CLEAN DEVELOPMENT MECHANISM

AMS-II.J

Small-scale Methodology

Demand-side activities for efficient lighting technologies

Version 05.0

Sectoral scope(s): 03

United Nations
Framework Convention on
Climate Change

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1. Introduction

1. The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical projects	Activities for adoption of self-ballasted compact fluorescent lamps (CFLs) to replace incandescent lamps (ICLs) in residential applications
Type of GHG emissions mitigation action	Energy efficiency: Displacement of more-GHG-intensive lighting by technology switch

2. Scope, applicability, and entry into force

2.1. Scope

2. This category comprises activities that lead to efficient use of electricity through the adoption 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.

2.2. Applicability

3. 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. Values in Table 2 may be used as an alternative option to such standards. If a lamp wattage is not in Table 2, linearly interpreted value shall be used to determine the minimum light output requirements for example 493 Lumens for a 45 W lamp.

Table 2. Light output requirements

Baseline technology - Incandescent lLamp (Watt)	Minimum light output (Lumen)
25	230
40	415
50	570
60	715
75	940
90	1,227
100	1,350
150	2,180
200	3,090

4. The aggregate electricity savings by a single project activity may not exceed the equivalent of 60 GWh per year.

5. The average life or the rated average life[1] of the CFLs shall be known ex ante. IEC 60969 (Self Ballasted Lamps For General Lighting Services - Performance Requirements) or an equivalent national standard shall be used to determine the average life. The project design document shall cite the standard used. If the average life value is not available ex ante, it shall be made available for verification before or at the same time that the results of the second ex post monitoring survey, as required per paragraph 24(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, for example ISO/IEC 17025.

6. CFLs utilized under the project activity shall, in addition to the standard lamp specifications,[2] be marked for clear unique identification for the project.

7. 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[3] 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.

8. 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:

   (a) Directly installing the CFLs;

   (b) Charging at least a minimal price[4] for efficient lighting equipment;

   (c) Restricting the number of lamps per household distributed through the project activity to six.

9. Whether the CFLs are directly installed or not directly installed, the project design document shall define actions to be taken to encourage CFLs being installed in locations within the residences where the utilization hours are relatively high, for example common areas. For CFLs not directly installed these actions can include educating the CFL recipients of the best uses for CFLs.

10. With this methodology, emission reductions can only be claimed for the average life of project CFLs.

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[1] See Section 4 for definitions of Average Life and Rated Average Life.

[2] For example power rating, lumen output, correlated colour temperature, voltage, power factor, frequency.

[3] Proposed method for collection and destruction shall allow for verification. An example method is collection of ICLs, recording of ICL wattage and destruction in decentralised or centralised locations, and destruction documented via witnessing by local environmental officials or time stamped video records. With recorded documentation of ICL destruction, the destruction can precede verification.

[4] For example cost equivalent of an incandescent lamp being replaced.

2.3. Entry into force

11. The date of entry into force is the date of the publication of the EB 73 meeting report on 31 May 2013.

3. Normative references

12. Project participants shall apply the "General guidelines for SSC CDM methodologies", information on additionality as contained in the "Guidelines on the demonstration of additionality of small-scale project activities" (Previously known as Attachment A of Appendix B to simplified modalities and procedures of small scale CDM project activities provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> mutatis mutandis.

4. Definitions

13. The definitions contained in the Glossary of CDM terms shall apply.

14. **Life (of an individual lamp)** - the length of time during which a complete lamp operates:

    (a) To burn out; or

    (b) Any other criterion of life performance defined in IEC 60696 or an equivalent national standard applied.

15. **Average life (life to 50 per cent failures)** - the length of time during which 50 per cent of the lamps reach the end of their individual life.

16. **Rated average life (rated life to 50 per cent failures)** - the life declared by the manufacturer or responsible vendor as being the expected time at which 50 per cent of any large number of lamps reach the end of their individual lives.

