a CDM project activity or CPA of another PoA involving CFLs has already been registered in the same geographic area. This search will cover registered project activities, project activities requesting registration, project activities under review and project activities

for which either a review or corrections have been requested. The process of checking will be duplicated by the DOE responsible for registering new SSC-CPAs under the proposed PoA.

Given that each SSC-CPA included in the PoA will be identified by geographical location, it is possible to unambiguously identify CPAs or CDM project activities potentially operating in the same area. The geographical boundary of each SSC-CPA is determined by the location of households where CFLs are installed. The collection of household addresses information (detailed in Annex 4) will ensure that the project boundary can be unambiguously defined.

The Data Management System (DMS) will be in place to ensure that no duplication will occur in the calculation of energy savings and emission reductions via a two step process:

1) Exchanges or direct installation will occur only once per participating household. Duplication will be avoided by using the DMS and either denying an existing household participation more than once in the exchange or by visiting each household only once.

2) If it is found in the DMS that a household participated more than once in the program, all duplicates will be removed and those CFLs won't be used to calculate energy savings and emission reductions.

(iii) De-bundling

As per the latest version of the '*Guidance for determining of debundling under a Programme of Activities*' (v.3 EB 54), if each of the independent subsystems/measures included in the CPA of a PoA is no larger than 1% of the small-scale thresholds defined by the methodology applied (in this case the 60GWh per year), then that SSC-CPA of PoA is exempted from performing de-bundling check i.e., considered as not being a de-bundled component of a large scale activity.

In the case of the energy efficient lighting retrofits proposed under the PoA, annual energy savings of individual pieces of lighting equipment will be considerably lower than the 1% threshold level (ie. less than 600,000 kWh of energy savings per year), and as such SSC-CPAs are considered as not being a de-bundled component of a large scale CDM activity. The example below clearly demonstrates the compliance of project activities with the debundling requirements of small-scale PoA:

Existing lighting equipment = 100W ICL

Replacement lighting equipment = 20W CFL

Usage = 3.5 hours per day, 365 days per annum

Annual Energy Savings = Exiting equipment annual usage – Replacement equipment annual usage
= ((100 x 3.5 x 365)/1000) – ((20 x 3.5 x 365)/1000)
= 127.75 – 25.55
= 102.2 kWh

As can be seen from this simple example individual lighting units will not exceed the 1% threshold amount of 600,000kWh per annum, and as such the SSC-CPAs satisfy debundling requirements for PoA.

(iv) Participants subscribed to the PoA

The CME is responsible for identifying, developing, registering and managing all SSC-CPAs to be included in the proposed PoA. This will mean that those operating the SSC-CPA will be aware and will have agreed that their activity is subscribed to the proposed PoA. Legal agreements have been put in place with PoA distribution partners and lighting suppliers clearly stipulating that their activities are subscribed to the PoA. Households will be made aware that they are participating in a climate change action program aiming to reduce greenhouse gas emissions, and will be required to sign a form assigning ownership of all carbon assets to the CME Eskom.

A.4.4.2. Monitoring plan:

The CME has opted to implement a sampling approach to collect data in relation to the ongoing survival of CFLs distributed under the PoA. The results of ex-post monitoring surveys will then be applied to each SSC-CPA under the PoA, with the DOE then individually verifying each SSC-CPA in order to determine the abatement created by the PoA. The DMS managed by the CME includes the following data-set that can be directly attributed to each SSC-CPA within the PoA, thereby allowing unambiguous determination of the emission reductions generated by each SSC-CPA:

(i) A list of households participating in each SSC-CPA including name, address, number and wattage of light bulbs exchanged, date and location of the exchange transaction;
(ii) Data obtained from periodic ex-post monitoring surveys of a sample of households indicating the proportion of project CFLs operating during each monitoring period; and
(iii) Destruction records of ILCs for leakage.

The CME will produce a monitoring report for the DOE to verify corresponding to the preceding monitoring period of each SSC-CPA. This report will unambiguously set out the data relating to the emission reductions generated by that SSC-CPA during the monitoring period.

PoA record keeping procedures will prevent double counting across SSC-CPAs. The list of households that participate in the exchange of light bulbs for each SSC-CPA cannot contain any duplicate entries. This duplication rule applies *within* each SSC-CPA (ie a household cannot participate more than once during each SSC-CPA), and *between* SSC-CPAs (ie households cannot participate in more than one SSC-CPA).

Verification of each SSC-CPA will occur at the end of each monitoring period. The project database will record the start and end dates of each monitoring period, and record the emission reductions attributable to each monitoring period. Appropriate record keeping procedures will be implemented to ensure that each monitoring period data set can be transparently attributed to its corresponding SSC-CPA, preventing any occurrences of double counting. An audit of the project database will be able to determine the current status of each SSC-CPA – the duration of previous monitoring periods, the participating households, ex-post monitoring sample groups delivering monitoring data, and current verification activities.

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

>>No public funding will be used for the PoA

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

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

>> 31 August 2011

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 ☐

Since the PoA will use the same type of technology applied in the same context across all CPAs (i.e. compact fluorescent lightbulbs distributed to households in exchange of incandescent lightbulbs), it is not required that each CPA conducts its own environmental analysis and this is sufficient at the PoA level.

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

>>The PoA involves the distribution and installation of CFLs in South African households. Any CFLs distributed under the PoA will have the Conformance Mark (CE) by which the technology suppliers declare that the products meet EU and South African safety, health and environmental requirements and are RoHS compliant. The use of 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 lighting equipment disposal. 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. Where possible, the CME 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.

Distribution of CFL are not listed in the *Waste management activities in respect of which a waste management license is required in accordance with Section 20(b) of the National Environmental Management Act, 2008* document and therefore, as per Category B of the mentioned document, this activity does not trigger an environmental impact assessment.

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 SSC-CPA level ☐

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:

>> In order to comply with the stakeholder engagement requirements set out in the Gold Standard, the Coordinating Management Entity has conducted a series of public consultations, and has compiled formal reports. In summary, the following steps were taken to engage stakeholders:

- Stakeholder consultation sessions were conducted at a public meeting in Cape Town, Durban and Johannesburg on the 20th, 22nd and 24th of June 2011 respectively.
- The meetings were advertised in national newspapers, as well as invitations being extended directly to government agencies, NGOs and academic institutions.
- All participants were provided with background information notes in advance of the meetings, and were invited to comment on the social and environmental impacts of the Project Activity as per the Gold Standard Sustainable Development Matrix.
- A report summarising all comments received during the meeting, and how these have been incorporated into the project design, was provided to stakeholders four weeks after the meeting.
- All project documents (presentation, project design documents, etc.) were then made available for sixty days to stakeholders for their comment via the Gold Standard website.
- Comments received during this main stakeholder consultation period were compiled and incorporated where relevant into the final project design.

D.3. Summary of the comments received:

>> A summary of comments received by stakeholders during the 3 sessions is provided below:

Category	Question/Comment

Category	Question/Comment
Life-cycle	It is essential that there be a full lifecycle assessment in terms of the CFL rollout, confirming that benefits do indeed outweigh the costs and recognising that many of the spent CFLs do not get properly disposed of. Please include emissions of mercury from power stations in the lifecycle analysis and all cumulative effects.
CFL rollout	Detail the differences between the sustainability and Greenfields projects including where exactly these are geographically and the underpinning rationale for the choice of projects and locations.
	Does Eskom exchange for spent CFLs or only incandescent?
	Is it not more effective to get mass retailers (like Game) to do the swopouts rather than going door to door?
CDM	Please detail how the CDM mechanism works
	Do CFL users get any additional benefit from CDM and if so how is that made available?
	Does Eskom plan to apply for CDM credits retrospectively as a function of the earlier rollout programmes
	Can the project idea note be made available?
	Will Eskom remain with CDM or move to voluntary reduction (VR) in future?
	Will Eskom be paid back by the developed countries for the CFLs they (Eskom) have purchased to date?
	What will the value of the carbon credits be (in monetary terms)?
	When will Eskom make a decision on which CDM route to follow and how will these apply to the Greenfields and sustainability programmes respectively ?
Service providers	How can potential service providers get involved in especially the Greenfields project?
Carbon credits	Will carbon credits be 'ring-fenced' so that the benefit all goes to CFL rollout or will some of the credits go to the broader organisation (Eskom)?
Down-lighters	What is being done about down-lighters? What can be used to replace them and will Eskom b rolling out such replacements?
LEDs	What is the status of LEDs and what role can they potentially play in superseding CFLs as more energy efficient light bulbs.
	Will LEDs be considered for the next roll-out ?
	Do LEDs contain mercury or other heavy metals and if so how do the quantities compare to CFLs?

Category	Question/Comment
Light pollution	What is Eskom's stance on light pollution in the context of the CFL rollout?
Municipalities	Explain how municipalities will be assisted in creating facilities for safe disposal of spent CFLs. There is a cost involved in disposing of hazardous waste properly and how will that cost be covered?
	How can municipalities benefit from the programmes?
	Municipalities must be involved.
Households only	Does the CFL rollout occur only for households or can businesses or other organisations also potentially benefit?
Funding	Who is funding the CFL rollout in the intervening period (until carbon credits are obtained)? Is it NERSA and if so who is the owner of the CFL programme?
CFL quality	What is done to ensure the quality of the CFLs in circulation so that they live up to the promise of the energy savings?
	CFL technology is advancing rapidly. What is Eskom doing to capitalise on the new developments in CFL technology?
Sustainability	How many *sustainable* jobs have been created in the programme. It is misleading to present employment figures if they only apply to employment for several days or weeks. It may be better to present employment in terms of job *days* and not just jobs.
	Can people who were hired for the door-to-door exchanges not be further utilised for recovering the spent CFL's for example?
	Will the same workforce be used for the sustainability programme (that was used previously)
	Can people be empowered by Eskom to make a living in the 'energy management' business? Viz. Are there opportunities to create and run businesses in this field?
	How sustainable is the CFL programme?
Other CDM projects	List the other CDM projects within Eskom's portfolio?
Waste (including mercury waste)	Please detail the methodology for recovering and disposing of the spent CFLs
	What is done at the disposal points to prevent potential environmental risks? (Disposal points just seem to be cardboard boxes that are not always sealed)
	What becomes of the mercury waste?

Category	Question/Comment
	What is the recovery rate on spent CFLs (viz. how many end up being disposed of at a properly licenced facility?)
	What is being done to enforce good practise to mercury disposal and what is Eskom doing to support that enforcement?
	Eskom must publicise the importance of safe disposal of spent CFLs.
	Please quantify the total volume of waste that will be generated through the CFL rollout. Present mercury quantities separately.
Origin of CFLs	Where do the CFLs come from viz. are they produced locally or are they imported?
	Is there some way of promoting local manufacturing of CFLs?
	Why does Eskom not promote local suppliers rather than the overseas based-suppliers
CFL utilisation	How does Eskom know how many of the CFLs distributed are actually used? Can people not sell them on for example?
Purchasing incandescents	How do you deal with people buying incandescent so that they have bulbs to exchange for CFLs.
	What is being done to dissuade people from buying incandescent and promoting the purchase of CFLs at retailers whilst incandescent remain considerably cheaper than CFLs
	How will Eskom promote the selling of CFLs at retail outlets - are you considering any interactions with retail outlets?
Climate change	EThekwini Metro is raising awareness about climate change in schools. The CFL programme should be mentioned in that.

