CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale Project Activity

A.1 Title of the small-scale Project Activity:

>> North West, KwaZulu-Natal & Eastern Cape CFL Replacement Project (2) in South Africa

Version Number: 01

Completion Date: 12/July/2011

A.2. Description of the small-scale Project Activity:

>>
Description

The objective of the Project Activity is to boost the energy efficiency of South Africa's residential lighting stock by distributing Compact Fluorescent Lamps (CFLs) free of charge to households across South Africa.

The Project Activity aims to distribute up to 1,000,000 CFLs to households in the following provinces:

- Eastern Cape
- KwaZulu Natal
- North West

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 project 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 Project Activity 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 use of energy intensive technologies such as electrical appliances.

CFLs will be made available via the following distribution mechanisms:

Door to door installation

[1] 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

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 incandcents lamps (ICLs) 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 household when not granted permission, by the householder, to enter the premises to conduct a direct installation. Up to six working incandescents will be exchanged for free of charge. All replacement will occur as detailed above.

STATIONARY EXCHANGE POINT

A large number of distribution points will be located within the area covered by the Project Activity. Residents will come to distribution points with their old incandescent bulbs and exchange them for up to 6 CFLs free of charge. All replacement will occur as detailed above. Each stand will have a computer with a data management system, or paper based forms for collecting the information (name, address, contact details) of each household as well as the wattages and number of incandescents exchange for CFLs.

All data forms will be captured in the data management system within 48 hours of product being installed/exchanged.

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

Contribution of the project to sustainable development

The Project Activity 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 an individual household level makes an important contribution to South Africa's economic efficiency and sustainability, particularly in the context of the rising demand for electricity currently occurring in South Africa.

The DSM programme administered by the national power utility, Eskom, has recognized the contribution that lighting can make to achieve national energy efficiency objectives in its Accelerated Energy Efficiency Plan (AEEP)[2]. This plan aims to save 3 000 MW by 2012 and a further 5 000 MW by 2025. Eskom's 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. This document set a target for reduction of electricity consumption in the residential sector of 10% by 2015.

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[2] Eskom DSM. http://www.eskomdsm.co.za/?q=Programme+Overview

Furthermore in order to deliver this program, Eskom will engage (directly and through partnerships) a large workforce over the short to medium term, to install and maintain the lighting products, 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 local Universities.

The major economic impacts of the project relate to reduced energy costs, and increased economic activity in the area of energy efficiency. Firstly, the Project Activity will reduce the overall cost associated with lighting use electricity consumption. It is hoped that these cost savings will have a materially positive impact on household purchasing power. Secondly, the Project Activity will have a positive impact on the local labour market via the creation of a number of semi-skilled jobs in order to install and maintain the lighting equipment. Finally, the sale of CERs in the international carbon market by the project proponents will have a positive foreign exchange impact for South Africa.

Estimated number of Jobs created by the distribution of 1,000,000 CFLs

Greenfield (2)	*Estimated Jobs*
ESCO Resources	**Overall Total**
Project Managers	9
Supervisors	31
Store Managers	10
Drivers	13
Field Workers	774
Admin	11
Data Capturers	21
TOTAL	**870**

As well as the direct financial benefit to households in terms of savings on their electricity bills each year, the Project Activity 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 technology in households will reduce the consumption, and hence generation of electricity. In addition to reducing GHGs, the Project Activity 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 1.87 MtSO_2, 2,801 tNO_x, 10 tonnes of Mercury and 55,600 tonnes of particulates[3]. As is set out in section B.2 below, The Project Activity will reduce electricity consumption by an average of 19.37 GWh/year for 10 years, 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 19.37 GWh of electricity savings per year:

Table A.1 Pollutant Emission Reductions from 38.74 GWh electricity savings

NOx	0.45 tonnes
SO_2	300 tonnes
Mercury	1.6 kg
Particulates	8.9 tonnes

Source: Calculations are based on data provided in Eskom Annual Report, 2009[2]

The Project Activity is not expected to have a material impact on the biodiversity of ecosystems.

Technology Transfer

The Project Activity 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 Project Activity are manufactured in China. By removing key barriers, the Project Activity 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 Project Activity. 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.

A.3. Project participants:

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

[3] 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

A.4. Technical description of the small-scale Project Activity:

A.4.1. Location of the small-scale Project Activity:

>> Republic of South Africa

A.4.1.1. Host Party(ies):

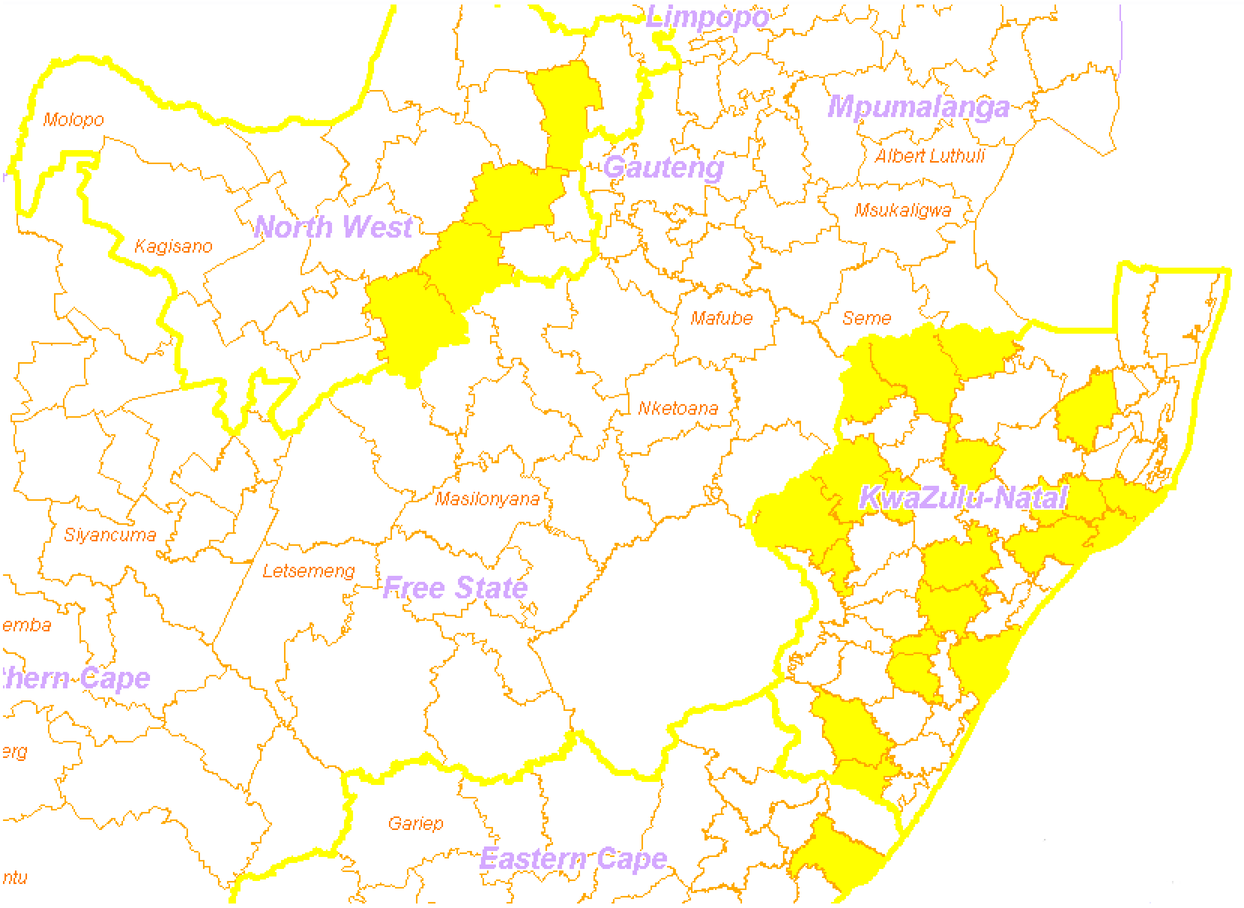
>> Republic of South Africa

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

>>Province of North West, KwaZulu-Natal & Eastern Cape

A.4.1.3. City/Town/Community etc:

