CLEAN DEVELOPMENT MECHANISM

AM0113

Large-scale Methodology

Distribution of compact fluorescent lamps (CFL) and light-emitting diode (LED) lamps to households

Version 01.0

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	Self-ballasted compact fluorescent lamps (CFLs) and light-emitting diode (LED) lamps are sold or distributed to households to replace less efficient lamps (e.g. incandescent lamps) in households
Type of GHG emissions mitigation action	Energy efficiency: Displacement of less-efficient lighting by a more-efficient technology

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology is applicable to project activities that enhance energy-efficient lighting in households. The project activity is implemented by a project coordinator who is the project participant. The project coordinator sells, at a reduced price, or installs directly energy efficient light bulbs (project lamps) within a distinct geographical area, thereby replacing less energy efficient light bulbs (baseline lamps) in households. The individual households that use the efficient lamps distributed or sold under the project activity are not the project participants.

3. A project activity implementation plan which specifies how the project is implemented should be established and documented in the CDM-PDD, including, inter alia, information on:

   (a) The type(s) of lamps that are distributed or sold by the project coordinator, including information on minimum lumen output and maximum power rating, etc.;

   (b) The total number of project activity lamps by type that are planned to be distributed by the project activity over the duration of the first crediting period;

   (c) Conditions under which households are eligible to participate in the project activity (e.g. households that are customers of an electric utility, households with a certain income, etc.);

   (d) How the lamps will be distributed or sold to household consumers;

   (e) Whether the project lamps are directly installed or not directly installed, the CDM-PDD shall define actions to be taken to encourage the project lamps being installed in locations within the residences where the utilization hours are relatively high, for example common areas. For project lamps not directly installed, these actions can include educating the project lamp recipients of the best uses for project lamps;

   (f) If the project activity distributes CFLs, how the spent CFLs will be collected and disposed of according to any relevant national/local hazardous waste and/or electronic waste regulations.

2.2. Applicability

4. The methodology is applicable under the following conditions:

(a) A project lamp sold or distributed to a household by the project coordinator shall be a self-ballasted CFL or self-ballasted LED lamp, and only the project lamps sold or distributed within the first crediting period are eligible for claiming emissions reductions;

(b) Only lamps meeting the national/local lighting performance standards (if any, at the time of distribution) are eligible as baseline lamps replaced by the project;

(c) The total lumen output of a project lamp shall be equal to or more than that of the baseline lamp being replaced. Lumen output of the baseline and the project lamps shall be determined in accordance with relevant national or international standard/s. Values in Table 2 may be used for non-halogen incandescent lamps as an alternative option to such standards. If a lamp wattage is not in Table 2, linearly interpolated 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[1]

Baseline technology – Incandescent lamp (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

(d) The project lamps utilized under the project activity shall be marked, in addition to the standard lamp specifications,[2] for clear unique identification for the project;

(e) The CDM-PDD shall explain the proposed method of distribution of project lamps and how the collection (e.g. exchanged for project lamps) and destruction[3] of

[1] Data from <http://www.efficientlighting.net/doc/20110309.pdf>.

[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 baseline lamps, recording of baseline lamps' 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 baseline lamps destruction, the destruction can precede verification.

baseline lamps will be conducted and documented. The CDM-PDD shall also explain how the proposed procedures eliminate double counting of emission reductions, for example due to project lamp manufacturers, wholesale providers or others possibly claiming credit for emission reductions from the project lamps;

(f) The project activity shall be designed to limit undesired secondary market effects (e.g. leakage) and free riders by ensuring that replaced lamps are collected and destroyed. Further project participants are required to undertake at least one of the following actions:

(i) Directly install the project lamps;

(ii) Charge at least a minimal price[4] for the project lamps;

(g) The number of lamps per household distributed through the project activity shall be restricted to six;

(h) The households receiving project lamps are connected to a national or regional electricity grid.

