

Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

TYPE II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS

Project participants shall take into account the general guidance to the methodologies, information on additionality, abbreviations and general guidance on leakage provided at:
<<http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>>.

II.x. Demand-side activities for outdoor and street efficient lighting technologies

Technology/measure

1. This category comprises activities that lead to efficient use of electricity through the adoption of energy efficient lamps and/or fixture combinations (referred to as project luminaires) to replace less efficient lamps and/or lamp fixture combinations (referred to as baseline luminaires) in street lighting and other outdoor applications, such as building exterior security lighting. This methodology is applicable for one-for-one project luminaire for baseline luminaire replacements or for replacing multiple baseline luminaire systems with multiple project luminaire systems that are in total more energy efficient¹. It is neither applicable to calculating Emission Reductions for the installation of lighting controls that reduce the lighting operating hours of project luminaires versus baseline luminaires nor for new construction. The luminaires and/or fixtures adopted to replace existing equipment must be new equipment not transferred from another activity.
2. The total useful illumination provided by the project luminaires must be equal to or more than that of the baseline luminaires being replaced or equal to or greater than the illumination requirements from an applicable approved national standard. Such illumination shall be determined in accordance with relevant national or international standard/s or documented standard industry practice².
3. The aggregate electricity savings by a single project activity may not exceed the equivalent of 60 GWh per year.
4. Project lamps, used in the project luminaires, must have been tested and rated by their manufacturer or an independent body according to a relevant national or international testing standard. The testing shall indicate a rated lifetime³ of the project lamps and the project design document shall cite the standard used.
5. Project luminaires, including lamps, shall be marked for clear unique identification for the project.
6. The Project Design Document shall explain how proposed project procedures eliminate double counting of Emission Reductions, for example due to project luminaire manufacturers,

¹ For example, replacing a collection of street lighting luminaires with new street lighting luminaires that may involve more luminaires, but in total consume less energy than the replaced luminaires.

² Standards and/or criteria to be provided.

³ 'Rated lifetime' or 'rated average life' or 'rated life to 50% failures' is the expected time at which 50% of any large number of lamps reach the end of their individual life.

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wholesale providers or others possibly claiming credit for Emission Reductions for the project luminaires.

7. The project activity shall be designed to limit undesired secondary market effects (e.g., leakage) by ensuring that replaced luminaires are exchanged and destroyed. The project design document shall explain the proposed method of distribution of project luminaires and how baseline luminaires will be replaced, stored and destroyed⁴.

Boundary

8. The project boundary is the physical, geographical location of each project luminaire installed.

Crediting Period

9. With this methodology, Certified Emission Reductions can only be earned for one crediting period of up to 10 years.

Emission Reductions

10. *Ex ante* calculations are done as per the following steps:
- (a) Estimate the nameplate/rated power (Watts) of the baseline luminaires to be replaced;
 - (b) Default value for daily hours of operation of baseline luminaires is assumed to be equal to:
 - (i) For outdoor luminaires controlled with a timer, use the number of hours that the timer will be set during the crediting period for operating hours during an average day; or
 - (ii) For outdoor luminaires controlled by ambient light sensors, use the average number of hours between sunset and sunrise; or
 - (iii) For outdoor luminaires controlled by motion sensors, use the average number of hours between sunset and sunrise divided by ten.
 - (c) Calculate the gross electricity savings by comparing the total nameplate/rated power rating of the project luminaires with that of the baseline luminaires and multiplied by annual hours of operation (daily hours times 365 or other number equal to the number of days per year that the lights are expected to be operated);
 - (d) Calculate the net electricity saving (NES) by correcting the gross electricity savings for leakage and transmission & distribution losses.

⁴ Proposed method shall allow verification by the DOE, may include for example collection of lamp or lamp/fixture systems, recording of lamp wattage and destruction in decentralised or centralised locations; evidences such as photographic evidence may be incorporated.

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11. Once the project is installed, the electricity saved by the project activity in year y is calculated as follows:

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

Where:

$$ES_i = \left((Q_{BL,i} \times P_{i,BL}) - (Q_{P,i} \times P_{i,P}) \right) \times O_{i,y} \times (D_y / 1000) \quad (2)$$

Where:

NES_y	Net electricity saved in year y (kWh)
Q	Quantity of baseline (BL) or project luminaires (P) of type i distributed or installed under the project activity (units). Once all of the project luminaires are distributed or installed, $Q_{P,i}$ is a constant value independent from y
y	Crediting year counter
i	Counter for equipment type
n	Number of types of luminaires
ES_i	Estimated annual electricity savings for equipment of type i , for the relevant type of project luminaire (kWh)
$LFR_{i,y}$	Luminaire Failure Rate for equipment type i in year y (fraction)
TD_y	Average annual technical grid losses (transmission and distribution) during year y for the grid serving the locations where the devices are installed, expressed as a fraction. This value shall not include non-technical losses such as commercial losses (e.g., theft/pilferage). The average annual technical grid losses shall be determined using recent, accurate and reliable data available for the host country. This value can be determined from recent data published either by a national utility or an official governmental body. Reliability of the data used (e.g., appropriateness, accuracy/uncertainty, especially exclusion of non technical grid losses) shall be established and documented by the project participant. A default value of 10% shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable
$P_{i,BL}$	Rated power of the baseline luminaires of the group of “ i ” lighting devices (Watts)
$P_{i,P}$	Rated power of the project luminaires of the group of “ i ” lighting devices (Watts)
D_y	Number of days per year that project luminaries, must be less than or equal to 365