Buffalo City Municipality	Msunduzi	Greater Taung
Ingquza Hill	Nongoma	Lekwateemane
Mbizana	Okhahlamba	Maquassi Hills
Nelson Mandela Metropolitan	Richmond	Matlosana
Emthonjaneni	Ulundi	Moretele Municipality
Ethekwini	Umdoni	Rustenburg
Kwadukuza	Umhlathuze	Tlokwe
Kwambonambi	Umlalazi	Ventersdorp
Mandeni	Umzimkhulu	


Limpopo
Mpumalanga
Albert Luthuli
Molopo
Gauteng
Msukaligwa
North West
Kagisano
Mafube
Seme
Nketoana
KwaZulu-Natal
Masilonyana
Siyancuma
Letsemeng
Free State
emba
hern Cape
erg
Gariep
Eastern Cape
ntu

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale Project Activity:

>>

Name	Type	Province	Coordinates
Buffalo City	Municipality	Eastern Cape Province	32° 59′ 0″ S, 27° 52′ 0″ E
Ingquza Hill	Municipality	Eastern Cape Province	32° 10′ 0″ S, 28° 35′ 0″ E
Mbizana	Municipality	Eastern Cape Province	32° 10′ 0″ S, 28° 35′ 0″ E
Nelson Mandela Metropolitan	Municipality	Eastern Cape Province	33° 57′ 29″ S, 25° 36′ 0″ E
Emthonjaneni	Municipality	Kwazulu Natal	28° 34′ 48″ S, 31° 22′ 48″ E
Ethekwini	Municipality	Kwazulu Natal	29° 52′ 0″ S, 31° 1′ 0″ E
Kwadukuza	Municipality	Kwazulu Natal	29° 20′ 0″ S, 31° 17′ 30″ E
Kwambonambi	Municipality	Kwazulu Natal	28° 48′ 0″ S, 32° 6′ 0″ E
Mandeni	Municipality	Kwazulu Natal	29° 9′ 22″ S, 31° 25′ 3″ E
Msunduzi	Municipality	Kwazulu Natal	29° 37′ 0″ S, 30° 23′ 0″ E
Nongoma	Municipality	Kwazulu Natal	27° 55′ 0″ S, 31° 39′ 0″ E
Okhahlamba	Municipality	Kwazulu Natal	28° 44′ 0″ S, 29° 22′ 0″ E
Richmond	Municipality	Kwazulu Natal	30° 25′ 0″ S, 30° 29′ 0″ E
Ulundi	Municipality	Kwazulu Natal	28° 19′ 0″ S, 31° 25′ 0″ E
Umdoni	Municipality	Kwazulu Natal	30° 17′ 0″ S, 30° 45′ 0″ E
Umhlathuze	Municipality	Kwazulu Natal	28° 45′ 0″ S, 31° 54′ 0″ E
Umlalazi	Municipality	Kwazulu Natal	28° 53′ 18″ S, 31° 26′ 54″ E
Umzimkhulu	Municipality	Kwazulu Natal	28° 53′ 18″ S, 31° 26′ 54″ E
Greater Taung	Municipality	North West Province	27° 30′ 0″ S, 24° 25′ 0″ E
Lekwateemane	Municipality	North West Province	27° 40′ 0″ S, 25° 20′ 0″ E
Maquassi Hills	Municipality	North West Province	27° 15′ 0″ S, 26° 0′ 0″ E
Matlosana	Municipality	North West Province	26° 50′ 0″ S, 26° 30′ 0″ E
Moretele Municipality	Municipality	North West Province	25° 10′ 0″ S, 28° 5′ 0″ E

Rustenburg	Municipality	North West Province	25° 40′ 0″ S, 27° 20′ 0″ E
Tlokwe	Municipality	North West Province	26° 45′ 0″ S, 27° 10′ 0″ E
Ventersdorp	Municipality	North West Province	26° 20′ 0″ S, 26° 55′ 0″ E

A.4.2. Type and category (ies) and technology/measure of the small-scale Project Activity:

>> Type II Project Activity, energy efficiency Project Activity, which reduces energy consumption on the demand side. Category: J. **Demand-side activities for efficient lighting technologies**

The project will provide energy efficient light bulbs, in the form of compact fluorescent lamps (CFLs), to replace incandescent light bulbs 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 project will abate greenhouse gas emissions, significantly reduce national electricity demand and stress on energy infrastructure, and save individual households money on their electricity bills.

CFLs require up to 80% less energy than incandescent lamps 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.

Philips Lighting has designed, engineered and manufactured the technologies to be installed under the Project Activity. 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.

The table below provides an indicative list of the CFLs that may be installed under the Project Activity.

15 Watts	Cold White
15 Watts	Warm White
20 Watts	Cold White
20 Watts	Warm White
8 Watts	Cold White
8 Watts	Warm White

All CFLs will be available on B22 and E27 cap-bases.
All CFLs are for 220-240-grid voltage.
All CFLs comply with the ELI Guidelines
Expected lifetime 10,000 (for 50% of the CFLs)

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

>>

The project would lead to an overall estimated 295,176 tCO_2e of emission reduction over a crediting period of 10 years.

Year	Annual estimation of emission reduction in tonnes of CO_2e
Year 1	53,022
Year 2	49,404
Year 3	45,786
Year 4	42,168
Year 5	38,550
Year 6	34,932
Year 7	31,314
Year 8	-
Year 9	-
Year 10	-
Total	**295,176**
Total number of crediting years	**10**
Annual average over the crediting period of estimated emission reductions (tCO2e)	**29,518**

The above CER estimate is for ex-ante purpose only. The actual CER generation during the Project Activity would be based on the (i) the actual number and wattage of the CFL distributed; and (ii) default or measured operating hours until a monitoring survey is undertaken as per SSC WG recommendation as per paragraph 12 of the SSC WG 22 (submission number SSC_350 dated 24th Sep 2009).