5. In addition, the applicability conditions included in the tools referred to below apply.

2.3. Entry into force

6. The date of entry into force of the revision is the date of the publication of the EB 76 meeting report on 8 November 2013.

3. Normative references

7. This methodology is based on:

(a) "AM0046: Distribution of efficient light bulbs to households";

(b) "AMS-II.J: Demand-side activities for efficient lighting technologies".

8. This methodology also refers to the latest version of the approved:

(a) "Tool to calculate the emission factor for an electricity system";

(b) "Tool for the demonstration and assessment of additionality";

(c) The methodological tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

3.1. Selected approach from paragraph 48 of the CDM modalities and procedures

9. "Existing actual or historical emissions, as applicable".

4. Definitions

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

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

11. For the purpose of this methodology, the following definitions apply:

(a) **Lamp group *t_x*** – project lamps of the same type *t* and installed in calendar year *x*. For the first two years of distribution of each type, the project participants may choose to combine the lamps type *t* installed in its first year and the lamps type *t* installed in the following year as one group, using the second year as *x*, the calendar year indicator. The first lamp group of type *t* shall include at least 10 per cent of the number of lamps type *t* to be distributed by the project activity, and if more lamps are to be distributed than planned (i.e. ten times the number of the first lamp group), the newer lamps may be considered as a different type;

(b) **Lamp type *t*** – lamps with the same manufacturer and similar (within 10 per cent) technical specifications and rated average life are considered to be of the same type. The project participants may include additional criteria (e.g. manufacturing year) for defining lamp types;

(c) **Rated average life** - 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. Project boundary

12. The spatial extent of the project boundary encompasses the physical, geographical location of each project lamp installed in the project area and the spatial extent of the electricity system(s) that the households are connected to as defined in the "Tool to calculate the emission factor for an electricity system".

13. Table 3 below illustrates which emission sources are included in the project boundary.

Table 3. Emission sources included in or excluded from the project boundary

Source		Gas	Included	Justification/Explanation
Baseline	Power plants servicing the electricity grid	CO_2	Yes	This is the main source of baseline emission
		CH_4	No	Minor source
		N_2O	No	Minor source
Project activity	Power plants servicing the electricity grid	CO_2	Yes	This is the main source of project emission
		CH_4	No	Minor source
		N_2O	No	Minor source

5.2. Identification of the baseline scenario and demonstration of additionality

14. If the project lamps sold or distributed by the project coordinator to households are self-ballasted LED lamps, the project activity is deemed automatically additional. The provision is valid for three years from the date of entry into force of version 1.0 of AM0113 on 8 November 2013; before the end of this period, the CDM Executive Board

will reassess the validity of the provision and extend or update it if needed. Any update of the provision does not affect the project activities that request registration as a CDM project activity or a programme of activities by 7 November 2016.

15. If the project lamp sold or distributed to a household by the project coordinator is self-ballasted CFLs,

(a) For countries which have no or only limited lighting efficiency regulations when the CDM-PDD is published for global stakeholder consultation, according to the Efficient Lighting Policy Status Map developed by UNEP's en.lighten initiative,[5] the project activity is deemed additional;

(b) For other countries, additionality shall be demonstrated using the latest version of the "Tool for the demonstration and assessment of additionality*"* that is available on the UNFCCC web site. Step 2 (Investment analysis) shall be used to demonstrate additionality. The investment analysis shall be applied from the perspective of the project coordinator undertaking the project activity.[6] Step 4 (Common practice analysis) shall be assessed from the perspective of the users of the project lamps. The proposed project activity is considered as "common practice", if the market penetration of CFLs for households in the geographical area of the project activity is greater than 20 per cent.

16. The assumed baseline scenario is that lighting by the project lamps would have been provided by the lamps collected and replaced by the project activity.