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

>> During the public sessions, the project developer answered directly to all questions raised. In addition a Stakeholder Consultation Report is being prepared. It is expected that this report will also include issues raised after the consultation sessions as well as any issues raised during the Global Stakeholder Consultation period. A copy of the report will be provided to the DOE during the validation process.

SECTION E. Application of a baseline and monitoring methodology

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

>>

The PoA will use the following approved small-scale methodology:
AMS-II.J. Demand-side activities for efficient lighting technologies – Version 04
Note that the methodology has been approved for use in a PoA by the Executive Board.

In addition, the PoA will utilise the following Tools and Guides:

Tool for the demonstration and assessment of additionality – Version 05.2
Tool to calculate the emissions factor for an electricity system – Version 2.2

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

>>

AMS-II.J requirements	Qualification / Justification
This category comprises activities that lead to efficient use of electricity through the adopted of self-ballasted compact fluorescent lamps (CFLs) to replace incandescent lamps (ICLs) in residential applications. Eligible self-ballasted CFLs have integrated ballasts as a non- removable part. The CFLs adopted to replace existing equipment must be new equipment and not transferred from another activity.	The methodology is applicable to SSC-CPAs under the proposed PoA as these projects provide energy efficient light bulbs, in the form of compact fluorescent lamps (CFLs), to replace incandescent light bulbs in residential properties. The CFL distribution directed under each SSC-CPA, requires that CFL purchase/dispatch records (refer to Section A.4.4.2 and E.7.2 for PoA and SSC-CPA Monitoring Plan, respectively) to ensure that only new CFLs are employed in the PoA, and that CFLs have not been transferred from another activity.
The total lumen output of the CFL should be equal to or more than that of the ICL being replaced; lumen output of ICL & CFL shall be determined in accordance with relevant national or international standard/s.	The monitoring plan of each SSC-CPA (refer to Section E.7.2) under the PoA provides a procedure that clearly identifies both the ICL replaced and the CFL distributed. The bulbs have been procured under the ELI Standards and as per the table included in AMS-II.J – Minimum Light Output.
The aggregate electricity savings by a single project activity may not exceed the equivalent of 60 GWh per year.	Each SSC-CPA requires the calculation of the aggregate energy savings to demonstrate that it does not exceed 60 GWh per year (see Section E.6.2, Equation (4)).
The average life or the rated average life of the CFLs shall be known *ex ante*. IEC 60969 (Self Ballasted Lamps For General Lighting Services - Performance Requirements) or an equivalent national standard shall be used to determine the average life. The project design document shall cite the standard used. If the average life value is not available *ex ante*, it shall be made available for verification before or at the same time that the results of the second *ex post* monitoring survey, as required per paragraph 18 (b), are available for verification. The laboratory conducting and certifying the tests to determine CFL average life shall comply with the requirements of a relevant national or international standard, e.g., ISO/IEC 17025.	The International manufacturer providing the CFLs will need to follow the Efficient Lighting Initiative (ELI) standards. Furthermore, KEMA Quality following the IEC 60969 (*Self-ballasted lamps for general lighting services - Performance requirements)* will independently test the CFLs.
CFLs utilized under the project activity shall, in addition to the standard lamp specifications (power rating, lumen	The monitoring plan of each SSC-CPA under the PoA (refer to Annex 4) provides a procedure that clearly

output, correlated colour temperature, voltage, power factor, frequency), be marked for clear unique identification for the project.	identifies each CFL along with is lamp specifications. All CFLs will be marked with the Eskom Logo and the words "Not for sale" (or equivalent).
The project design document shall explain the proposed method of distribution of efficient lighting equipment and how ICL collection (e.g., exchanged for project CFLs) and destruction will be conducted and documented. The Project design document shall also explain how the proposed procedures eliminate double counting of Emission Reductions, for example due to CFL manufacturers, wholesale providers or others possibly claiming credit for Emission Reductions for the project CFLs.	The monitoring plan of each SSC-CPA under the PoA (refer to Section E.7.2) provides a step-wise procedure for 1. CFL distribution, 2. Ex-post Monitoring, 3. ICL destruction. Section A.4.4.1 Operational and Management Plans describes a procedure for the CME of the PoA to implement in order to avoid double accounting.
The project activity shall be designed to limit undesired secondary market effects (e.g., leakage) and free riders by ensuring that replaced lamps are exchanged and destroyed. Further project participants are required to undertake at least one of the following actions: (i) Directly installing the CFLs; (ii) Charging at least a minimal price for efficient lighting equipment; (iii) Restricting the number of lamps per household distributed through the project activity to six.	The procedure in ESCO Requirements V6 (Operational Manual) describes how ICLs collected during the exchanges are destroyed in order to prevent leakage. This process will be independently verified. As defined in Section 2. Policy measure or stated goal, CFLs will be offered free of charge via (i) direct installation, or (ii) gate to gate or stationary exchange of up to 6 working ICLs.
Whether the CFLs are directly installed or not directly installed, the project design document shall define actions to be taken to encourage CFLs being installed in locations within the residences where the utilization hours are relatively high, for example common areas. For CFLs not directly installed these actions can include educating the CFL recipients of the best uses for CFLs.	As per the ESCO Requirements V6 (Operational Manual), the distribution process will be supported by a communication campaign to ensure households area aware of the Project Activity. This communication campaign includes working with local municipalities and Ward Councilors to create project awareness thereby ensuring easier access to households. Audits will be done to verify the distribution of product brochures and knock and drop leaflets. These brochures and leaflets include information to encourage the installation of CFLs in high use areas.

NOTE: In the case of CPAs, which individually do not exceed the SSC threshold, SSC methodologies may be used once they have first been reviewed and, as needed, revised to account for leakage in the context of a SSC-CPA.

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

>>The project boundary is the physical, geographical location of each measure (each piece of equipment) installed.

	Source	Gas	Included?	Justification
Baseline	Power plants servicing the electricity grid	CO_2	Yes	
		CH_4	No	Minor Source
		N_2O	No	Minor Source

Project Activity	Power plants servicing the electricity grid	CO_2	Yes	
		CH_4	No	Minor Source
		N_2O	No	Minor Source

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

The Project Proponent has identified the following baseline scenarios to the proposed PoA:

Number & name of scenario	Description
1. Business-as-usual	Continued use of ICLs by South African households.
2. Autonomous replacement	The proposed activity is undertaken without being registered as a CDM project activity. Under this scenario householders chose to replace their existing lighting systems with new CFLs (or purchase CFLs to replace failed Eskom CFLs from previous projects) on a scale comparable to that envisaged by the proposed PoA.
3. Mandatory replacement	Laws stipulating the replacement of inefficient lamps with more efficient technologies such as CFLs.
4. Alternative incentives	The introduction of alternative energy saving regulations or policies, such as a demand side management scheme, that create an incentive in the absence of the CDM to improve the energy efficiency of residential lighting systems. Such incentives would need to cause the uptake of energy efficient lighting technologies on a scale comparable to that envisaged by the proposed PoA.

In this section, the Project Proponent will discuss whether there are identified alternative scenarios that are consistent with current mandatory laws and regulations.

Number & name of scenario	Consistent with mandatory laws?	Comment
1. Business-as-usual	Yes	There are no laws or regulations preventing the continued use of existing inefficient lighting technologies by South Africa householders.
2. Autonomous replacement	Yes	There are no laws preventing the take-up of energy efficient lighting in residential properties.
3. Mandatory replacement	No	This alternative is not applicable because there are currently no mandatory regulations in South Africa requiring replacement of inefficient lamps with more efficient technologies such as CFLs.

4. Alternative incentives	No	There are currently no nationally regulated alternative incentives to the CDM to facilitate wide scale adoption of energy efficient lighting systems in residential buildings. All CFL Demand Side Management CFL projects run by Eskom, have incorporated the recovery of costs through the generation of carbon credits as documented in the Eskom's Investment and Finance Committee of September 2007[3] were it states that *"Eskom will vigorously pursue the recovery, or at least, part of the costs through carbon credits, ..."*. In relation to the proposed PoA, the only source of funding available to Eskom to pursue the continued replacement of ICLs and failed Eskom CFLs is through the CDM. No other incentive mechanisms is available to households, and CER revenue is the only way in which program costs can be recovered by Eskom.

Based on the above analysis there are two realistic alternative scenarios to the proposed activity – either 1. the continuation of business-as-usual or, 2. the autonomous replacement by householders of their existing lighting systems with new energy efficient technologies on a scale comparable to that envisaged by the proposed PoA.

The discussion of possible barriers is provided in section A.4.3. As per this analysis, the take-up of CFLs by households faces barriers such that the 'business-as-usual' scenario, or continued use of ICLs, is the most likely baseline scenario for lighting options in South African households. This baseline scenario is considered to be applicable for all SSC-CPAs under the PoA.

As is discussed in section A.4.3, because of the prevailing barriers to the uptake of more energy efficient technologies, the project proponents believe that the most likely baseline scenario in the absence of the PoA is the continuation of business-as-usual. In the absence of the PoA, householders would continue to utilize inefficient lighting technologies. Well-documented barriers to the uptake of energy efficient CFLs, including technological barriers, barriers due to prevailing practice and other barriers such as access to finance households, are prevalent in the South African residential lighting sector. Without the proposed CDM PoA, it is unlikely that there will be an autonomously generated improvement in the energy efficiency of lighting in South African households.

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

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

>>
EB 60, Annex 26 para 4 states: "The Board clarified that a full additionality assessment is not required in the context of component project activities (CPA), rather the confirmation of additionality for CPAs should be conducted by means of the eligibility criteria."

Section A.4.3 above provides extensive discussion of the additionality of the PoA, in particular the barriers that prevent the adoption of CFLs in South African households. It is expected that individual SSC-CPAs will face similar barriers to those impacting on the PoA as a whole, and as such will generate emission reductions that are additional.

To demonstrate the additionality of a typical SSC-CPA, the CME will provide a discussion of one or more of the barriers listed below, as per the guidance provided in the Attachment A of Appendix B and as requested by the *Standard for demonstration of additionality, development of eligibility criteria for programme of activities* (EB56). In summary, it is expected that SSC-CPAs will encounter one or more of the following barriers:

Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.

Barrier due to prevailing practice: prevailing practice would have led to implementation of a technology with higher emissions;

Householders may have a limited understanding of the benefits of energy savings on lowering whole-of-life lighting costs, and as such continue to purchase and use ICLs which are perceived as being cheaper, familiar and risk free. The challenge of monitoring and quantifying realized cost savings (electricity and lamp replacement) for individual householders to overcome information barriers and transaction/search costs to obtain new information is significant. SSC-CPAs can demonstrate that ICLs are considerably cheaper than CFLs, and as such householders intend to continue to utilise them, and that without access to the services and revenues provided through the PoA, do not intend to replace their light bulbs to improve energy efficiency.