A.4.4. Public funding of the small-scale Project Activity:

>>No public funding has been used for the development and implementation of the Project Activity

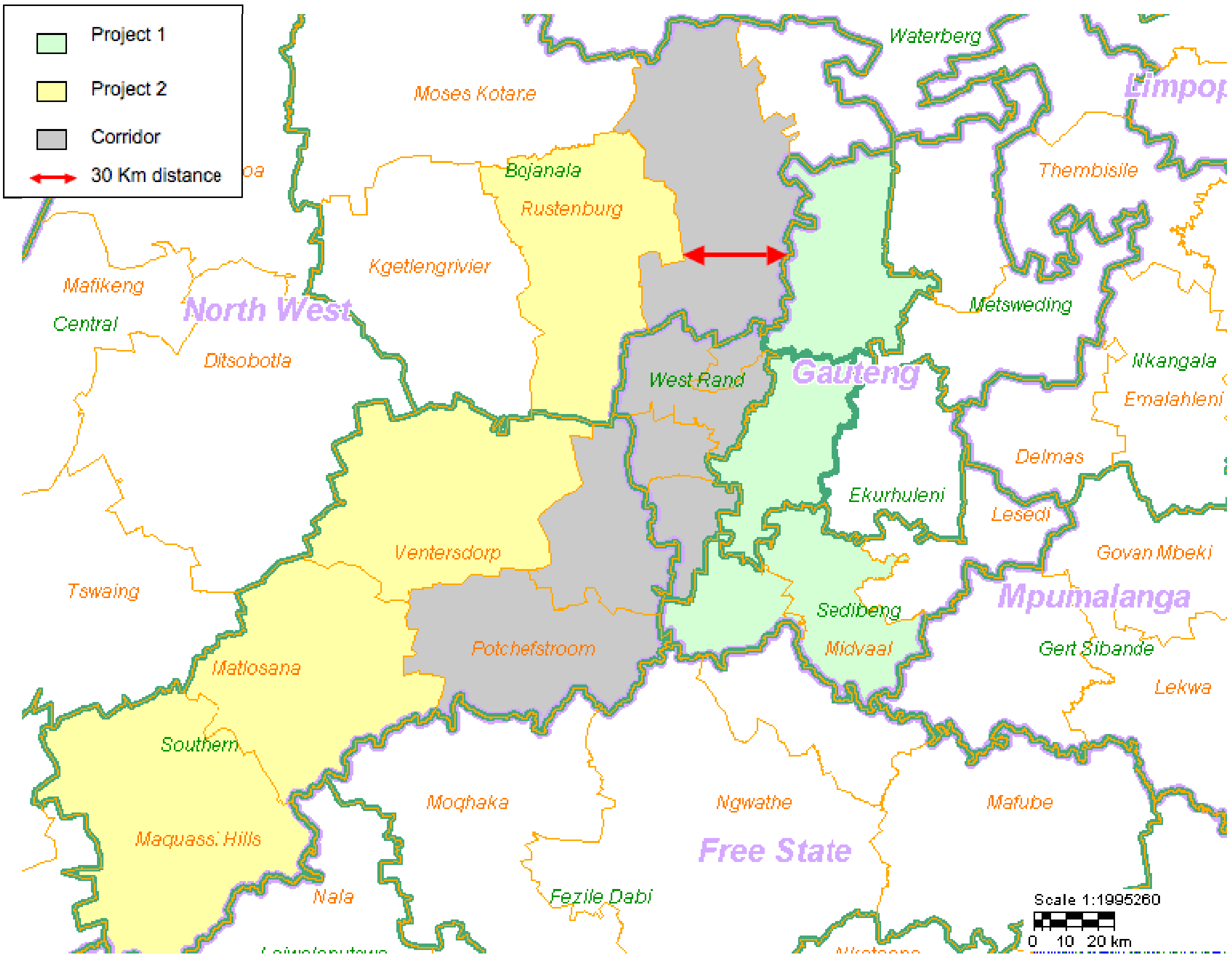
A.4.5. Confirmation that the small-scale Project Activity is not a debundled component of a large-scale Project Activity:

Eskom has proposed to implement a second Project Activity similar to the one described in this document in neighboring provinces. While the proposed Project Activity is with the same project participants, in the same project category and technology/measure as the Project Activity described in this document, the respective boundary of the two Project Activities **are not** within 1 km of each other at the closest point.

As shown in the map below, a corridor of an area of 10,644 squares km separates the 2 projects, with 30 km distance between their project boundaries at their closest points.

According to the Guidelines on assessment of de-bundling for SSC project activities[4] (see below) the proposed SSC PA is not deemed to be a debundled component of a large Project Activity, because it fulfills the requirement of the boundaries not being within the 1 km from each other, and therefore it is eligible to use the simplified modalities and procedures for small scale Project Activities.

[4] EB 47 Report Annex 32 Page 4


Project 1
Project 2
Corridor
30 Km distance
Waterberg
Limpopo
Moses Kotane
Bojanala
Rustenburg
Thembisile
Kgetlengrivier
Mafikeng
Central
North West
Metsweding
Ditsobotla
West Rand
Gauteng
Nkangala
Emalahleni
Delmas
Ekurhuleni
Lesedi
Ventersdorp
Govan Mbeki
Tswaing
Sedibeng
Mpumalanga
Potchefstroom
Midvaal
Gert Sibande
Matlosana
Lekwa
Southern
Moqhaka
Ngwathe
Mafube
Maquassi Hills
Free State
Nala
Fezile Dabi
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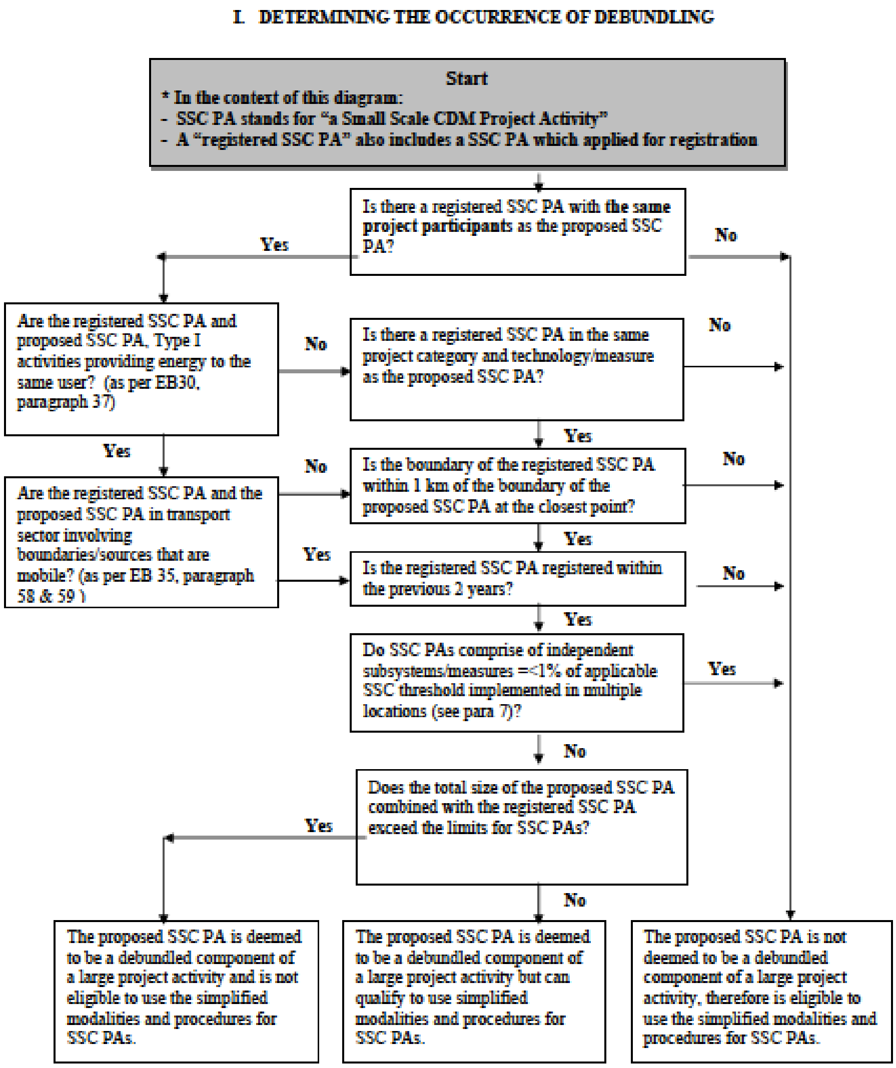
0 10 20 km



SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale Project Activity:

>>
The small-scale methodology used is AMS-II.J: ***Demand-side activities for efficient lighting technologies, Version 4.***

B.2 Justification of the choice of the project category:

>>
This Project Activity is a Type (II) Project Activity ("Energy efficiency improvement projects") because it increases the efficiency of lighting use in households.

This Project Activity belongs to the Category J ("Demand-side activities for efficient lighting technologies") because it increases the efficiency of lighting use in individual households (demand-side) and the Project Activity consists of a large quantity of ICLs (Lighting technology) to be replaced over a given period of time.

The annual energy savings derived from the Project Activity will remain below the 60 GWh threshold during its crediting period (please refer to table below), therefore the Project Activity qualifies as a small scale Project Activity.

Year	Annual estimation of energy savings in kWh
Year 1	55,776,918
Year 2	51,971,069
Year 3	48,165,219
Year 4	44,359,370
Year 5	40,553,521
Year 6	36,747,672
Year 7	32,941,822
Year 8	29,135,973
Year 9	25,330,124
Year 10	21,524,275
Total	**386,505,963**

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 the Project Activity because it provides 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 the Project Activity requires CFL purchase/dispatch records ensure that only new CFLs are employed in the project, 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 the Project (refer to Annex 4) 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.	The Project Activity requires the calculation of the aggregate energy savings to demonstrate that it does not exceed 60 GWh per year (see Section B.2 – Annual Estimation of Energy Savings in kWh).
The average life or the rated average life of the CFLs shall be known *ex ante*. IEC 60969 (Self	International manufacturer Philips Lighting following the Efficient Lighting Initiative

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.	standards has provided the CFLs. Furthermore, KEMA Quality following the IEC 60969 (*Self-ballasted lamps for general lighting services - Performance requirements)* has independently tested the CFLs.
CFLs utilized under the Project Activity shall, in addition to the standard lamp specifications (power rating, lumen output, correlated colour temperature, voltage, power factor, frequency), be marked for clear unique identification for the project.	The monitoring plan for the Project Activity (refer to Annex 4) provides a procedure that clearly 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 for the Project Activity (refer to section B.7.2) provides a step-wise procedure for 1. CFL distribution, 2. Ex-post Monitoring, 3. ICL destruction, 4. Avoidance of double counting.
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., 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	As per the ESCO Requirements V6 (Operational Manual), the distribution process will be supported by a communication campaign to ensure

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.	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.

B.3. Description of the project boundary:

>>

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 buildings are connected. The project boundary is therefore defined by the location of the participating households in the Municipalities listed below. The customer database will provide address details for each participating household.

Name	Type	Province	Coordinates
Buffalo City	Municipality	Eastern Cape Province	32° 59′ 0″ S, 27° 52′ 0″ E
Ingquza Hill	Municipality	Eastern Cape Province	32° 10′ 0″ S, 28° 35′ 0″ E
Mbizana	Municipality	Eastern Cape Province	32° 10′ 0″ S, 28° 35′ 0″ E
Nelson Mandela Metropolitan	Municipality	Eastern Cape Province	33° 57′ 29″ S, 25° 36′ 0″ E
Emthonjaneni	Municipality	Kwazulu Natal	28° 34′ 48″ S, 31° 22′ 48″ E
Ethekwini	Municipality	Kwazulu Natal	29° 52′ 0″ S, 31° 1′ 0″ E
Kwadukuza	Municipality	Kwazulu Natal	29° 20′ 0″ S, 31° 17′ 30″ E
Kwambonambi	Municipality	Kwazulu Natal	28° 48′ 0″ S, 32° 6′ 0″ E
Mandeni	Municipality	Kwazulu Natal	29° 9′ 22″ S, 31° 25′ 3″ E
Msunduzi	Municipality	Kwazulu Natal	29° 37′ 0″ S, 30° 23′ 0″ E
Nongoma	Municipality	Kwazulu Natal	27° 55′ 0″ S, 31° 39′ 0″ E
Okhahlamba	Municipality	Kwazulu Natal	28° 44′ 0″ S, 29° 22′ 0″ E
Richmond	Municipality	Kwazulu Natal	30° 25′ 0″ S, 30° 29′ 0″ E
Ulundi	Municipality	Kwazulu Natal	28° 19′ 0″ S, 31° 25′ 0″ E
Umdoni	Municipality	Kwazulu Natal	30° 17′ 0″ S, 30° 45′ 0″ E

Umhlathuze	Municipality	Kwazulu Natal	28° 45′ 0″ S, 31° 54′ 0″ E
Umlalazi	Municipality	Kwazulu Natal	28° 53′ 18″ S, 31° 26′ 54″ E
Umzimkhulu	Municipality	Kwazulu Natal	28° 53′ 18″ S, 31° 26′ 54″ E
Greater Taung	Municipality	North West Province	27° 30′ 0″ S, 24° 25′ 0″ E
Lekwateemane	Municipality	North West Province	27° 40′ 0″ S, 25° 20′ 0″ E
Maquassi Hills	Municipality	North West Province	27° 15′ 0″ S, 26° 0′ 0″ E
Matlosana	Municipality	North West Province	26° 50′ 0″ S, 26° 30′ 0″ E
Moretele Municipality	Municipality	North West Province	25° 10′ 0″ S, 28° 5′ 0″ E
Rustenburg	Municipality	North West Province	25° 40′ 0″ S, 27° 20′ 0″ E
Tlokwe	Municipality	North West Province	26° 45′ 0″ S, 27° 10′ 0″ E
Ventersdorp	Municipality	North West Province	26° 20′ 0″ S, 26° 55′ 0″ E

B.4. Description of baseline and its development:

>> The proposed project of activity replaces ICLs with CFLs in South African households. Without the project intervention and incentive provided by the CDM, households would continue to utilise ICLs and would not take up energy efficient lighting options.

By using revenues from the sale of CERs, the project aims to overcome the barriers to the uptake of CFLs. The project owner 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 project activity will help to overcome, including: access to finance, high discount rates, lack of information, additional transaction costs. The provision of free CFLs, possible only through the use of carbon finance, overcomes these barriers.

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 technology.[5] It is estimated that without the intervention of Eskom's Demand Side Management program, of which the proposed Project Activity is part, the total penetration of CFLs in South Africa would be substantially 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.[6]

[5] Understanding Consumer Preferences in Energy Efficiency, Accenture, 2010

[6] 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

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

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 Project Activity.
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 Project Activity.