5.3. Emission reductions

17. The project activity enhances the efficiency of lighting in households and thereby reduces electricity consumption of the households. Emission reductions are calculated based on the grid emission factor ($EF_{CO2,ELEC,y}$) and the quantity of electricity saved by the households as a result of the project activity, using equation (1). Project proponents may replace the default values by project specific values derived through research, studies or surveys, as applicable.

$$ER_y = \left[\sum_t \sum_x \sum_i (P_{i,BL} - P_{i,PJ}) \times O_t \times (1 - LFR_{t,y-x})\right] \times 365/10^6 \times NTG \times \frac{EF_{CO2,ELEC,y}}{1 - TDL_y} \quad \text{Equation (1)}$$

Where:

ER_y = Emission reductions in year *y*, CO_2/y

$EF_{CO2,ELEC,y}$ = Grid emission factor in year *y* calculated following the guidance in the latest approved version of "Tool to calculate the emission factor for an electricity system", t CO_2/MWh

TDL_y = Technical distribution loss in year *y*, fraction

[5] Accessible at <http://www.enlighten-initiative.org/CountrySupport/GlobalPolicyMap.aspx>.

[6] A simple cost analysis may be applied according to EB 59, para. 36.

i	=	Project lamps in group *t_x*
t	=	Project lamp type *t*
x	=	Calendar year x, when lamp group *t_x* is installed
$P_{i,BL}$	=	Rated power of the baseline lamp for project lamp *i*, W
$P_{i,PJ}$	=	Rated power of project lamp *i*, W
O_t	=	Daily operation hours of lamp type *t*
$LFR_{t,y-x}$	=	Lamp failure rate of lamp type *t*, (y-x) years after it is installed
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

18. Baseline lamps may be replaced by the project only if local regulations allow for their distributions at the time of replacement. If local regulations do not allow, for example, distribution of incandescent lamps, these cannot be replaced by the project.

5.3.1. Ex ante determination of lamp failure rate of lamp type *t*, *n* years after its installation ($LFR_{t,n}$)

19. The rated average life of each project lamp type *t* (L_t) shall be known ex ante. Manufacturer specifications shall be used to determine the rated average life. The CDM-PDD shall cite the standard used by the manufacturer.

20. The ex ante lamp failure rate of lamp type *t*, *n* years after its installation ($LFR_{t,n}$) is estimated based on the rated average life as follows:

$$LFR_{ex\ ante,t,n} = \begin{cases} n \times O_t \times 365 \times \dfrac{100 - R}{100 \times L_t}, & L_t > (n \times O_t \times 365) \\ 1, & L_t \leq (n \times O_t \times 365) \end{cases} \quad \text{Equation (2)}$$

Where:

$LFR_{ex\ ante,t,n}$	=	Lamp failure rate of lamp type *t*, *n* years after its installation, determined ex ante
L_t	=	Rated average life for lamp type *t* (hours)
R	=	50, i.e. percentage of lamps operating at the end of the rated average life
O_t	=	Daily operation hours of lamp type *t*

5.3.2. Ex post determination of $LFR_{t,n}$

21. Lamp failure rates ($LFR_{t,n}$) are monitored through surveys consisting of identifying project lamps that are installed and operating within the first group of lamp type *t* installed, i.e. the group with the earliest year *x.* The failure rates of the subsequent groups shall be estimated from the survey results of failure rates conducted for the first group of the same lamp type *t*.

22. The monitoring shall be conducted until the rated average life of the first lamp group is reached, i.e. $n = L_t/(O_t \times 365)$. Monitoring surveys are carried out at least at the shorter of the following intervals:

    (a) Once every three years[7] for project activities implementing CFLs or upon renewal of the crediting period for project activities implementing LEDs; or

    (b) Once for every 30 per cent of the rated average life of the lamp type *t*.