Access to Finance Barrier: the project activity could not access appropriate capital without consideration of the CDM revenues;

Households
The high up front costs of energy efficient lighting presents a significant barrier to householders whom are not able to justify the prioritisation of the capital expenditure above basic requirements such as food, healthcare and education. Each SSC-CPA under the PoA will require that a large number of ICLs be replaced before the end of their useful lifetimes to avoid additional electricity consumption and emissions. SSC-CPA can demonstrate that

Institutional
The access-to-finance barrier is also relevant at the institutional level with CER revenues representing the only mechanism available to Eskom to recoup costs associated with SSC-CPAs. SSC-CPAs can provide a simple investment analysis demonstrating that CER revenue provide a cost recovery mechanism otherwise unavailable to the project implementer and CME, Eskom.

Other barriers: such as institutional barriers or limited information, managerial resources, or organizational capacity.

SSC-CPAs may choose to identify and discuss other barriers such as those listed above in order to demonstrate the additionality of the project activity.

A SSC-CPA able to demonstrate that any one of the aforementioned barriers is prevalent is considered to be additional.

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

>>
Additionality criteria (included in the Eligibility Criteria table in section A.4.2.2):

- Conduct a barrier analysis to demonstrate that the project activity faces significant barriers that are overcome through the CDM. These analysis includes any of the following questions (amongst others):
  - Is there a less technologically advanced alternative to the project activity that involves lower risks due to performance uncertainty that will lead to higher emissions?
  - Is there a prevailing practice that will lead to the implementation of a technology with higher emissions?
  - Is there a technology that requires less up front capital from households in order to be implemented that will lead to higher emissions?

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

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

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

>>The following are the methodological choices provided for in AMS-II.J v.04 which will be applied in relation to each of the SSC-CPAs to be developed under this PoA.

Total Lumen Output of CFL
The total lumen output of the CFL should be equal to or more than that of the ICL being replaced. The lumen output can either determined via (i) in accordance with relevant national standards or international standard(s), or (ii) Table 1 of AMS-II.J, which provides the minimum light output requirements (lumen) for incandescent globes (ICLs).

Under this PoA, the total lumen output for CFLs and ICLs were determined using the ELI standard as per the table below[16]:

[16] ELI Technical Documents for Certification (2006).

<table>
<tr><th>Requirements</th><th>Specifications</th></tr>
<tr><td>Label and Comparison of Self-Ballasted Compact Fluorescent Lamps to General Lighting Service</td><td>Product packaging, enclosed literature, or product specification sheet shall list the diameter of lamp tubes and the lamp-cap type, and the length, efficiency and color rendering index of the lamp.

The packaging or enclosed literature should specify the rated luminous flux of the lamps, and should note its equivalency compared to the luminous flux of an incandescent lamp for general lighting service (GLS). The equivalent GLS must be elected in accordance with IEC 60064.

<table>
<tr><th>Light output (lm)</th><th>Power of standard GLS (W)</th></tr>
<tr><td>≥230</td><td>25</td></tr>
<tr><td>≥415</td><td>40</td></tr>
<tr><td>≥570</td><td>50</td></tr>
<tr><td>≥715</td><td>60</td></tr>
<tr><td>≥940</td><td>75</td></tr>
<tr><td>≥1,227</td><td>90</td></tr>
<tr><td>≥1,350</td><td>100</td></tr>
<tr><td>≥2,180</td><td>150</td></tr>
<tr><td>≥3,090</td><td>200</td></tr>
</table>
</td></tr>
</table>

Annual technical grid losses

The average annual technical grid losses (%) may be determined using recent, accurate and reliable data for the host country. Under the PoA, each CPA would determine the TD_y from the most recent average annual audited data published either by the official government electricity authority. Reliability of data used (e.g., appropriateness, accuracy/uncertainty, especially exclusion of non technical grid losses) shall be established and documented by the project participant.

Alternatively, a default value of 10% shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable.

Under this PoA, the average annual technical grid losses are 8.3% as per Eskom Annual Report 2011.[17]

Net-to-gross adjustment factor

A default value of 0.95 can be used for the Net-to-gross adjustment factor, unless a more appropriate value based on a lighting survey from the same region and not older than 2 years is available. Under this PoA, the Net-to-gross adjustment factor was assigned the default value of 0.95 as provided by methodology AMS-II.J.

Average daily operating hours

To determine the average daily operating hours of the lighting devices (ICLs) replaced by the group of *i* lighting devices, a default value of 3.5 hours per 24 hour period can be used. This default value can also be used *ex ante* as well as *ex post* throughout the crediting period.

[17] http://www.eskom.co.za/c/84/annual-report/

Alternatively, the daily operating hours can be deduced from a continuous measurement of the usage hours of baseline/project lamps for a minimum of 90 days at a representative sample of households. This can be conducted prior to or concurrent with the first *ex post* monitoring survey. The days selected for measurement of operating hours shall be either representative of the annual variation of daylight hours in the region, or a correction factor must be applied in order to account for the variation in daylight.

As per footnote 6 in AMS-II.J v4, the project participant can decide prior to the first *ex- post* measurement whether to use the 3.5 hours default value or ex post measured operating hours for determining O_i in equation 2. At the time of commencing validation, the CME is undecided as to which option to pursue. A decision regarding whether the 3.5 hours/day default value or another value determined through a 90 day study shall be used will be made prior to the first ex-post monitoring survey of the initial SSC-CPA included under the PoA. This value will then be applied to all SSC-CPAs included under the PoA.

For the purpose of determining ex-ante emission reductions as set out in this PoA-DD and attached SSC-CPA-DDs, the default value of 3.5 hours/day will be assumed. It should be noted that if a subsequent decision is made by the CME to use a different value for O_i as determined through the 90 day survey, that this may lead to significant differences between the *ex-ante* estimate and actual *ex-post* emission reductions generated by SSC-CPAs. This variation is allowed for under the methodology, and as such should not be considered a deviation to the provisions of the monitoring plan or registered PoA or SSC-CPA. At the time of verification, the verifying DOE will take account of the provision for use of either a default or measured value, note the choice of the CME, and will certify emission reductions accordingly.

As per the requirements of AMS-II.J, a description of the possible approach to a 90-day metering survey is provided in Annex 4 of this PoA-DD.

Leakage
There are no significant emissions attributable to the PoA that occurs outside the Project Boundary. Leakage will be neglected because the replaced equipment will be scrapped and independent monitoring of the scrapping of replaced equipment will be implemented in compliance with the requirements of the applied baseline and monitoring methodology.

***Ex-post* Monitoring**
As per AMS-II.J, point 17 (a), *Ex post* monitoring surveys are required within the first year after installation to adjust the Net Electricity Savings (NES_y) considering the actual Lamp Failure Rate ($LFR_{i,y}$) data, the actual average daily operating hour of the light bulbs replaced (O_i) (if a default value is not selected), the CFL Average Life (if a CFL Rate Average Life was used initially), and using the actual quantity of CFLs for each wattage group i ($Q_{PJ,i}$).

Subsequent *ex post* monitoring surveys to determine the *ex post* Lamp Failure Rate ($LFR_{i,y}$) will be carried out by the CME (or its contractors) at one of the following intervals:

(1) Once every 3 years
(2) Once for every 30% of the elapsed Rated Average Life or Average Life of lamp.

The modifications to the Net Electricity Savings (NES_y) are be made to as per point 18 of AMS-II.J:

(a) If Rate Average Life values were used initially for calculating $LFR_{i,y}$, per equation (3), as soon as Average Life values are available they shall be used for calculation of subsequent $LFR_{i,y}$ values.
(b) If the *ex post* monitoring surveys indicate that the failure rate is equal to or less than the $LFR_{i,y}$ value indicated using equation (3) with *ex ante* or prior year, *ex post* monitoring values, for subsequent years $LFR_{i,y}$ shall continue to be determined using Equation (3) and established Average Life values for L_i.
(c) However, for subsequent years, L_i values in $LFR_{i,y}$ Equation (3) shall be adjusted if the *ex post* monitoring surveys indicate that the failure rate ($LFR_{i,y}$) is greater than the value indicated using Equation (3) with Average Life or prior year, *ex post* monitoring values. In this situation, a new value for Li shall be determined using Equation (3) and new values of $LFR_{i,y}$ shall be used beginning from the first calculation year after completion of the *ex post* survey.

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

>> The emission reduction achieved by the SSC-CPA project activity is determined using AMS-II.J. "Demand-side activities for efficient lighting technologies". The sequence of calculations are reproduced as follows:

The electricity saved by the project activity in year y is calculated as indicated in equations (1) and (2):

$$NES_y = \sum_{i=1}^{n} Q_{PJ,i} \times (1 - LFR_{i,y}) \times ES_i \times \frac{1}{(1 - TD_y)} \times NTG \quad (1)$$

where

$$ES_i = (P_{i,BL} - P_{i,PJ}) \times O_i \times 365/1000 \quad (2)$$

NES_y	Net electricity saved in year *y* (kWh)
$Q_{PJ,i}$	Number (quantity) of pieces of equipment (CFLs) of type *i* distributed or installed under the project activity (units). In total for all "i", this value shall be equal to or less than the documented number of all baseline incandescent lamps destroyed. Once all of the project CFLs are distributed or installed, $Q_{PJ,i}$ is a constant value independent from *y*
i	Counter for equipment type
n	Number of types of equipment i
ES_i	Estimated annual electricity savings for equipment of type *i*, for the relevant technology (kWh)
$LFR_{i,y}$	Lamp Failure Rate for equipment type *i* in year *y* (fraction)
TD_y	Average annual technical grid losses (transmission and distribution) during year *y* for the grid serving the locations where the devices are installed, expressed as a fraction. This value shall not include non-technical losses such as commercial losses (e.g., theft/pilferage). The average annual technical grid losses shall be determined using recent, accurate and reliable data available for the host country.

	This value can be determined from recent data published either by a national utility or an official governmental body. Reliability of the data used (e.g., appropriateness, accuracy/uncertainty, especially exclusion of non technical grid losses) shall be established and documented by the project participant. A default value of 10% shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable
NTG	Net-to-gross adjustment factor, a default value of 0.95 is to be used unless a more appropriate value based on a lighting use survey from the same region and not older than 2 years is available
$P_{i, BL}$	Rated power of the baseline lighting devices of the group of "*i*" lighting devices (Watts)
$P_{i, PJ}$	Rated power of the project lighting devices of the group of "*i*" lighting devices (Watts)
O_i	Average daily operating hours of the lighting devices replaced by the group of "*i*" lighting devices. For *ex post* values use either[18] (a) 3.5 hours per 24 hour period or (b) the average measured value determined from measurements of a representative sample conducted once, prior to or concurrent with the first *ex post* monitoring survey (see paragraph 18 below). Note that surveying to assess retention rates is still required even if a default value for O_i is chosen. In no case may a value greater than 5 hours per 24 hour period shall be used under this methodology.