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 Project Activity, 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 Project Activity.

The barrier analysis described in Section B.5. shows that *Business-as-usual*, the continued use of ICLs, is the most likely baseline scenario for lighting options in South African households. The municipalities chosen by Eskom for the Greenfield Project (2) are the areas that haven't previously received CFLs in other campaigns since the initial demand side management strategy started in 2005. Eskom has maintained a comprehensive data management system that identifies names and addresses of the participating households in previous projects, and is well documented that the household within the municipalities included in this Project Activity are not part of the Eskom database.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM Project Activity:

Voluntary Coordinated Action

The Project Activity is a voluntary coordinated action initiated by the project proponent. There are no laws mandating the use of energy efficient lighting technologies in South Africa. All householders and lighting technology providers participating in Project Activity will do so through a voluntary collaboration with the project proponent.

By using revenues from the sale of CERs, the Project Activity aims to overcome the barriers to the uptake of CFLs. The project proponent 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 Project Activity 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.

Additionality Tool

There are significant, demonstrable barriers to the take-up of energy efficient lighting in residential properties across South Africa. The Project Activity 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 project participants have selected the following barriers to demonstrate the additionality of the Project Activity:

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.[7]

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 technology.[8] It is estimated that without the implementation of this Project Activity, 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.[9]

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[10] . Most of these perceptions however are being addresed with the

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

[8] Understanding Consumer Preferences in Energy Efficiency, Accenture, 2010

[9] 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

[10] Compact Fluorescent Lights (CFLs) Primer Enlightening Facts, Hinkle Charitable Foundation

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[11]. 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 Project Activity.

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

- 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."[12]
- 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 one's time to undertake these tasks. In a Californian study by Sathaye et al (2004)[13], 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

[11] Department of Minerals & Energy, South Africa. *Energy Efficiency Strategy for the Republic of South Africa 2005.*

[12] Productivity Commission, *The Private Cost Effectiveness of Improving Energy Efficiency,* 2005, p.105.

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

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[14]. 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[15]. Based on Eskom data, the residential sector in South Africa consumes 19.7% of electricity generated, equivalent to 45,788GWh per year[16], 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 Project Activity 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 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

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

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

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

studies have estimated implicit discount rates applied by consumers to energy efficiency investments range from 25% to 300% across a range of technologies[17].

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 Project Activity is considered to be additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>> The following are the methodological choices provided for in AMS-II.J v04, which will be applied in relation to the proposed project of activity.

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

$$NES_y = \sum_{i=1}^{n} Q_{PJ,i} \times \left(1 - LFR_{i,j}\right) \times ES_i \times \frac{1}{\left(1 - TD_y\right)} \times NTG \qquad (1)$$

where

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

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 documented number of all baseline incandescent lamps destroyed. Once all the project CFLs are distributed or installed, $Q_{PJ,i}$ is a constant value independent from *y*.
i	Counter for equipment type (i.e. wattage type of CFL, e.g. 20 W CFL)

[17] 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.

n	Number of types of equipment *i*
ES_i	Estimated annual electricity savings for equipment of type *i*, for the relevant technology (kWh)
$LFR_{i,y}$	Estimated 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.
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 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 *i* lighting devices (Watts)
$P_{i,PJ}$	Rated power of the project lighting devices of the group *i* lighting devices (Watts)
O_i	Average daily operating hours of the lighting devices replaced by group of *i* lighting devices (Watts)

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:

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

If $y \times X_i \geq L_i$ $\quad LFR_{i,y} = 1$

where

L_i	Average Life (or Rated Average Life until average life value is available) for equipment type *i* (hours)
R_i	Percent of CFLs of type *i* operating at the rated lifetime (use a value of 50%)
X_i	Number of operating hours per year for CFL type *i* (hours)
y	Counter for year

Under the Project Activity, 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:

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

where

ER_y Emission reductions in year y (tCO_2e)

$EF_{CO2,ELEC,y}$ Emission factor in year y calculated in accordance with the provisions in provisions in the “Tool to calculate the emission factor for an electricity system” (version 2.2.1) (tCO_2/MWh).

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 proposed project of activity, the total lumen output for CFLs and ICLs were determined using the ELI standard as per the table below[18]:

<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

[18] ELI Technical Documents for Certification, 2006

for the host country. The Project Activity will 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 proposed project of activity, the average annual technical grid losses (%) are 8.3% as per Eskom Annual Report 2011.

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 Project Activity, the Net-to-gross adjustment factor was assigned the default value of 0.95 as provided by the 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.

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 Oi in equation 2. At the time of commencing validation, the project owner 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.

For the purpose of determining ex-ante emission reductions as set out in this PDD, the default value of 3.5 hours/day will be assumed. It should be noted that if a subsequent decision is made by the project owner to use a different value for Oi 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 the project. 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 project activity. 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 project owner, 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 PDD.

Leakage
There are no significant emissions attributable to the Project 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, as described in the ESCO Requirements Document V6.

Monitoring

***Ex-post* Monitoring**

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 ($LFR_{i,y}$) can 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.

The households included in the ex post monitoring surveys 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.

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.

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

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 Project Activity during the monitoring interval y, calculated according to the latest approved version Tools to Calculate Emission Factors.
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 :	Project proponent has obtained 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:	Default AMS-II.J value
Value applied:	3.50 hours per 24 hours period
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 365 days per year
Justification of the choice of data or description of measurement methods and procedures actually applied :	The Project 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 Project Activity shall use a default value of 0.95 under the Project Activity.
Any comment:	-

Data / Parameter:	$\mathbf{L_i}$
Data unit:	Hours
Description:	rated average operating hours for CFL type *i*
Source of data used:	Life test report of CFLs
Value applied:	10,000
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 Philips Lighting technical data. The value is fixed ex-ante.
Any comment:	-

Data / Parameter:	$\mathbf{TD_y}$
Data unit:	%
Description:	Average annual technical grid losses
Source of data used:	Published in Eskom Annual report 2011
Value applied:	8.3%
Justification of the choice of data or description of measurement methods and procedures actually 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.
Any comment:	This value will be fixed for the duration of the crediting period.

B.6.3 Ex-ante calculation of emission reductions:

>>The equation described on section B.6.1 of this document can be found below:

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

$$NES_y = \sum_{i=1}^{n} Q_{PJ,i} \times \left(1 - LFR_{i,j}\right) \times ES_i \times \frac{1}{\left(1 - TD_y\right)} \times NTG \qquad \textbf{(1)}$$

Where

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

NES_y	Net electricity saved in year y (kWh)
$Q_{PJ,i}$	1,000,000 lightbulbs
ES_i	($P_{i,BL}$ Watts – $P_{i,PJ}$ Watts) * 3.5 hours/day * 365 / 1000 = 57.51 kWh per year
TD_y	8.3%
NTG	0.95
$P_{i,BL}$	63.00 W
$P_{i,PJ}$	17.98 W
O_i	3.50 hours

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:

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

(3)

If $y \times X_i \geq L_i$ $\quad LFR_{i,y} = 1$

Where

L_i	10,000 hours
R_i	50%
X_i	1,277.5

Based on the above, the $LFR_{i,y}$ and NES_y are shown below:

Year	$LFR_{i,y}$ (%)	NES_y (kWh)
Year 1	93.61%	55,776,918
Year 2	87.23%	51,971,069
Year 3	80.84%	48,165,219

Year 4	74.45%	44,359,370
Year 5	68.06%	40,553,521
Year 6	61.68%	36,747,672
Year 7	55.29%	32,941,822
Year 8	48.90%	29,135,973
Year 9	42.51%	25,330,124
Year 10	36.13%	21,524,275

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

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

Where

ER_y Emission reductions in year *y* (tCO_2e)

$EF_{CO2,ELEC,y}$ 0.9506 tCO_2/MWh

As per AMS-II.J, Certified Emission Reductions can only be earned only for the rated lifetime (rated life to 50% failures) of project CFLs, not to exceed one crediting period of up to 10 years.