23. For the first lamp group type t, if a monitoring survey is conducted during any calendar year (i.e. *n* years after the installation of the first lamp group), the results of the monitoring survey shall be used to determine $LFR_{t,n}$. Otherwise, $LFR_{t,n}$ shall be estimated by interpolating two lamp failure rates of year a and b (monitored ex post, or 50 per cent failure rate at the end of the rated average life is taken) using the following equation:

$$LFR_{t,n} = (n-b) \times \frac{LFR_{t,a} - LFR_{t,b}}{a-b} + LFR_{t,b} \qquad \text{Equation (3)}$$

Where:

$LFR_{t,n}$ = Lamp failure rate of lamp type *t*, *n* years after it is installed

a and b = Years after the installation of the first lamp group

(a) If the failure rate from a monitoring survey is lower than the failure rate from any of the previous surveys, the highest failure rate from the previous surveys will be used instead;

(b) Prior to the first monitoring survey, interpolate the rated average life of the lamp, using $a=L_t/(O_t \times 365)$, $LFR_{t,a}=50\%$, $b=0$, $LFR_{t,b}=0$;

(c) After the first monitoring survey and until the rated average life of the first lamp group type t is reached:

    (i) If the subsequent survey result is available before submitting the issuance request, interpolate the previous survey's results and the subsequent survey's results, using:

        a. *b* and $LFR_{t,b}$ from the latest survey prior to year *n*; and

        b. *b* and $LFR_{t,b}$ from the first survey after year *n*;

    (ii) If the subsequent survey result is not available before submitting the issuance request, use the more conservative value between:

        a. Interpolation of the latest survey's results and the rated average life of the lamp, using:

            i. $A = L_t/(O_t \times 365)$, $LFR_{t,a}=50\%$; and

[7] For example assuming a rated lifetime of 10,000 hours and annual hours of operation of 1,278, the subsequent surveys take place every three years. LED lamps, with assumed rated lifetime of 50,000 hours, may be monitored only upon renewal of the crediting period.

ii. *b* and $LFR_{t,b}$ from the latest survey prior to year *n*;

b. Extrapolation of the previous two surveys' results, using:

i. *a* and $LFR_{t,a}$ from the second last survey prior to year *n* (if only one survey has been conducted, *a*=0, $LFR_{t,a}$=0);

ii. *b* and $LFR_{t,b}$ from the latest survey prior to year *n*;

(d) $LFR_{t,n}$ is 100%, after the rated average life of the first lamp group is reached, i.e. $n > L_t/(O_t \times 365)$;

(e) If the failure rate calculated or surveyed is equal to or above 50 per cent, the lamp failure rate $LFR_{t,n}$ is considered to be 100 per cent in equation (1).

24. For each subsequent group using lamp type *t*, the survey results for the first group using lamp type *t* shall be used to apply the procedure above. For example, if the first group of lamp type *t* are installed in 2012/2013, the failure rate from the survey of year 2016 for the first group ($LFR_{t,3}$) can be assumed to be the results of a survey conducted in year 2018 for the group of lamp type *t* installed in 2015 ($LFT_{t,3}$).

25. Only project lamps with an original project identification may be counted as installed. While project lamp replaced as part of a regular maintenance or warranty program can be counted as operating for estimating $LFR_{t,n}$, the replacement shall not be undertaken as part of this monitoring survey process. Compared to the maintenance or warranty program to replace failed lamps for the first group, that of the subsequent groups of the same lamp type *t* shall remain the same or be further expanded/strengthened; otherwise, the failure rates of the subsequent groups shall be adjusted conservatively by discounting the replaced lamps in the first group.

5.4. Generic instructions for conducting sampling

26. The standard for "Sampling and surveys for CDM project activities and programme of activities" shall be followed while conducting the sampling.

27. A project database shall be established containing all relevant information for estimating baseline emissions and sampling the project lamps, including, inter alia:

(a) Details of each user of the project lamps (name, address, contact details);

(b) Model, power rating, type (as defined by this methodology) and unique serial number of the project lamp;

(c) Rated average life of the project lamp;

(d) Power rating and technology (i.e. CFL or incandescent lamp) of the returned baseline lamp;

(e) Date of installation/distribution of the project lamp;

(f) Dates of expiration, replacement or drop-out of the device if such events occur;

(g) Dates of checking whether the project lamp is working.