The Lamp Failure Rate ($LFR_{i,y}$) is the percentage of lamps that have failed during a year. The average life or rated average life is used to calculate the Lamp Failure Rate as follows:

$$y * X_i < L_i, LFR_{i,y} = y * X_i * (100 - R_i)/(100 \times L_i) \quad (3)$$

If $y * X_i > or = L_i, LFR_{i,y} = 1$

where

$LFR_{i,y}$	Lamp Failure Rate for equipment type *i* in year *y* (fraction)
L_i	Average Life (or Rated Average Life until average life value is available) for equipment type *i* (hours)

[18] The project participant shall decide prior to the first ex- post measurement whether to use the 3.5 hours default value or ex post measured operating hours for determining O_i in equation 2. If the project participant is undecided prior to the first ex post measurement as to which option to use, approaches to each option under consideration should be described in the PDD, with details of a sampling plan. However, once an approach is implemented, the project participant may not switch options. In particular, it is not possible to collect measured operating hour data (which may, for example, show 3 hours per day of operation) and then switch back to use the default value of 3.5 hours.

R_i % of lamps of type *i* operating at the end of average life or the rated average life (use a value of 50)

X_i Number of operating hours per year for equipment type *i* (hours)

y Counter for year

Under the PoA, the Lamp Failure Rate is calculated ex-ante using the equation (3) and adjusted ex-post based on monitoring survey results.

Emission reductions made by the project per year can thus be deduced from the annual electricity saved multiplied by the emission factor:

$$ER_y = NES_y \times EF_{CO2,ELEC,y} \quad (4)$$

where

$EF_{CO2,ELEC,y}$ Emission Factor in year *y* calculated in accordance with the provisions in "Tool to calculate the emission factor for an electricity system" version 2.2 (tCO_2/MWh)

ER_y Emission Reductions in year *y* (tCO_2e)

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:	tCO_2/MWh
Description:	CO_2 emissions factor for electricity displaced from the grid serving the households that participate in the SSC-CPA during the monitoring interval y, calculated according to the latest approved version of "Tool to calculate the emission factor for an electricity system" version 2.2.1.
Source of data used:	Eskom grid emissions data: http://www.eskom.co.za/live/content.php?Item_ID=4226
Value applied:	0.9506
Justification of the choice of data or description of measurement methods and procedures actually applied :	The SSC-CPA implementer shall obtain latest data from national utility and applied calculation methodology specified in "Tool to calculate the emission factor for an electricity system" version 2.2.1. Details of calculations are provided in Annex 3.
Any comment:	-

Data / Parameter:	**O_i**
Data unit:	hours/day
Description:	Average daily operating hours of the baseline ICLs of the group *i*
Source of data used:	Either default value or results of 90 day monitoring survey
Value applied:	3.5 hours per 24 hours period or other value determined through 90 day study

Justification of the choice of data or description of measurement methods and procedures actually applied :	As per footnote 6 in AMS-II.J v4, the project participant can decide prior to the first *ex- post* measurement whether to use the 3.5 hours default value or ex post measured operating hours for determining O_i. The design approach to a possible 90 day monitoring survey is provided in Annex 4 – Monitoring Plan.
Any comment:	-

Data / Parameter:	**X_i**
Data unit:	hours/year
Description:	Average daily operating hours of the lighting devices replaced by group *i* lighting devices
Source of data used:	Calculated value
Value applied:	1,277.5 hours per year, or other value determined through a 90-day study.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The SSC-CPA implementer shall use either 3.5 hours per 24 hours period, or other value determined through a 90-day study. Hence the yearly value is fixed prior to the first ex-post monitoring survey.
Any comment:	-

Data / Parameter:	**NTG**
Data unit:	fraction
Description:	Net-to-gross adjustment factor
Source of data used:	Default AMS-II.J value
Value applied:	0.95
Justification of the choice of data or description of measurement methods and procedures actually applied :	The SSC-CPA shall use a default value of 0.95 under the PoA.
Any comment:	-

Data / Parameter:	**L_i**
Data unit:	hours
Description:	Rated average operating hours for CFL type *i*
Source of data used:	Life test report of CFLs
Value applied:	To be determined for each SSC-CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	Determined as per the independent life tests of the CFLs as per national/international standard and manufacturer technical data. The value is fixed ex-ante.
Any comment:	-

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

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

Data / Parameter:	**N**
Data unit:	-
Description:	Sample size of ex-post Monitoring Survey.
Source of data to be used:	Calculated as per statistical requirements in AMS-II.J (90% confidence interval and +-10% error margin) as detailed in Annex 4
Value of data applied for the purpose of calculating expected emission reductions in section B.5	value determined through ex-post monitoring survey
Description of measurement methods and procedures to be applied:	Households will be surveyed to determine the proportion of installed and distributed CFLs still in operation. Sample size calculated as per statistical requirements in AMS-II.J (90% confidence interval and +-10% error margin). Calculations to follow PoA-DD Annex 4.
QA/QC procedures to be applied:	Independent statistical experts from an appropriately qualified South African University will design the sampling methodology. The project proponents shall determine the representative sample size with minimum 90% confidence interval and 10% maximum error margin. To be conservative the minimum number of households surveyed should be one hundred.
Any comment:	-

Data / Parameter:	**$Q_{PJ,i}$**
Data unit:	number
Description:	Number of CFLs of the group of i CFLs (e.g. 20W CFL) in operation during the first 12 months of distribution
Source of data to be used:	Data Management System and ex-post survey
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be recorded by SSC-CPA based on the ex-post $Q_{PJ,i}$ survey:
Description of measurement methods and procedures to be applied:	The SSC-CPA will determine $Q_{PJ,I}$ using the first ex-post survey and the data will be entered into the SSC-CPA Data Management System.
QA/QC procedures to be applied:	Use of standardised data forms and compliance protocols of SSC-CPA. The DMS will use industry standard software, databases, infrastructure and back-up procedures to allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misrecorded, overwritten or lost.

	Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate customer/building information, and an accurate number of lamps and equipment replaced is recorded.
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:	**$LFR_{i,y}$**
Data unit:	%
Description:	Lamp Failure Rate for CFL type *i* in year y.
Source of data to be used:	Ex-post Monitoring Survey
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The ex-ante LFR calculated value is adjusted as per the results of ex-post monitoring surveys.
Description of measurement methods and procedures to be applied:	Determine as per monitoring surveys of the installed CFLs. The survey will consist of identifying CFLs, with unique Project Activity markings that are installed and operating. Under the survey, only CFLs with an original marking can be counted as installed. While CFLs replaced as part of a regular maintenance or warranty program can be counted as operating, CFLs cannot be replaced as part of the survey process and counted as operating.
QA/QC procedures to be applied:	The survey will consist of identifying CFLs, with unique SSC-CPA markings that are installed and operating. During the survey, only CFLs with an original marking can be counted as installed. While CFLs replaced as part of a regular maintenance or warranty program can be counted as operating, CFLs cannot be replaced as part of the survey process and counted as operating. Independent statistical experts from an appropriately qualified South African University will design the sampling methodology. The project proponents shall determine the representative sample size with minimum 90% confidence interval and 10% maximum error margin. To be conservative the minimum number of households surveyed should be one hundred.
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:	**Lamp distribution data**
Data unit:	-
Description:	The start and completion date of CFL Distribution will be clearly described. Household information will be available in the Data Management System as described in the Operational Manual.
Source of data to be	Data Management System

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be recorded for each SSC-CPA: Distribution of CFLs - Start date: dd/mm/yyyy Distribution of CFLs - Completion date: dd/mm/yyyy Utility household consumer data would be provided in the SSC-CPA Data Management System.
Description of measurement methods and procedures to be applied:	ESKOM will engage the Project Management Company of the SSC-CPA to ensure all data is properly captured and stored as per the Operational Manual (ESCO Requirements Document V6).
QA/QC procedures to be applied:	The data should be documented and verifiable by the CME and DOE at random. Each employee involved in the project will be trained in the use of the DMS to ensure accurate record keeping. The DMS will use industry standard software, databases, infrastructure and back-up procedures to allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misrecorded, overwritten or lost. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate customer/building information, and an accurate number of lamps and equipment replaced is recorded.
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:	$N_{Destroyed}$
Data unit:	number
Description:	Number of ICLs collected and destroyed
Source of data to be used:	Data Management System and scrapping reports
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be recorded for each SSC-CPA. Once determined, the value is fixed for the entire project crediting period.
Description of measurement methods and procedures to be applied:	The total number of ICLs will be available through the data management system and will be verified with the scrapping reports provided to Eskom by the independent waste management contractor.
QA/QC procedures to be applied:	The data for the destruction of the baseline ICLs should be documented and verifiable by the DOE. The results of the ICL crushing reports will be stored in the DMS. The DMS will use industry standard software, databases, infrastructure and back-up procedures to allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misrecorded, overwritten or lost. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate customer information, and an accurate number of

	lamps replaced is recorded.
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:	$\mathbf{P_{i,BL}}$
Data unit:	W
Description:	Rated power of the baseline ICLs in group *i*
Source of data to be used:	Weighted average calculated using rated power of the baseline ICLs as recorded in the SSC-CPA database.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be recorded in the Data Management System.
Description of measurement methods and procedures to be applied:	The project proponents will monitor $P_{i, BL}$ during the ICL replacement. The data will be entered into the Data Management System (as per Operational Manual procedures) and fixed for crediting period duration.
QA/QC procedures to be applied:	Each employee involved in the project will be trained in the use of the DMS to ensure accurate record keeping. Use of standardized data forms and compliance protocols of the Project Activity. The DMS will use industry standard software, databases, infrastructure and back-up procedures to allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misrecorded, overwritten or lost. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate customer information, and an accurate number of lamps replaced is recorded.
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:	$\mathbf{P_{i,PJ}}$
Data unit:	W
Description:	Rated power of the project CFLs in group *i*
Source of data to be used:	Weighted average calculated using rated power of the CFLs as recorded in SSC-CPA Data Management System.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be recorded in the Data Management System.
Description of measurement methods and procedures to be	The project proponents will monitor $P_{i,PJ}$ during the CFL distribution. The data will be entered into the Data Management System (as per Operational Manual procedures) and fixed for crediting period duration.

applied:	
QA/QC procedures to be applied:	Use of standardized data forms and compliance protocols of SSC-CPA. The DMS will use industry standard software, databases, infrastructure and back-up procedures to allow full auditability with the aim of ensuring long-term data integrity and security so that data is not misrecorded, overwritten or lost. Data is verified in a timely manner at point of data entry to ensure valid and non-duplicate customer information, and an accurate number of lamps replaced is recorded.
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:	**TD_y**
Data unit:	%
Description:	Average annual technical grid losses
Source of data to be used:	Published in Eskom Annual report 2011
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8.3%
Description of measurement methods and procedures to be applied:	The methodology requires that the average technical grid losses shall be determined using recent, accurate and reliable data available for the host country. This value can be determined from recent data published either by a national utility or an official governmental body. The project proponents have chosen to source the data from the national utility, Eskom.
QA/QC procedures to be applied:	-
Any comment:	This value will be fixed for the duration of the crediting period.

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

>>A detailed description of the monitoring plan of the PoA is provided in section A.4.4.2. Each SSC-CPA must implement the following activities:

1. CFL distribution
2. Ex-post Monitoring Surveys
3. ICL destruction.

1. CFL Distribution

Each SSC-CPA will involve the replacement of eligible lamps (ICLs or failed Eskom CFLs) free of charge using the following distribution mechanism:

(i) Door to door direct installation
(ii) Gate to gate exchange
(iii) Stationary point exchange.