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$O_{i,y}$ Average daily operating hours of the project luminaires in year y . This value is assumed to equal the daily operating hours of the baseline luminaires and is equal to a measured value, corrected for seasonal variation of lighting hours if any, based on continuous measurement of usage hours of project luminaires for a minimum of 60 days at representative installation locations (sampling determined by minimum 90% confidence interval and 10% maximum error margin). The measurements shall be repeated at the representative sample installation location at the time of ex post monitoring as indicated in paragraph 14 and the most recent measured value is used for daily operating hours. In no case, however, can a value greater than the daily average annual number of hours between sunset and sunrise hours, per 24 hour period, be used under this methodology

The Luminaire Failure Rate (LFR_y) is the % of luminaires that have failed during a year. The rated lifetime is used to calculate the *ex ante* Luminaire Failure Rate as follows:

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

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

Where:

$LFR_{i,y}$	Luminaire Failure Rate for project luminaire type i in year y (fraction)
L_i	Rated average life for project luminaire type i (hours)
R_i	% of project luminaires of type i operating at the rated lifetime (use a value of 50)
X_i	Number of operating hours per year for project luminaire type i (hours)
y	Counter for year

12. Emissions reduction is net electricity savings (NES) times an Emission Factor (EF) calculated in accordance with provisions under AMS-I.D.

$$ER_y = NES_y * EF_{CO_2,ELEC,y} \quad (4)$$

Where:

$EF_{CO_2,ELEC,y}$	Emission Factor in year y calculated in accordance with the provisions in AMS-I.D (tCO ₂ /MWh)
ER_y	Emission Reductions in year y (tCO ₂ e)

13. The electricity savings from the project luminaires installed by the project activity shall be considered from the date of completion of installation of the equipment.

14. *Ex post* monitoring and adjustment of net electricity savings:

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- (a) First *ex post* monitoring survey, carried out within the first year after installation of all project luminaires shall provide a value for O_i and D_y ;
- (b) First *ex post* monitoring survey, carried out within the first year after installation of all project luminaires shall provide a value for the number of project luminaires placed in service and operating under the project activity. The results of this survey are used to determine the quantity of luminaires ($Q_{P,i}$) in the Emission Reduction calculation. The survey will consist of identifying project luminaires, marked per paragraph 5, that are installed and operating. Only project luminaires with an original marking can be counted as installed. While project luminaires replaced as part of a regular maintenance or warranty program can be counted as operating, project luminaires cannot be replaced as part of the CDM monitoring survey process and counted as operating;
- (c) Subsequent *ex post* monitoring surveys are carried out at the following intervals to determine the *ex post* Luminaire Failure Rate ($LFR_{i,y}$) and *ex post* average daily operating hours (O_i) for use in *ex post* Emission Reduction calculations until such time as CERs are no longer being requested (choose either of the following two options that define the minimum requirement for the frequency of the survey)⁵:
 - (i) Once every 3 years;
 - (ii) Once for every 30% of the elapsed rated lifetime of the luminaire.

15. On the basis of *ex post* monitoring surveys, the net electricity savings are adjusted considering the actual luminaire failure data. If the *ex post* failure rates ($LFR_{i,y}$) are higher or lower than the *ex ante* estimate, subsequent Emission Reduction claims shall be based on linear failure rate curve reconstructed for the remaining period of the crediting period. However, under no circumstances can an estimate of project luminaire $LFR_{i,y}$ value be lower than that indicated per the independent tests referenced in paragraph 4 of this methodology.

Monitoring

16. Monitoring includes (a) recording of luminaire distribution data, and (b) *ex post* monitoring surveys as defined in paragraph 14:

- (a) During project activity implementation, the following data are to be recorded:
 - Number of project luminaries distributed under the project activity, identified by the type of equipment and the date of supply;
 - The number and power of the replaced devices;

⁵ For example assuming a rated lifetime of 25,000 hours and annual hours of operation of 4,000, since the first *ex post* monitoring survey is done in year 1, the subsequent survey takes place in year 4 and 7 with the crediting period ending during year 7.

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- Data to unambiguously identify the recipient of the equipment distributed under the project activity;
- (b) The Emission Reductions are calculated *ex ante* and adjusted *ex post* following the monitoring surveys, as described under paragraphs above.

Generic instructions for sampling

17. The following sampling principles shall be followed:
- The sampling size is determined by minimum 90% confidence interval and the 10% maximum error margin;
 - 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 project installations is random;
 - The project document must contain the design details of the survey.

Project activity under a Programme of Activities

18. No special provisions are required.