5. Baseline methodology

5.1. Boundary

17. The project boundary is the physical, geographical location of each measure (each CFL) installed.

5.2. Emission reductions

18. Ex ante calculations are done as per the following steps:

    (a) Estimate the nameplate/rated power (Watts) of the baseline incandescent lamps to be replaced;

    (b) Determine operating hours of project (and baseline) lamps using one of the following two options:

        (i) **Option 1:** a default value of 3.5 hours per 24 hours period for 'daily operating hours', that is factor O_i in equation (2), is chosen ex ante and is used ex post throughout the crediting period. In this case no surveying to determine O_i is required;

(ii) **Option 2:** instead of using a default value of 3.5 hours for O_i, a measured value can be used for the ex ante estimate using the sampling requirements indicated in the definition of O_i for equation (2);

(c) Calculate the annual gross electricity savings by comparing the nameplate/rated power rating of the CFL with that of the baseline incandescent lamp and multiplying by: (i) annual hours of operation; and (ii) the estimated number of CFLs that are part of the project. If more than one type (wattage) of CFL is to be used, repeat calculation for each type;

(d) Calculate the annual net electricity saving (*NES*), for each year of the assumed crediting period, by correcting the gross electricity savings for leakage, a net-to-gross adjustment (*NTG*) factor, transmission & distribution losses, and Lamp Failure Rate.[5]

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

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

Where:

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

Where:

NES_y	=	Net electricity saved in year *y* (kWh)
$Q_{PJ,i}$	=	Number (quantity) of pieces of equipment (CFLs) of type *i* distributed or installed under the project activity (units). In total for all *i*, this value shall be equal to or less than the documented number of all baseline incandescent lamps destroyed. Once all of the project CFLs are distributed or installed, $Q_{PJ,i}$ is a constant value independent from *y*
i	=	Counter for equipment type
n	=	Number of types of equipment *i*
ES_i	=	Estimated annual electricity savings for equipment of type *i*, for the relevant technology (kWh)
$LFR_{i,y}$	=	Lamp Failure Rate for equipment type *i* in year *y* (fraction)

[5] Calculate annual savings with consideration of lamp failure rate as indicated in equation (3) using either Average Life or Rated Average Life of CFLs.

TD_y	=	Average annual technical grid losses (transmission and distribution) during year *y* for the grid serving the locations where the devices are installed, expressed as a fraction. This value shall not include non-technical losses such as commercial losses (e.g. theft/pilferage). The average annual technical grid losses shall be determined using recent, accurate and reliable data available for the host country. This value can be determined from recent data published either by a national utility or an official governmental body. Reliability of the data used (e.g. appropriateness, accuracy/uncertainty, especially exclusion of non-technical grid losses) shall be established and documented by the project participant. A default value of 10 per cent shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable
NTG	=	Net-to-gross adjustment factor, a default value of 0.95 is to be used unless a more appropriate value based on a lighting use survey from the same region and not older than two years is available
$P_{i,BL}$	=	Rated power of the baseline lighting devices of the group of *i* lighting devices (Watts)
$P_{i,PJ}$	=	Rated power of the project lighting devices of the group of *i* lighting devices (Watts)
O_i	=	Average daily operating hours of the lighting devices replaced by the group of *i* lighting devices. For ex post values use either:[6] (a) 3.5 hours per 24 hour period; or (b) The average measured value determined from measurements of a representative sample conducted once, prior to or concurrent with the first ex post monitoring survey (see paragraph 24 below). Note that surveying to assess retention rates is still required even if a default value for O_i is chosen. In no case may a value greater than five hours per 24 hour period shall be used under this methodology

20. To use a value for 'daily operating hours' other than 3.5 hrs/day, a continuous measurement of usage hours of baseline or project lamps for a minimum of 90 days at representative sample households is required. Also see requirements in paragraph 28. The days selected for measurement of operating hours shall either be representative of the annual variation of daylight hours in the region or a correction shall be applied to account for annual variation in daylight. For further instructions on sampling and surveys see the latest version of the "Standard for sampling and surveys for CDM project activities and programme of activities".

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

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

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

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

Where:

$LFR_{i,y}$ = Lamp Failure Rate for equipment type *i* in year *y* (fraction)

L_i = Average Life (or Rated Average Life until average life value is available) for equipment type *i* (hours)

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

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

y = Counter for year

22. Emissions reduction is net electricity savings (*NES*) times an Emission Factor (*EF*) calculated in accordance with provisions under "AMS-I.D: Grid connected renewable electricity generation".

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

Where:

$EF_{CO2,ELEC,y}$ = Emission factor in year *y* calculated in accordance with the provisions in AMS-I.D (t CO_2/MWh)

ER_y = Emission reductions in year *y* (t CO_2e)

23. The electricity savings from the efficient lighting equipment installed by the project activity shall be considered from the date of completion of installation of the equipment.