The distribution process will be supported by an education campaign to ensure households are aware of the project activity, and that distribution occurs relatively quickly. The method of distribution and associated awareness-raising campaigns will focus on providing the majority of efficient appliances to low income households, and will encourage households to install CFLs n high use areas within the home.

In all cases, a data form has to be filled and signed by the household. The data from these forms will be captured within a Data Management System (DMS) known as the SSC-CPA database shortly after CFLs are installed or exchanged. Each SSC-CPA will follow the record keeping and monitoring requirements stipulated in ASM II.J and maintain appropriate records documenting the following variables for each household participating in the CPA:

- Geographical location of each CPA
- Name of household (name and surname)
- The address (street number, name and suburb) of household
- Meter number of household
- Date of distribution and installation (if different) of CFLs
- Specifications of ICLs replaced, including: number replaced, power rating or wattage
- Specifications of failed Eskom CFLs replaced, including: number replaced, power rating or wattage Specifications of CFLs installed, including: number installed, power rating or wattage
- Date of return and destruction of ICLs replaced
- Date of return and disposal of distributed CFLs that were broken
- A household signature accepting to transfer all the carbon credits to Eskom.

The Coordinating/Managing Entity (CME) will be responsible for the management of records and data associated with each SSC-CPA. Data will be stored in secure project databases for the duration of each SSC-CPA crediting period, plus two years. The information stored in the databases will be used as the basis of the production of monitoring reports used to quantify emission reductions and claim CERs.

The number and power rating of all ICLs collected will be employed to determine the weighted average power rating of the baseline light bulbs ($P_{i,BL}$). Similarly, the number and power rating of all CFLs installed will be employed to determine weighted average power rating of the project light bulbs ($P_{i,PJ}$).

2. Ex-post Monitoring Survey

The emission reductions of each SSC-CPA under the PoA are calculated *ex ante* and adjusted *ex post* using data from the *ex post* monitoring surveys. *Ex post* monitoring surveys are required within the first year after installation to adjust the Net Electricity Savings (NES_y) considering the actual Lamp Failure Rate ($LFR_{i,y}$) data, the actual average daily operating hours of the light bulbs replaced (O_i) (if a default value is not selected), the CFL Average Life (if a CFL Rate Average Life was used initially), and using the actual quantity of CFLs for each wattage group i ($Q_{PJ,i}$).

Due to the large number of installations, it is not possible to monitor all households in a SSC-CPA. Establishing a survey sample group is a scientific and statistical procedure to determine a sampling mean that can be applied to the broader population across different SSC-CPAs. The *ex post* monitoring surveys are conducted following the generic instructions for conducting the surveys and sampling (AMS-II.J, point 20.):

- The sampling size is determined by minimum 90% confidence interval and the 10% maximum error margin; the size of the sample shall be no less than 100;
- Sampling must be statistically robust and relevant, i.e., the survey has a random distribution and is representative of target population (size, location);
- The method to select respondents for interviews is random;
- The survey is conduced by site visits;
- Only persons over age 12 are interviewed;
- The project document must contain the design details of the survey.

Further procedure to determine the project sample group is presented in Annex 4.

It is the intention of the CME to undertake ex-post monitoring surveys with a number of representative sample groups determined by the geographic location and timing of SSC-CPA implementation. These results will then be applied across all SSC-CPAs from the same region, for SSC-CPAs implemented at a similar time. It is not the intention of the CME to undertake ex-post monitoring surveys for each SSC-CPA implemented under the PoA. Because of the high degree of similarity of households participating in the PoA (particularly those from the same or adjacent municipalities or provinces), the CME will establish a number of sample groups, representative of certain regions and implementation timing (eg. all SSC-CPAs implemented in 2011, 2012 etc) from which results will be applied to the relevant SSC-CPAs. This will avoid the situation whereby multiple surveys are conducted of households from the same region for SSC-CPAs implemented at the same time, which would create significant statistical redundancy. The CME has worked with a suitably qualified university in South African to determine the sampling regime for the ex-post monitoring surveys, with details provided in Annex 4.

3. ICL Destruction
ICLs collected during the exchanges will be collected, stored and then destroyed to prevent leakage. The number of ICLs collected and destroyed, as well as their power rating shall be recorded in the SSC-CPA database. In addition, the method of destruction and presence of responsible witnesses, e.g. officials from Eskom, or independent national institutions or service providers, must be documented in the SSC-CPA database.

To ensure there is no leakage, at the beginning of the monitoring interval, the SSC-CPA implementer must verify whether the number of distributed CFLs is less than or equal to the number of collected and destroyed ICLs in the SSC-CPA area.

This process will be independently verified by a relevant third party (specialised in environmental auditing, consulting and certifications), and the results of the audit presented for verification by the DOE.

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

>>
Date 30 June 2011
Rodrigo Castellanos
RAMP Carbon

Francois Carre

BNP Paribas

Enoch Lerato Liphoto
Eskom Holdings Ltd

Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NO PUBLIC FUNDING IS USED FOR THIS PROJECT

Annex 3

BASELINE INFORMATION

The baseline scenario for the PoA has been determined to be the ongoing use of ICLs. The emissions associated with continued ICL use are monitored by proxy based on measuring the use of CFLs distributed under the PoA, and multiplying energy savings by a grid emission factor. This Annex presents a calculation of the emission factor for the South African electricity grid which will be used for the duration of the PoA crediting period to determine baseline emissions. This Annex should be read in conjunction with the GEF Calculation spreadsheet provided to the DOE for the purposes of validation.

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. In order to achieve this, the project developer must calculate 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 to calculate emission factors for an electricity system" (version 2.2.1)* mentions the following steps:

Step 1: Identify the relevant electric power system
Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)
Step 3: Select an operating margin method
Step 4: Calculation of the operating margin emission factor
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 "*Tool to calculate emission factors for an electricity system*" (version 2.2.1) stipulates that:

"For the purpose of this tool, the reference system is the project electricity system. Hence electricity transfers from a connected electricity systems to the project electricity system are defined as electricity imports while electricity transfers from the project electricity system to connected electricity systems are defined as electricity exports.

For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system;

For the purpose of determining the operating margin emission factor, use one of the following options to determine the CO_2 emission factor(s) for ***net electricity imports*** *from a connected electricity system:*

0 tCO_2/MWh; or

(a) The weighted average operating margin (OM) emission rate of the exporting grid, determinedas described in Step 4 (d) below; or
(b) The simple operating margin emission rate of the exporting grid, determined as described inStep 4 (a), if the conditions for this method, as described in Step 3 below, apply to the exporting grid; or
(c) The simple adjusted operating margin emission rate of the exporting grid, determined as described in Step 4 (b) below."

The project will be implemented within the geographic boundary of South Africa. Therefore the relevant project electricity system is the South African national grid. National utility, 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. The whole transmission system is taken as a homogenous mix of electricity supply by all generators.

Although since 2002 Eskom has not had exclusive generation rights in South Africa, it does have the practical monopoly on the bulk of electricity generated in the country, supplying about 95 percent of South Africa's electricity[19].

The national transmission network is partly interconnected with countries from the Southern African Development Community region (SADC). Hence electricity transfers from SADC to the project electricity system are defined as electricity imports.

According to The "*Tool to calculate emission factors for an electricity system*" (version 2.2.1) only **net electricity imports** are to be taken into account for the purpose of calculating the operating margin. Eskom is a net exporter (exports exceed imports) of electricity to the region[20], therefore there are no net electricity imports to be considered in the calculation of the operating margin.

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

Option I has been chosen for this step: Only grid power plants are included in the calculations.

No off-grid power plants have been included since these play a very minor role in South Africa's overall power generation as explained in Step 1.

Step 3: Select an operating margin method

In accordance with the Tool, the calculation of the operating margin emission factor ($EF_{grid,OM,y}$) must be

[19] Proportion of Eskom generation into South African grid reported at: http://www.energy.gov.za/files/electricity_frame.html
[20] Source: Eskom Holdings Limited Integrated Report 2011, p 179 and Eskom Holdings Limited Integrated Report 2011, p 150.

based on one of the following methods:

a) Simple OM, or
b) Simple adjusted OM, or
c) Dispatch data analysis OM, or
d) Average OM.

The project developer has selected option a) Simple OM. As described by Eskom electricity production tables, the Low Cost/Must Run power plants in the system account for 0.30% of average electricity production for the past 5 years.[21]

"The simple OM method (option a) can only be used if low-cost/must-run resources2 constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production."

The Tool also states in its footnote number 2 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."

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- Ex ante option: If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use 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. For off-grid power plants, use a single calendar year within the 5 most recent calendar years prior to the time of submission of the CDM-PDD for validation.

- Ex post option: If the ex post option is chosen, the emission factor is determined for the year in which the Project Activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate 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.

For this project, the project developer has chosen to use the Ex ante option. The latest data available from the Eskom website (2009/10) are the electricity generation and fuel consumption from coal fired power plants for the years 2007/8, 2008/9 and 2009/10. This data is available from the CDM calculations webpage provided by Eskom[22].

[21] See Grid Emission Factor calculation sheet for determination of the electricity generation by Low Cost/Must Run power plants. Data for the GEF calculation sheets is sourced from Eskom: http://www.eskom.co.za/content/calculationTable.htm

[22] http://www.eskom.co.za/content/calculationTable.htm

Step 4: Calculation of the operating margin emission factor

The simple OM emission factor is calculated as the generation-weighted average CO2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The project developer has chosen Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit using equation (1) from the Tool:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (1)$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	=	All power units serving the grid in year *y* except low-cost / must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

The project developer has also chosen Option A1 to calculate the emission factor of each power unit as per equation (2) from the Tool:

Option A1. 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 as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad (2)$$

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) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	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 units serving the grid in year *y* except low-cost/must-run power units
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Electricity and fuel consumption were obtained from Eskom CDM Calculations website[23] while net calorific values for each year were obtained from Eskom Annual Report 2010[24]. The project developer also used the emission factors from 2006 IPCCC guidelines[25] for sub-bituminous coal[26] and natural gas.

A summary of the Operating Margin Emission Factor calculation can be found below:

OPERATIONAL MARGIN			
	2007/8	**2008/9**	**2009/10**
Total Electricity Generated (ex LC-MR) (MWh)	222,906,667	211,690,925	215,953,317
Emissions (tCO2)	215,195,689	215,219,017	219,314,650
Emission Factor (tCO2/MWh)	0.965	1.017	1.016

OPERATIONAL MARGIN (tCO2/MWh)	**0.999**

Step 5: Calculate the build margin emission factor

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

As per the Tool to Calculate Emission Factors Version 2.2.1, in terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

[23] http://www.eskom.co.za/content/calculationTable.htm. All sources are referenced further in the GEF Calculation sheet.

[24] http://www.eskom.co.za/annreport10/corp_tables_statistic.htm. All sources are referenced further in the GEF Calculation sheet.

[25] 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Table 1.4 Lower Level. All sources are referenced further in the GEF Calculation sheet.

[26] Greenhouse Gas Inventory South Africa, Environment Affairs & Tourism, May 2009 (page 13)

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex ante*, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The project developer has chosen **Option 1** to calculate the Emission Factor.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual= electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

(c) From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. Ignore steps (d), (e) and (f).

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activity, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2$ Å~ AEG_{total}), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units m used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{-}>10yrs}$).