Year	NES_y (kWh)	ER (tCO_2)
Year 1	55,776,918	53,022
Year 2	51,971,069	49,404
Year 3	48,165,219	45,786
Year 4	44,359,370	42,168
Year 5	40,553,521	38,550
Year 6	36,747,672	34,932
Year 7	32,941,822	31,314
Year 8	29,135,973	-
Year 9	25,330,124	-
Year 10	21,524,275	-

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

>>

Year	Estimation of Project Activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
Year 1	21,176	74,197	0	53,022

Year 2	19,731	69,134	0	49,404
Year 3	18,286	64,072	0	45,786
Year 4	16,841	59,009	0	42,168
Year 5	15,396	53,946	0	38,550
Year 6	13,951	48,884	0	34,932
Year 7	12,506	43,821	0	31,314
Year 8	-	-	0	-
Year 9	-	-	0	-
Year 10	-	-	0	-
Total	**117,887**	**413,063**	**0**	**295,176**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**N**
Data unit:	Number
Description:	Sample Size of Monitoring Survey
Source of data to be used:	Calculated as per statistical requirements in AMS-II.J (90% confidence interval and +-10% error margin)
Value of data	100 houses
Description of measurement methods and procedures to be applied:	Calculated as per statistical requirements in AMS-II.J (90% confidence interval and +-10% error margin)
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	1,000,000
Description of measurement methods and procedures to be	The project proponents will determine $Q_{PJ,}$ using the ex-post survey and the data will be entered into the Project Activity database.

applied:	
QA/QC procedures to be applied:	Use of standardised data forms and compliance protocols of 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/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 project, 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-ante as per AMS-II.J and Ex-post from Monitoring Survey
Value of data	Linear rate of 6.39% per year as per ex-ante calculations
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:	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 project, 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 used:	Data Management System
Value of data	Distribution starts – 13th January 2011 Distribution ends – 30th June 2011

	Household contact information is available in the Data Management System
Description of measurement methods and procedures to be applied:	ESKOM has engaged the project manager Karebo 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 project proponents and the 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 project, 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	1,000,000
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 project, whichever occurs later.

Data / Parameter:	**$P_{i,BL}$**

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 Project Activity database
Value of data	63.00 Watts
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 project, 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 project CFLs as recorded in Project Activity database
Value of data	17.98 Watts
Description of measurement methods and procedures to be applied:	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.
QA/QC procedures to be applied:	Use of standardized data forms and compliance protocols of 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 project, whichever occurs later.

B.7.2 Description of the monitoring plan:

>>

>>A detailed description of the monitoring plan of the Project Activity is provided in Annex 4. In summary, the project proponent will implement the following monitoring activities:

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

1. CFL Distribution

The SSC-PA will involve the replacement ICLs with new CFLs free of charge using the following distribution mechanisms:

(i) Door to door 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 maximizing the number of CFLs provided to participating household, and that those CFLs provided are installed in high usage areas.

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 product being installed/exchanged. The Project Activity 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 Project Activity:

- Home owner's name & 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 removed
- Installer's reference number
- Exchange point (only if done through an exchange program)
- Date of installation
- Type of exchange
- A household signature agreeing to transfer all the carbon credits to Eskom.

The Project Activity implementer will be responsible for the management of records and data associated with the Project Activity. Data will be stored in secure project databases for the duration of the Project

Activity 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 used to determine the weighted average power rating of the baseline light bulbs for each wattage type i ($P_{i,BL}$). Similarly, the number and power rating of all CFLs installed will be used to determine weighted average power rating of the project light bulbs for each wattage type i ($P_{i,PJ}$).

2. Ex-post Monitoring Survey

The emission reductions of the Project Activity 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 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 ($Q_{PJ,i}$).

Due to the large number of installations, it is not possible to monitor all households in the Project Activity. Establishing a project sample group is a statistical procedure to determine a sampling mean that can be applied to the broader population within a project. 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.

The procedure to determine the project sample group is presented in Annex 4 of this PDD.

3. ICL Destruction

ICLs collected during the exchanges will be 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 data management system. In addition, the method of destruction and its supervision must be documented.

To ensure there is no leakage, at the beginning of the monitoring interval, the SSC-PA implementer must confirm that the amount of ICLs destroyed, matches the data collected in the DMS and the amount of CFLs distributed.

4. Avoid Double Counting

The Project Activity will eliminate double counting of Emission Reductions by ensuring that the following elements are part of the implementation of the project:

1. Unambiguous identification of households participating in the Project Activity within the database management system. The Project proponent will be able to effectively and

transparently identify the houses participating in the project within the data management system and confirm the number of CFLs installed/distributed to each participating household.

2. Data collection and signing of forms from participating households as to assign the rights to claim CERs for the project activity.
3. Unambiguous identification of CFLs participating in the project activity by ensuring each CFL contains the Eskom (or program logo), the year of distribution (i.e. 2011) and the legend "Not for sale" (or equivalent).

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

>>>>January 31, 2012
Enoch Lerato Liphoto

SECTION C. Duration of the Project Activity / crediting period

C.1 Duration of the Project Activity:

C.1.1. Starting date of the Project Activity:

>>13/01/2011

C.1.2. Expected operational lifetime of the Project Activity:

>>10 years

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

C.2.1. Renewable crediting period

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

>>Not applicable

C.2.1.2. Length of the first crediting period:

>>Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>> 01/09/2012

C.2.2.2. Length:

>>10 Years

SECTION D. Environmental impacts

>>

The proposed Project Activity involves the distribution and installation of CFLs in South African households. Any CFL distributed under the proposed Project Activity 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. Furthermore 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 proposed Project Activity.

There are no statutory environmental requirements on lighting equipment disposal.

The primary environmental impacts of the Project Activity relate to the physical waste created by the collection of old, inefficient light bulbs. The methodology requires that these items be collected and destroyed in order to prevent leakage. Considerable effort will be made by the project proponent to deal with the waste created by this equipment. In many instances, base materials of old appliances (e.g. glass and metals from light bulbs) can be recycled. Where possible, the project proponent will work with local businesses to implement a recycling strategy to deal with the waste accumulated through the collection of incandescent bulbs.

CFLs contain a very small amount of mercury sealed within the glass tubing – 5 milligrams on average (roughly equivalent to the tip of a ball-point pen). Mercury is an essential, irreplaceable element of CFLs as it allows the bulb to be an efficient light source. By comparison, older home thermometers contain 500 milligrams of mercury and manual thermostats up to 3000 milligrams.