24. Ex post monitoring and adjustment of corresponding Net Electricity Savings (NES_y):

(a) First ex post monitoring survey, carried out within the first year after installation of all efficient lighting equipment will provide a value for the number of CFLs placed in service and operating under the project activity. The results of this survey are used to determine the quantity of CFLs ($Q_{PJ,i}$) in the emission reduction calculation to determine the ex post Lamp Failure Rate ($LFR_{i,y}$) for use in ex post emission reduction calculations;

(b) Subsequent ex post monitoring surveys are carried out at the following intervals to determine the ex post Lamp Failure Rate ($LFR_{i,y}$) for use in ex post emission reduction calculations until such time as CERs are being requested, (choose either of the following two options that define the minimum requirement for the frequency of the survey):

(i) Once every three years;[7]

(ii) Once for every 30 per cent of the elapsed Rated Average Life or Average Life of the lamp;

(c) The surveys will consist of identifying CFLs, marked per paragraph 6, that are installed and operating. 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, cannot be replaced as part of this monitoring survey process and counted as operating for the purposes of determining $Q_{PJ,i}$.

25. Changes to Lamp Failure Rate ($LFR_{i,y}$) and treatment of differences between Rated Average Life and Average Life for adjustment of Net Electricity Savings (NES_y): the Net Electricity Savings shall be modified for changes to the Lamp Failure Rate as may be indicated by ex post monitoring survey results and/or on the basis of CFL Average Life values if a CFL Rated Average Life was used initially. The modifications shall be made using the following methods:

(a) If Rated Average Life values were used initially for calculating LFR_y, per equation (3), as soon as Average Life values are available they shall be used for calculation of subsequent year $LFR_{i,y}$ 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 the 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 L_i 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.

6. Monitoring methodology

26. Monitoring includes: (i) recording of lamp distribution data; and (ii) ex post monitoring surveys as defined in paragraph 25:

(a) During project activity implementation, the following data are to be recorded:

(i) Number of pieces of equipment distributed under the project activity, identified by the type of equipment and the date of supply;

(ii) The number and power of the replaced devices;

(iii) Data to unambiguously identify the recipient of the equipment distributed under the project activity;

[7] For example assuming a rated lifetime of 10,000 hours and annual hours of operation of 1,278, since the first ex post monitoring survey is done first year after installation of all efficient lighting equipment, the subsequent surveys take place every three years.

(b) The emission reductions are calculated ex ante and adjusted ex post following the monitoring surveys, as described under paragraphs above.

6.1. Generic instructions for conducting the surveys and sampling

27. The following survey principles shall be followed for activities related to determining number of CFLs placed in service and operating under the project activity and, if required, determining the number of operating hours of baseline and project lamps:

(a) The sampling size is determined by minimum 90 per cent confidence interval and the 10 per cent maximum error margin; the size of the sample shall be no less than 100;

(b) Sampling must be statistically robust and relevant that is the survey has a random distribution and is representative of target population (size, location);

(c) The method to select respondents for interviews is random;

(d) The survey is conducted by site visits;

(e) Only persons over age 12 are interviewed;

(f) The project document must contain the design details of the survey.

6.2. Project activity under a programme of activities

28. Scrapping of replaced equipment to avoid leakage is addressed under paragraph 8, therefore no specific requirements are indicated.

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Document information

Version	*Date*	*Description*
05.0	31 May 2013	EB 73, Annex 10 The revision removes limitations that restrict the methodology to a fixed crediting period.
04	28 May 2010	EB 54, Annex 6 The revisions include inter alia: • Definitions of Average life and Rated average life of lamp; • Deletion of Annex 1 for ex post monitoring survey; • Provisions to use lamp's rated average life for ex ante emission reduction estimation; • Additional clarifications on how to take into account ex post survey data on Lamp Failure rate and ex post determined lamp's average life.
03	28 May 2009	EB 47, Annex 21 The revisions include inter alia: • Broader range of eligible incandescent and CFL Wattages; • Deletion of cross effect calculations and baseline penetration assessment for PoAs; • Provisions to use results of ex post surveys to correct CFL attrition rates; • Fixed average daily utilisation hours of CFL (3.5 hrs/day).
02	28 November 2008	EB 44, Annex 22 The revisions clarify the project design requirements, consideration of electricity T&D losses in the baseline, frequency of ex post surveys, and estimation of cross-effects of lighting and heating.
01	02 August 2008	EB 41, Annex 16 Initial adoption.

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