As per the process described above:

(a) The most recently built power plants that provided electricity and fuel consumption data according to the Eskom CDM calculations[27] website are:

Power Plant	Commissioned Date	2009/10 Electricity Production (MWh/Year)
Majuba	1/04/96	22,340,081
Kendal	1/10/88	23,307,031
Matimba	4/12/87	27,964,141
Lethabo	22/12/85	25,522,698
Tutuka	1/06/85	19,847,894
Total		118,981,845

The project participants excluded the power plants Palmiet (1988), Ankerli (2007) and Gourikwa (2007) as no electricity generation and/or fuel consumption data is provided by Eskom[28]. Removing these power plants from the build margin makes the calculation of Build Margin more accurate and conservative by allowing power plants with higher electricity production and fuel consumption to be included.

The total Energy Production of the selected plants is equivalent to 55.1% of the electricity produced by the system in 2009/10 (215,953,317 MWh)

(b) The total Electricity Generation of the System in 2009/10 is 215,953,317. To reach 20% of electricity generation with the most recently built power plants the project developer has identified the following plants:

Power Plant	Commissioned Date	2009/10 Electricity Production (MWh/Year)
Majuba	1/04/96	22,340,081
Kendal	1/10/88	23,307,031
Total		45,647,112

The total Energy Production of the selected plants is equivalent to 21.1% of the electricity produced by the system in 2009/10 (215,953,317 MWh)

(c) $SET_{5\text{-}units}$ = 118,981,845 MWh = 55.1% of the total electricity produced by the system

$SET_{\geq 20\%}$ = 45,647,112 MWh = 22.1% of the total electricity produced by the system

[27] ESKOM website http://www.eskom.co.za/content/calculationTable.htm

[28] See data provided by Eskom http://www.eskom.co.za/content/calculationTable.htm

Therefore $SET_{5\text{-units}}$ will be selected as per the tool, however all power plants from $SET_{5\text{-units}}$ started to generate electricity more than 10 years ago. As such, the project developer has identified registered CDM projects generating electricity in South Africa and has included them in the calculation of the Build Margin as set out below.

(d) As per the date of this PDD being completed (6th July 2011), 11 CDM projects have been registered for South Africa in the Energy Industries (renewable - / non-renewable sources) scope.

Registered	Title	Methodology
25-Dec-10	Fuel switch project on the Gluten 20 dryer of Tongaat Hulett Starch Pty (Ltd) Germiston Mill	AMS-III.B. ver. 14
8-Oct-09	Bethlehem Hydroelectric project	AMS-I.D. ver. 13
24-Aug-09	Alton Landfill Gas to Energy Project	AMS-I.D. ver. 13 AMS-III.G. ver. 6
26-Mar-09	Durban Landfill-Gas Bisasar Road	AM0010
18-Jul-08	Kanhym Farm manure to energy project	AMS-I.D. ver. 11 AMS-III.D. ver. 12
19-Oct-07	Transalloys Manganese Alloy Smelter Energy Efficiency Project	AM0038 ACM0002 ver. 6
20-May-07	Mondi Richards Bay Biomass Project	AM0036 ver. 1
12-Feb-07	Tugela Mill Fuel Switching Project	AMS-I.C. ver. 8
15-Dec-06	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	AM0010
29-Sep-06	PetroSA Biogas to Energy Project	AMS-I.D. ver. 9
27-Aug-05	Kuyasa low-cost urban housing energy upgrade project, Khayelitsha (Cape Town; South Africa)	AMS-I.C. ver. 5 AMS-II.C. ver. 5 AMS-II.E. ver. 5

Out of these 11 projects, only 3 CDM projects are producing electricity and feeding it back into the grid:

Power Plant	Installed capacity (MW)	Commissioning Date	Fuel type	2009/10 Electricity Production (MWh)
Bethlehem Hydroelectric project (**)	7	8/10/09	Hydro	1,497
Durban Landfill-Gas Bisasar Road (**)	4	26/03/09	Landfill-Gas	13,218
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills (**)	0.5	15/12/06	Landfill-Gas	4,198
			Total	18,913

The total Energy Production of the selected CDM plants is equivalent to 0.01% of the total electricity produced by the system in 2009/10 (215,953,317 MWh).

(e) As identified by the project developer, only 3 CDM power plants are supplying electricity into the grid, and there are no further $SET_{sample\text{-}CDM}$ plants that can be included in the Build Margin calculation as suggested by the Tool.

(f) By using the initial set of power plants identified in step (a) ($SET_{5\text{-}units}$) plus the set of CDM power plants identified in $SET_{sample\text{-}CDM}$ the final group of plants that compromise 20% of the electricity system is as follows:

Power Plant	Commissioned/ Registration Date	2009/10 Electricity Production (MWh/Year)
Majuba	1/04/96	22,340,081
Kendal	1/10/88	23,307,031
Bethlehem Hydroelectric project (**)	8/10/09	1,497
Durban Landfill-Gas Bisasar Road (**)	26/03/09	13,218
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills (**)	15/12/06	4,198
Total		45,666,025

The total Energy Production of the selected plants is equivalent to 21.1% of the electricity produced by the system in 2009/10 (215,953,317 MWh)

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, calculated as follows:

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

(3)

Where:

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

then, as a conservative approach, only option A2 from guidance in Step 4 (a) (equation 3) can be used and the default values provided in Annex 1 shall be used to determine the parameter $\eta_{m,y}$.

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}} \quad \textbf{(4)}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All power units serving the grid in year *y* except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

A summary of the Build Margin Emission Factor calculation can be found below:

BUILD MARGIN 2009/10	
Total Electricity Generation (MWh)	215,953,317
BM Plants - Electricity Generation (MWh)	45,666,025
% of Total Electricity Generation	21.15%
BM Plants - Emissions (tCO2)	41,215,641
BUILD MARGIN (tCO2/MWh)	**0.903**

Step 6: Calculate the combined margin emission factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \textbf{(5)}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$ = 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 W_{OM} and W_{BM}:

- Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;
- All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period,9 unless otherwise specified in the approved methodology which refers to this tool.

Therefore, the combined margin emission factor for this project is:

$$\mathbf{EF_{grid,CM,y}} = \mathbf{(0.999 * 0.5) + (0.903 * 0.5)}$$
$$= \boldsymbol{0.4995 + 0.4515}$$
$$= \boldsymbol{0.9506}$$

Annex 4

MONITORING INFORMATION

The following is an extract from the Operational Manual to be used by ESCOs engaged by the CME in the distribution and installation of CFLs. It specifies the procedures for entering data from hard copy forms into the Project Activity DMS.

1. DATA CAPTURE

- Capturing to be done within 100 km of implementation area.
- The address for the capturing facility must be forwarded prior to the implementation of the project.
- ESCOs are required to remove all duplications and make the necessary corrections to their database as per their audit results.
- ESCOs must make their data forms available for inspection at the capturing facility.
- Only the format supplied by the Project Management Company of the SSC-CPA may be used. ESCOs can use their own front-end software to capture, only if the SSC-CPA's Project Management Company approves it.
- The database must remain on an Access 2007 format at all times.
- Forms must be captured within 48 hours of the physical installation.
- ESCOs are required to have their own IT support with the relevant experience in access, excel and word.
- Computers must be networked to allow for automatic consolidation.
- ESCOs are required to backup files daily and ensure that a suitable UPS unit is in place to accommodate power outages and other power failures.
- The door-to-door installations, door-to-door exchanges at the gate and exchange point forms should be kept on separate databases, as required for measurement and verification.

The following are mandatory fields:

- Home owner's name and surname
- House number (pole numbers to be used where there are no house numbers)
- Street name (transformer numbers where there is no street name)
- Suburb/Village
- Ward number
- Municipality
- ID number
- Meter number
- Details of CFL's installed
- Details of incandescents (ICLs) removed
- Installers reference number
- Exchange point (only if done through an exchange program)
- Date of installation
- Type of exchange
- Household signature accepting transfer of carbon credits to Eskom.

2. DATA STORAGE AND REPORTING

Information will be electronically saved in the Project Management Company's system and progress reports will be available every week.

The Project Manager has developed a Data Management System (DMS) that will record all information relevant to the Project Activity and monitoring, including:

- A list of households participating in the project, including information to identify households by name and address.
- A record of the incandescent bulbs collected (number and power) surrendered by, and replacement CFLs (number and power) provided to, each participating household.
- A list of households participating in ex post monitoring survey and the results of periodic checks of distributed CFLs. The proportion of CFLs still operating at the end of each monitoring period will be calculated and entered into the DMS.

3. EX POST MONITORING SURVEYS

As per AMS-II.J, paragraph 17 (a), *Ex post* monitoring surveys are required within the first year after installation to adjust the Net Electricity Savings (NES_y) considering the actual Lamp Failure Rate ($LFR_{i,y}$) data, the actual average daily operating hour of the light bulbs replaced (O_i) (if a default value is not selected), the CFL Average Life (if a CFL Rate Average Life was used initially), and using the actual quantity of CFLs for each wattage group i ($Q_{PJ,i}$).

Subsequent *ex post* monitoring surveys to determine the *ex post* Lamp Failure Rate ($LFR_{i,y}$) will be carried out at one of the following intervals:

(1) Once every 3 years
(2) Once for every 30% of the elapsed Rated Average Life or Average Life of lamp.

A sample of CFLs installed in participating households will be surveyed as per the requirements described above to ensure continuing operation.

The households included in the ex post monitoring survey will be randomly selected from the database of participating households. The result of this sampling will determine the proportion of the total number of devices still operating at the end of each monitoring period, which will be applied to the calculation of emissions reductions for that period. CFLs distributed under the PoA will be marked with an Eskom logo (or equivalent) to ensure that they can be unambiguously differentiated from other light bulbs installed in the selected households.

As discussed above, the results obtained from the sampling process will be directly extrapolated across the entire population of households participating in the Project Activity. Therefore, the proportion of

CFLs installed and continuing to function as determined through the household ex post monitoring survey will be taken to be representative of the pattern occurring in all households.

4. 90 DAY SURVEY TO DETERMINE DAILY HOURS OF USE

To determine the average daily operating hours of the lighting devices (ICLs) replaced by the group of *i* lighting devices, a default value of 3.5 hours per 24 hour period can be used. This default value can be used *ex ante* as well as *ex post* throughout the crediting period. Alternatively, the daily operating hours can be deduced from a continuous measurement of the usage hours of baseline or project lamps for a minimum of 90 days at a representative sample of households. This can be conducted prior to or concurrent with the first *ex post* monitoring survey. The days selected for measurement of operating hours shall be either representative of the annual variation of daylight hours in the region, or a correction factor must be applied in order to account for the variation in daylight.

As per footnote 6 in AMS-II.J v4, the project participant can decide prior to the first *ex- post* measurement whether to use the 3.5 hours default value or ex post measured operating hours for determining O_i in equation 2. At the time of commencing validation, the CME is undecided as to which option to pursue. A decision regarding whether the 3.5 hours/day default value or another value determined through a 90 day study shall be used will be made prior to the first ex-post monitoring survey of the initial SSC-CPA included under the PoA. This value will then be applied to all SSC-CPAs included under the PoA.