There is no current substitute for mercury in CFLs; however, manufacturers have taken significant steps to reduce mercury levels in fluorescent lighting products over the past decade, with some beginning research into the production of mercury-free CFLs.

The introduction of energy efficient lighting technology in residential buildings will reduce the consumption, and hence generation of electricity. The Project Activity will therefore reduce the harmful gases and particulate matter produced during the burning of fossil fuels to produce electricity.

It is estimated that in 2009 electricity generation in South Africa lead to the emission of 1.87Mt SO2, 2,801 tNOx, 10 tonnes of Mercury and 55,600 tonnes of particulates[19]. The Project Activity will cut electricity consumption by an average of 19.37 GWh/year for 10 years 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 19.37 GWh of electricity savings per year:

Pollutant	**Annual Emission Reductions from 38.74 GWh electricity saving**
NOx	0.45 tonnes
SO2	300 tonnes
Mercury	1.6 kg

[19] 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

Particulates	8.9 tonnes

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the Project Activity:

The South African Government does not require that environmental impact assessments should be undertaken for the proposed Project Activity.

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

>>The host Party requires no environmental impact assessment.

SECTION E. Stakeholders' comments

>>

E.1. 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.

E.2. 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?
Municipalitie s	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?

E.3. 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.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NO PUBLIC FUNDING IS USED FOR THIS PROJECT

Annex 3

BASELINE INFORMATION

The baseline emissions for the Project Activity will be calculated from the available information on the replaced ICL and its usage during the Project Activity. The monitoring of the usage of ICL in the baseline will be done by proxy, based on the usage of CFLs monitored in households randomly selected from the entire population of the household that participate in the Project Activity. The sampling will involve establishing a daily hours of use through a 90 day study, and household surveys to determine the ongoing functionality of distributed CFLs. These monitoring activities are discussed further in Annex 4 below. In order to ensure that the sample is representative and that at least a minimum level of information is available to achieve useful result – at least 100 households will be selected.

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[20].

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[21], 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.

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

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 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.[22]

"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

[22] 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

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[23].

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:

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

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:

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

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:

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

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[24] while net calorific values for each year were obtained from Eskom Annual Report 2010[25]. The project developer also used the emission factors from 2006 IPCCC guidelines[26] for sub-bituminous coal[27] 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

…are referenced further in the GEF Calculation

…. All sources are referenced further in the GEF Calculation sheet.

26 2006 IPCC Guidelines for National Greenhouse Gas Inventories – Table 1.4 Lower Level. All sources are referenced further in the GEF Calculation sheet.

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

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.

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 ($SET_{sample-CDM}$) the annual electricity generation ($AEG_{SET-sample-CDM}$, 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. $AEG_{SET-sample-CDM} \geq 0.2$ Å~ AEG_{total}), then use the sample group $SET_{sample-CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample-CDM}$ 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 ($SET_{sample-CDM->10yrs}$).

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[28] 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[29]. Removing these power plants from the build margin makes the calculation of Build Margin more accurate and conservative by

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

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

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

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 $SET_{sample-CDM}$ 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) ($SET_{5-units}$) plus the set of CDM power plants identified in $SET_{sample-CDM}$ 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:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(3)}$$

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:

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

Annex 4

MONITORING INFORMATION

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

1. **DATA CAPTURING**

- 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 Karebo (project management company) may be used. ESCOs can use their own front-end software to capture, only if Karebo 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 to transfer all the carbon credits to Eskom.

Minimum Computer and Software Specifications:

- Processor: 1.3 GHz
- Ram: 1 GB Ram
- Windows operating system
- Windows office 2007 Business edition (including Access).

2. DATA STORAGE AND REPORTING

Information will be electronically saved in Karebo system and progress reports will be available every week.

The project proponent 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 lamps 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 SURVEY

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 ($LFR_{i,y}$) can 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.

As instructed by 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”. The UNFCCC General Guidelines for Sample and Surveys For Small-Scale CDM Project Activities (*version 01*)[30], section 34., point 5, p. 8, suggests that the sampling plan submitted by the project proponent must ensure that the “proposed sample size is adequate to achieve the minimum confidence/precision requirements”. Using a simple equation developed by Cochran (1977)[31], the sample size can be determined by:

$$n = \frac{z^2 (pq)^2}{\delta^2} \quad \textbf{(1)}$$

[30] UNFCCC General Guidelines for Sample and Surveys For Small-Scale CDM Project Activities, EB 50 Report, Annex 30, p. 9.

[31] Cochran, W.G. (1977) Sampling Techniques (3rd ed.), New York: John Wiley & Sons.

where

n sample size
z desired level of confidence
(pq) measure of variance
δ acceptable margin of error

For a confidence interval of 90%, z = 1.645 (from t charts), and a 10% maximum error implies that δ = 0.1. If the variability in population is unknown, then a maximum variability of 50% can be assumed and hence $p = 0.5$. Where $q = 1- p =0.5$, (pq) will therefore equal 0.25. Note, UNFCCC Guidelines also state (section 34., point 5, p. 8) that if an *ex ante* estimate of population variance is needed for the calculation of the sample size, this must be adequately justified.

Using the minimum confidence interval and maximum error and variability, the sample size estimate is:

$$n = \frac{(1.645)^2\,(0.25)^2}{(0.10)^2} = 67.65$$

A sample size of 100 would therefore be employed in this case.

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 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.

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 project proponent 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. This value will then be applied to the project activity.

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.