28. In addition, the following survey principles shall be followed for activities related to determining number of project lamps 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 95 per cent confidence level and the 10 per cent maximum error margin; the size of the sample shall be no less than 100, for each lamp type *t*;

    (b) Sampling must be statistically robust and relevant so that 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 CDM-PDD must contain the design details of the survey.

5.5. Leakage

29. Scrapping of replaced equipment to avoid leakage is addressed under applicability conditions, therefore no specific requirements are indicated.

5.6. Changes required for methodology implementation in 2nd and 3rd crediting periods

30. Project participants shall apply the methodological tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”.

5.7. Data and parameters not monitored

Data / Parameter table 1.

Data / Parameter:	**L_t**
Data unit:	H
Description:	Rated average life of project lamp type *t*
Source of data:	-
Measurement procedures (if any):	Based on manufacturer specifications, relying on industrial standards
Any comment:	-

6. Monitoring methodology

31. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.

32. Furthermore, all parameters required by tools referred to by this methodology shall be monitored.

6.1. Data and parameters monitored

Data / Parameter table 2.

Data / Parameter:	**Project database**
Data unit:	-
Description:	Household and lamp information as detailed in section 5.4.
Source of data:	Database
Measurement procedures (if any):	-
Monitoring frequency:	Database shall be maintained continuously
QA/QC procedures:	Project proponents shall ensure that information is registered correctly, controlled and updated with stringent measures
Any comment:	The database is the source for, inter alia, $P_{i,PJ}$ and $P_{i,BL}$

Data / Parameter table 3.

Data / Parameter:	**O_t**
Data unit:	h
Description:	Daily operation hours of project lamp type *t*
Source of data:	Operating hours shall be determined as either (a) A default value of 3.5 hours per 24 hours period; or (b) An average measured value determined from measurements of a representative sample conducted once, prior to or concurrent with the first ex post monitoring survey for determining the lamp failure rate
Measurement procedures (if any):	A continuous measurement of usage hours of baseline or project lamps for a minimum of 90 days at representative sample households is required. 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. The operation hours may be calculated by installing an electricity meter and dividing the electricity consumed by the lamp rated power. 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"
Monitoring frequency:	-
QA/QC procedures:	In no case shall a value greater than 5.5 hours per 24 hour period be used under this methodology

Any comment:	The project participant shall decide prior to the first ex post survey/measurement whether to use the 3.5 hours default value or ex post measured operating hours for determining O_t. 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. Once an approach is implemented, it is not possible to switch back to the alternative approach. If the sampling results do not meet the required confidence and precision level but the average daily operating hours are higher than 3.5 hours, the project participant may switch to use the default value of 3.5 hours

Data / Parameter table 4.

Data / Parameter:	**$LFR_{t,n}$**
Data unit:	-
Description:	Lamp failure rate of lamp type *t*, *n* years after its installation
Source of data:	Survey
Measurement procedures (if any):	See sections on ex post determination of $LFR_{t,n}$ and generic instructions for conducting sampling
Monitoring frequency:	See section on ex post determination of $LFR_{t,n}$
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 5.

Data / Parameter:	**TDL_y**
Data unit:	-
Description:	Technical distribution losses in the electricity grid serving the household consumers that participate in the project during the monitoring interval *y* (kWh of technical electric losses in the electricity grid/kWh of electricity generated)
Source of data:	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
Measurement procedures (if any):	-

Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	The 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, shall not include non-technical losses such as commercial losses (e.g. theft/pilferage)

Data / Parameter table 6.

Data / Parameter:	**Scrapping/destruction of replaced baseline lamps**
Data unit:	-
Description:	-
Source of data:	-
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	As required in section 2.2.

Data / Parameter table 7.

Data / Parameter:	**National/local lighting performance standards**
Data unit:	-
Description:	-
Source of data:	-
Measurement procedures (if any):	-
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	As required in section 2.2.

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