As per the "General Guidelines for Sampling and Surveys for Small Scale CDM Project Activities (Version 01)" the sampling plan and approach for the 90-day and ex post monitoring Surveys (independently developed by experts from the North West University) can be found below:

5. 90 DAY SURVEY SAMPLINNG PLAN

a. Sampling Objective

Within the methodology it prescribes that if another daily operational hour value than the default 3.5 hour needs to be used, a 90 day survey is required. During this 90 day survey a representative amount of lights should be measured satisfying the 90/10 (confidence/precision) requirement [1]. During the 90 day period the daily operational hours of a sample of lights will be measured. An appropriate and representative time frame will be chosen and if required, compensation for difference in daylights hours will be incorporated.

b. Field Measurement Objectives and Data to be collected

The focus of the field measurements is to determine the average operational hours of a light in a South-African residential home. From 2004 the local power utility Eskom distributed millions of CFLs to residents in South Africa. During these rollouts Eskom specifically targeted the lights mostly used in a household. From databases compiled during all these rollouts, it was calculated that on average 6 CFLs were distributed per household.

Therefore it is also the aim to determine the average operational hours of the six most used CFLs in a South African household. The field metering should capture the following variables and data:

- Time stamp of when a light was switched on;
- Time stamp of when a light was switched off;
    - From this the duration the light was on can be determined.

Using the above the operational hours of each light for specific day can be recorded.
From an analysis of available technologies able to capture these variables the desired metering technology also had to satisfy the following:

- Remote transmission of data through a reliable technology;
- A non-intrusive technology that will not require rewiring or replacement of the current light fitting;
- A device with plug and play capabilities to reduce installation and maintenance time; and
- Most important, the technology should not change the lighting use behaviour of the household.

The only technology satisfying all these criteria and which will be appropriate for SA conditions, are a GSM based hour meters that sends the recorded data via SMS. The SMS data is received by a receiving SMS server and interpreted by the system. Every time the light is switched on the meter will send an SMS containing the information of the past 12 switching events. This improves robustness and ensures data delivery even thou some SMSs may get lost within the Mobile Network.

c. The target Population and Sampling Frame

The target population is South-African residents connected to the power grid of the local power utility Eskom which were included in the Eskom CFL rollout.

The sampling frame refers to all the information sources on the basis of which the project database is developed. During the Eskom CFL Rollouts, databases were accumulating listing relevant information of the households CFLs were distributed to.

The sample frame is developed from these databases with the frame consisting of street addresses or house location info (lot number etc). These databases are representative and can be used for CDM purposes since it covers the different income groups and also the different provinces and municipalities in SA.

d. Sample Method

The Sample Method used is known as Simple Random Sampling. This implies that each household in the project database holds an equal probability of being identified for the sample group.

A direct application of this on the total project data base is not plausible due to limitations when incorporating field metering.

i. Field metering approach limitations

The Eskom CFL rollouts were done all over South-Africa. It is therefore also necessary to capture the light usage behaviour of residents all over SA which formed part of the CFL rollouts. However, attempting to install field metering equipment all over South Africa will be too costly and impracticable. This is due to the following;

- Within SA there are 262 municipalities
  - It will have to be arranged with each municipality where a meter needs to be installed;

- The local leaders of that area will need to be informed; and
- Residents will have to be informed of the installation through the media.

- Some houses forming part of the sample may be more than a 1000 km from each other. Due to the vast distances, meter installers need to drive, the following will be too difficult and costly:
  - Meter installation;
  - Meter maintenance; and
  - Meter retrieval after the 90day period was completed.
- Due to the sample size and amount of towns/municipalities in SA, it might occur that only one meter will be installed in a town. Although the meters will be typographically representative distributed over SA it may not be representative of a community (area/municipality). Having a representative sample of each community where meters are installed implies stratification which in return increases the original sample size up to ten times.

ii. Sample Household area selection

Considering the field meter limitation it was therefore decided that instead of having the meter distributed all over SA a different approach is required. Four representative cities within the Eskom distribution regions will be chosen. Within each city a representative suburb will be chosen wherein the meter rollout will take place. See Figure 1 below for a flow descriptive flow chart.

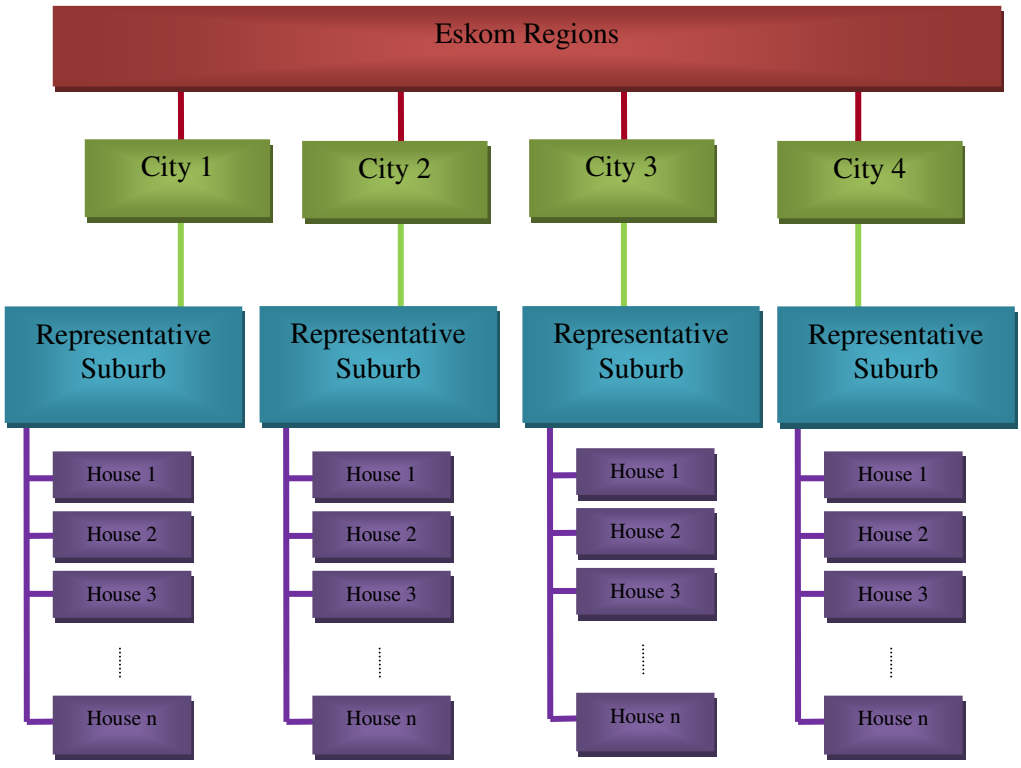

Figure 1: Flow chart of sample household area and household selection

1. Eskom Distribution regions

Eskom have divided South-Africa into different distribution regions for their transmission network. See Figure 2. These regions were also used for the CFL rollouts that started in 2004.
The selection of the cities will be done to representative of the different Eskom regions:

- Central
- Eastern
- Northern
- North-West
- Southern
- Western

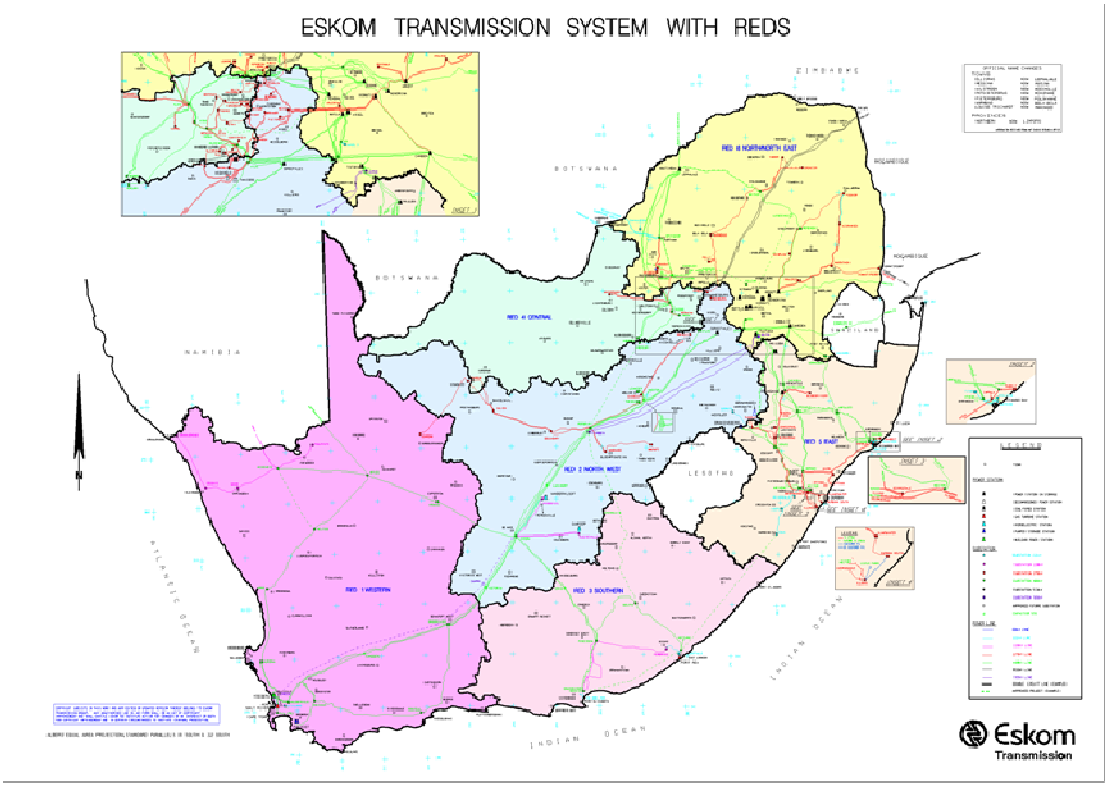

Figure 2: Eskom Regions

2. Metering within Cities

The cities selected should conform to the following criteria:

- Typographic representatively distributed over SA
  - This will ensure that the difference in behaviour people in different regions (business and socially related) have will be captured;
  - The difference in climate may have on the residents' behaviour (like the time they get up in the morning).

- The city should be representative of a specific region
    - Representative of the region in the amount of CFLs rolled out within the city as part of the 43million;
    - Representative of the businesses and operations in that region (with regarding aspects that may influence lighting operational hours).

Even having the metering area reduced to four cities there are still too many different suburbs/areas and municipalities within in some cities. In addition, the CFL rollout programs focussed on certain suburbs within cities.