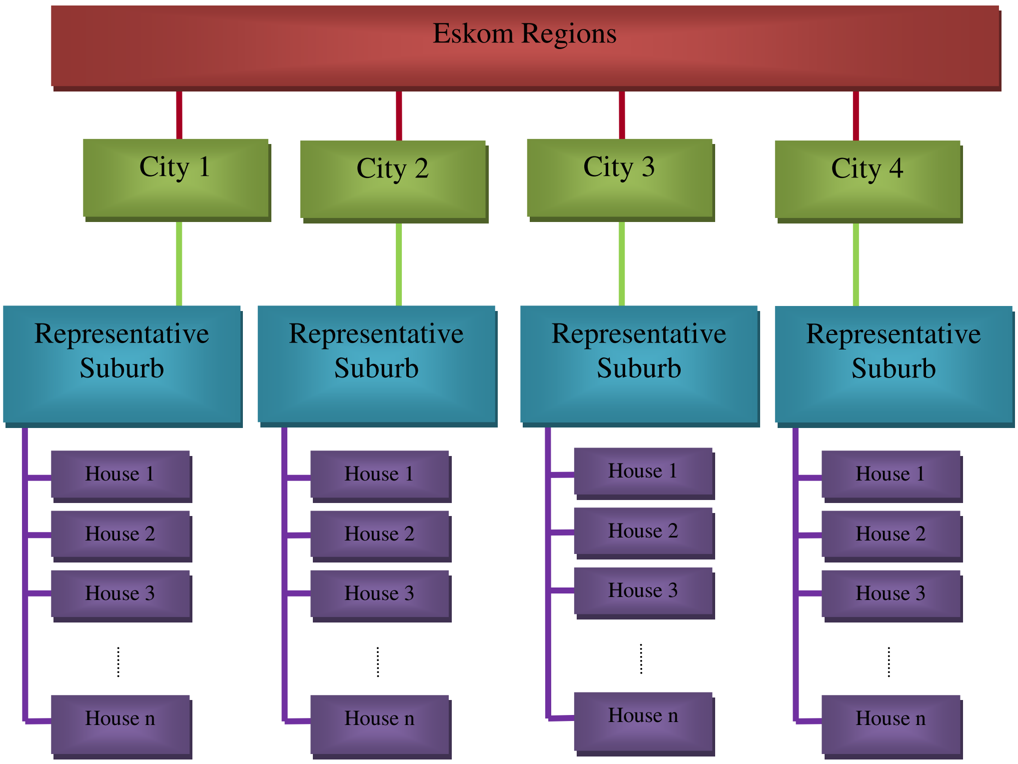

Figure 1: Flow chart of sample household area and household selection

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

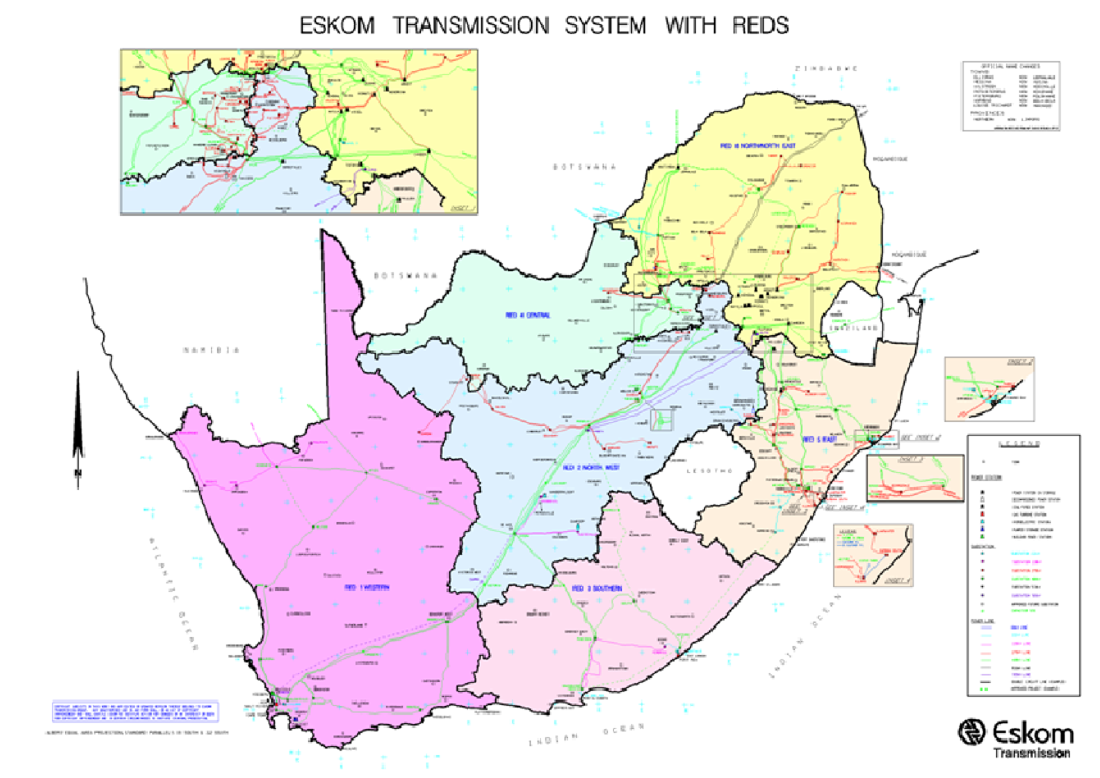

Figure 2: Eskom Regions

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. <u>Desired Precision/Expected Variance and Sample Size</u>

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]:

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

But $PZ\leq z\alpha 2=1-\alpha$ and $x-\mu xsx\sim N0,1$

$\therefore z\alpha 2\cong esx$

$\therefore e\cong z\alpha 2sx=z\alpha 2sxn$

$\therefore n\cong z\alpha 22sx2e2$

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)

$z\alpha 2$ 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:

- Number of CFLs placed in service and operating (ex-post survey)
- CFL failure rate (ex-post monitoring surveys)

Within the methodology it is prescribes that Ex-post monitoring surveys need to be performed on the CFLs that were rolled out. There are two types of survey:

1. Installation Discount Factor (IDF) Survey - Once distribution has finalised, a survey has to be conducted within three months to confirm the installation rate of the distributed CFLs.
2. Lifetime Decay Curve or Life Failure Rate (LDC or LFR) Survey – the LDC is similar to the IDF survey and has to be carried on every 3 years or once for every 30% of the elapsed rated lifetime of the lamp.

b. The target Population

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.

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 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.

e. Desired Precision/Expected Variance and Sample Size

i. Desired precision

As prescribed by the methodology there is 90/10 (confidence/precision) requirement. [1]

ii. Expected variance and Sample size

In order to estimate the proportion of CFLs placed in service and operating under the project activity, the optimal sample size of CFLs can be calculated following the same statistical method discussed in Section x, we should obtain with another method the value of CFLs in operation. This can be done by:

- Using information from similar sample surveys from previous surveys done for M&V on Eskom CFL projects; or
- Performing a pilot study with only 10 households; or
- Using a conservative estimate of 50% for bigger sample sizes; or
- Using a LFR obtained during previous Ex-post monitoring surveys.

As instructed by 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". The UNFCCC General Guidelines for Sample and Surveys For Small-Scale CDM Project Activities (*version 01*)[32], section 34, point 5, p. 8, suggests that the sampling plan submitted by the project proponent must ensure that the "proposed sample size is adequate to achieve the minimum confidence/precision requirements". Using a simple equation developed by Cochran (1977)[33], the sample size can be determined by:

$$\mathbf{n} = [z^2(pq)]/\delta^2 \qquad \textbf{(1)}$$

where

n	sample size
z	desired level of confidence
(pq)	measure of variance
δ	acceptable margin of error

For a confidence interval of 90%, z = 1.645 (from t charts), and a 10% maximum error implies that δ = 0.1. If the variability in population is unknown, then a maximum variability of 50% can be assumed and hence p = 0.5. Where $q = 1 - p = 0.5$, (pq) will therefore equal 0.25. Note, UNFCCC Guidelines also state (section 34., point 5, p. 8) that if an *ex ante* estimate of population variance is needed for the calculation of the sample size, this must be adequately justified.

Using the minimum confidence interval and maximum error and variability, the sample size estimate is:

$$\mathbf{n} = [(1.645)^2(.25)]/(0.10)^2 = \mathbf{67.65}$$

However, in all cases is can be shown with simple statistics that the value obtained is likely to be less than 100. Therefore the initial foundation is that we will select at least 100 houses per project for the Ex-post monitoring surveys.

This approach will be followed for all ex-post monitoring surveys.

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32 UNFCCC General Guidelines for Sample and Surveys For Small-Scale CDM Project Activities, EB 50 Report, Annex 30, p. 9.

33 Cochran, W.G. (1977) Sampling Techniques (3rd ed.), New York: John Wiley & Sons.

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.

REFERENCES

[1] AMS-II.J version 04
[2] Lohr, S.L. 1999. Sampling: Design and Analysis. Duxbury Press: Pacific Grove