3. Metering at suburb level

Using the project database a suburb within a city will be selected to represent the lighting use of the city (a suburb in the city covered by the Eskom CFL rollouts). A suburb will have to comply with the following:

1. A large part of the CFL rollouts within the city should have taken place in the specific suburb;
2. The suburb should be representative of the other suburbs in the city also included in the CFL rollouts;
3. The suburb should be accessible by the M&V Teams.
    - (Some suburbs are very hostile towards anyone associated with Eskom)

A suburb for a city will be randomly selected from a list of suburbs satisfying the above criteria.

iii. Sampling from selected suburbs

Having the representative suburbs within each region, sample metering houses can be randomly selected from the database for these suburbs. The selection will be done in such way that the amount of houses selected in a region will also be represent of the percentage of CFLs rolled out in that region (percentage of the total amount of Eskom CFLs rolled out).
The owners of the selected houses will be informed via a phone call ahead of the meter installation that they were selected for the metering group. Once the M&V Teams arrive at the house for the physical installation and the house may not be appropriate to host the meters, specific rules will be in place to select another household. This is to ensure that the selection of houses is unbiased. The first step is to randomly choose more houses form a suburb than actually required to allow a buffer group.
A clear motivation with proof needs to be given on a formal document why the house is not appropriate. Motivation may be:

- The light fittings in the house may not be able to support the GSM meters;
- The house is not lockable and the meters will not be safe.
- The homeowner were not at home;
    - In this case the M&V Team have to call the homeowner and return at least once at different time of the day.

e. Desired Precision/Expected Variance and Sample Size

i. Desired precision

As prescribed by the methodology there is 90/10 (confidence/precision) requirement.

ii. Expected variance

Since the start of the CFL rollouts Eskom contracted M&V teams to independently measure and verify the MWh and MW reduction due the project initiative. Part of the M&V process there were hundreds of small event logger meters installed with lights to measure the average operational hours of a typical residential light. The focus was to get an average value per room type in a house. Therefore the measurements evaluated all lights in a house and not only the ones used the most.

These meters were installed for a period of two weeks in each household. The measurements were done in several houses in different regions in SA. See Table 1 for an example of the measurements taken. As a conservative measure, the standard deviation obtained from these measurements was used to calculate the standard deviation.

Table1: Average daily operation hours of CFLs measured

Average daily operational hours - Soweto and Daveyton									
Number	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9
1	5.64	3.91	4.06	10.79	3.19	9.82	7.50	0.05	0.37
2	14.06	1.23	2.38	4.82	1.99	3.57	8.58	2.65	0.61
3	5.04	0.31	6.30	5.21	8.22	7.96	7.00	2.14	4.56
4	4.07	6.06	0.46	8.16	6.42	9.55	9.79	2.31	1.73
5	2.18	1.33	8.30	6.33	0.68	10.00	6.20	3.20	2.86
6	0.94	7.55	2.14	4.49	0.26	6.15	5.39	2.46	4.87
7	9.41	5.58	4.62	4.97	2.53	10.92	6.28	2.53	5.03
8	7.26	1.70	3.45	6.30	2.94	8.63	0.46	2.96	2.50
9	0.95	2.89	9.26	3.88	1.83	10.55	8.32	0.96	8.36
10	1.34	1.76	1.20	1.57	4.68	2.56	2.13	3.97	4.00

iii. Sample size

The following approach was followed for the statistical analysis of the sample size:

Under the assumption of an infinite population and a sufficiently large sample, the sample distribution of a sample mean x is approximately normal and the finite population correction factor is approximately 1 and therefore negligible. Under these assumptions the relationship between the margin of error *(e)* and the sample size (n) of a variable x in a simple random sample design can be derived as follows [2]:

$Px-\mu x \leq e = 1-\alpha \quad Px-\mu xsx \leq esx = 1-\alpha$

But $PZ \leq za2 = 1-\alpha$ and $x-\mu xsx \sim N0,1$

$\therefore za2 \cong esx$

$\therefore e \cong za2\,sx = za2\,sxn$

$\therefore n \cong za22\,sx2\,e2$

Where:

n denotes the sample size

x denotes the sample mean

μx denotes the population mean of x

e denotes the margin of error

$sx2$ is the sample variance of the variable x

$sx2$ is the sample variance of the sample mean x

Z denotes the stogastic variable of a standard normal distribution

$N0,1$ means: normal distribution with a mean of 0 and a variance of 1.

α denotes the specified significance level (i.e. the probability of a Type I Error)

$za2$ is the critical value of a standard normal distribution at significance level $\alpha 2$

Similar to the above, the relative *precision* may be expressed as

$Px-\mu x\mu x \leq e = 1-\alpha$

Using the required precision of 0.1 (or 10%), then

$Px-\mu x\mu x \leq 0.1 = Px-\mu x \leq 0.1\mu x = 1-\alpha$

If the population mean, μx, is then taken to be 5 hours, for example, then

$Px-\mu x \leq 0.5 = 1-\alpha$

This is equivalent to working with a margin of error of 30 minutes, in this instance.

Using the above method and considering the two weeks of data collected that with the 90/10 requirement a sample size of only 130 meters is necessary. However due to the nature of the project and the risks involved during the 90 day measuring period the sample size will have to be significantly increased. The risks include:

- Theft of meters;
- Damage to meters;
- Removal of the meters by the home owner;
- Data loss through meter malfunctioning; and
- Data loss through extended periods with no communication to the meter.

Considering these it was decided that at least 400 lights should be measured at all times. To realise this, 600 field meters will be employed. The 200 extra meters will be used for extra buffering and replacement for malfunctioning/stolen meters.

f. Procedures for Administering Data Collection and Minimizing Non- Sampling Errors

The NWU M&V Team have an ISO9001 accredited QMS system in place to ensure a clear and transparent data audit trail of all or M&V activities. In addition, a QMS system was specially designed for this CFL CDM project. The function of the QMS is to:

- Ensure reliability of data considering the nature of the parameters and interest of the project;
- Ensuring that measurement errors are avoided as far possible;
- Incorporation of check measures to verify data recording to pick up any measurement errors or data deviations;
- Specific reporting on measurement errors identified (such events is physically reported in a non-conformance document);
- Incorporation of approved procedures on how to handle measurement errors.

The QMS provides a data audit trail having check measures making sure that what was measured by a meter is what actually occurred. The QMS guards al steps, processes and calculations the data undergoes till the final reporting.

g. Implementation

i. Implementation Schedule

As per the provisions in AMS-II.J it is expected that the 90-day survey will be implemented prior the first Ex Post monitoring survey.

ii. Data collection and analysis

The NWU M&V Team will perform the actual data collection and analyses.

6. EX-POST MONITORING SURVEYS SAMPLING METHOD

a. Sampling Objective

The sampling objective is to establish a reliable estimate of the flowing two key variables:

- Proportion of project CFLs placed in service and operating (First ex-post monitoring survey)
- Project CFL failure rate (Subsequent ex-post monitoring surveys)

Within the methodology there are two types of ex-post monitoring survey:

1. First Ex Post Monitoring Survey - A survey has to be conducted within the first year after installation of all efficient lighting equipment will provide a value for the number of CFLs placed in service and operating under the project activity.
2. Subsequent Ex Post Monitoring Surveys - Life Failure Rate (LFR) Survey – the LFR has to be carried on, as a minimum, every 3 years or once for every 30% of the elapsed rated lifetime of the lamp.

Reliability Requirements
According to UNFCCC Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities (version 02), section III, point 19, p. 3, the "*Parameter values shall be estimated by sampling in accordance with the requirements in the applied methodology separately and independently for each of the CPAs included in a PoA except when a single sampling plan covering a group of CPAs is undertaken applying 95/10 confidence/precision for the sample size calculation.*"

For the present Programme of Activities representative samples for the Ex Post Monitoring surveys will be monitored at the PoA level therefore the required confidence/ precision criteria to be met is 95/10.

b. The target Population

The target population is the total project lights distributed during the monitored period under consideration.

c. Sampling Frame

As discussed in Section 5.c the sampling frame refers to all the information sources on the basis of which the project database is developed. During the Eskom CFL Rollouts, databases were accumulating listing relevant information of the households CFLs were distributed to.
The sample frame is developed from these databases with the frame consisting of street addresses or house location info (lot number etc). These databases are representative and can be used for CDM purposes since it covers the different income groups and also the different provinces and municipalities in SA.

d. Sample Method

The selected sampling method is a stratified multistage random sampling. The stratified approach was

chosen because when sub-populations vary considerably, it is advantageous to group elements into relatively homogeneous subpopulations and sample each subpopulation independently. The multistage sampling method was chosen in order to limit the potential high cost of information gathering that could arise from using a simple random sampling method to measure a homogeneous but rather large and geographically dispersed population. In effect a significant component of the cost of data collection is the travel time between households, but there is minimal cost to collect data on units within a household.

The project lights will first be classified based on the South African financial year of distribution ("vintage year") and a representative sample will be monitored. The "vintage years" are mutually exclusive and they are also collectively exhaustive: no population element is excluded.

Within each vintage year a multistage sampling method will be applied in order to select a representative sample of minimum 300 project lights.

Once the vintage years have been defined, the approach chosen will consist of the following steps:

- *Cluster the population by relevant geographical area and randomly select cluster(s).*

- *Random selection of a minimum of 50 households per vintage year within the last clusters units selected.*
  The selected households may be within the geographical boundary of 1 or more CPAs.

- *Data collection on all the project lighting fixtures in the selected household.*
  Given that an average of 6 CFLs were distributed to participating households, up to 300 lighting fixtures will be sampled within each vintage year, for every monitored period. This figure sits well above the 95/10 confidence/precision required in the Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities (version 02), and also compensates for the loss of accuracy inherent to a multistage sampling method.

e. Desired Precision/Expected Variance and Sample Size

i. Desired precision

As prescribed by the methodology there are 95/10 (confidence/precision) requirements.

ii. Sample size

The minimum sample size will be estimated by using the following formula:

$$n = \frac{Z^2 * CV^2}{e^2} \qquad (1)$$

Where,

n = Sample size

Z= Z- value, 1.96 for 95% confidence

e = Desired level of precision (i.e. 10%)

CV = Co-efficient Variation (initially taken as 0.50 to be more conservative)

Therefore, for a confidence level of 95% with 10% precision, and a CV of 0.5, the estimate of required sample size for infinite population size will be:

$$n = \frac{1.96^2 * 0.5^2}{0.1^2} = 96$$

According to the methodology "the size of the sampling shall be no less than 100 project lights". In this case, as mentioned above, the sampling design chosen by the project proponent ensure that the minimum sample size will be at least to 300 project lights for every vintage year. Just as an example, if the PoA distributes CFLs during 3 years (i.e. 3 vintage years), a total of 900 project lights would be monitored in total across the PoA. This figure is well above the UNFCCC requirements for PoA sampling.

The result of this sampling will determine the proportion of the total number of devices still operating at the end of each monitoring period, which will be applied to the calculation of emissions reductions for that period. CFLs distributed under the Project Activity will be marked with an Eskom logo (or equivalent) to ensure that they can be unambiguously differentiated from other light bulbs installed in the selected households.

As discussed above, the results obtained from the sampling process will be directly extrapolated across the entire population of households participating in the Project Activity. Therefore, the proportion of CFLs installed and continuing to function as determined through the household ex post monitoring survey will be taken to be representative of the pattern occurring in all households within the monitored period.

f. Procedures for Administering Data Collection and Minimizing Non- Sampling Errors

The same QMS system described in Section 5.f will be used to guard the data quality during the ex-post monitoring surveys.

g. Implementation

i. Implementation Schedule

The different ex-post monitoring surveys will be performed as prescribed in the methodology and set out in Section 6.a.

ii. Data collection and analysis

The NWU M&V Team will perform the actual data collection and analyses. Please see Appendix A for a summary of the NWU M&V Teams experience.