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.J. Demand-side activities for efficient lighting technologies

Technology/measure

1. 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 ballasts integrated to the lamp as a non-removable part. The ~~high efficiency technology~~ CFLs adopted to replace existing equipment must be new equipment not transferred from another activity.

2. The total lumen output of the ~~efficient lighting device~~ CFL should be equal to or more than that of the ~~lighting device~~ ICL being replaced; lumen output of ICL & CFL shall be determined in accordance with relevant national or international standard/s. In the case of ICL, values in the table below may be used as an alternate option; If a lamp wattage is not in this table, linearly interpreted value shall be used to determine the minimum light output requirements e.g., 492.5 Lumens for a 45 W lamp.

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
~~Baseline Technology - Incandescent Lamp (Watt)~~	~~Minimum Light Output (Lumen)~~
~~40~~	~~415~~

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

II.J. Demand-side activities for efficient lighting technologies (cont)

~~60~~	~~715~~
~~75~~	~~940~~
~~100~~	~~1350~~

3. Project participants are encouraged to replace incandescent lamps with CFLs that have long rated lifetimes and the lowest eligible wattage that delivers the equivalent or better lumen output than the replaced lamp, as this will result in maximum emission reductions. However, this methodology does not preclude the use of higher wattage CFLs as long as the lumen output requirements are met.

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

5. High quality lamps that have been independently tested must be used. To ensure this a relevant national or international testing standard shall be followed to determine the rated lifetime[1] of the lighting equipment; the project design document shall cite the standard[2] used to determine the rated lifetime of efficient lamps distributed under the project activity.

6. CFLs utilized under the project activity shall, in addition to the standard lamp specifications[3], be marked for clear unique identification for the project.

~~Efficient lighting technology under the project activity (e.g. uncovered compact fluorescent lamp with integrated electronic ballast) shall, in addition to the standard lamp specifications, be marked for clear unique identification for the project. Such marking may for example include:~~

~~Batch number providing information on period of manufacture;~~

~~Standard to which the lamp type is certified.~~

7. The project design document shall explain the proposed method of distribution of efficient lighting equipment and how the following activities will be conducted and documented; baseline incandescent lamps returned (e.g., exchanged for project CFLs), stored and destroyed[4]. ~~Measures to replace defective project CFLs shall be explained.~~ 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.

[1] '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.

[2] National standards or in the absence of national standards, international standards (e.g., IEC 60969) may be used.

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

[4] Proposed method shall allow random verification by the DOE, may include for example collection of ICLs, recording of ICL wattage and destruction in decentralised or centralised locations; evidences such as photographic evidence may be incorporated.

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

II.J. Demand-side activities for efficient lighting technologies (cont)

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:

(i) Directly installing the CFLs;

(ii) Charging at least a minimal price[5] for efficient lighting equipment;

(iii) 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 recipients of the CFLs.

~~9. For efficient lighting equipment not directly installed, project participants shall take measures to encourage efficient lamps being installed in locations where the (daily) utilization hours can be expected to be equal to or greater than 3.5 hours per day (e.g. educating the recipients of the efficient lighting equipment).~~

Boundary

10. The project boundary is the physical, geographical location of each measure (each ~~piece of energy efficient lighting equipment~~ CFL) installed.

Crediting Period

11. With this methodology, Certified Emission Reductions can only be earned only for the rated lifetime (rated life to 50% failures) of ~~efficient lighting equipment~~ project CFLs, not to exceed one crediting period of up to 10 years.

Emission Reductions

12. *Ex ante* calculations are done as per the following ~~four~~ steps:

(i) Estimate the nameplate/rated power (Watts) of the baseline incandescent lamps to be replaced. ~~Determine the technology of the lamps (e.g. incandescent, CFLs, tubular),nameplate/rated power (Watts) and daily hours of operation[6] of the lamps in the baseline situation in the project area through a baseline survey~~;

[5] For example cost equivalent of an incandescent lamp being replaced. ~~To ensure efficient lamps are used in locations where the (daily) efficient lighting equipment utilization hours can be expected to be at least 3.5 hours per day. For example, encouraging placement of efficient lighting equipment in areas other than bathrooms or storage rooms.~~

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

II.J. Demand-side activities for efficient lighting technologies (cont)

(ii) Default value for daily hours of operation of baseline incandescent lamps is 3.5 hours per 24 hrs period. Use the default value or the measured value determined from the representative sample[7];

(iii) Calculate the gross electricity savings from an individual lamp by comparing the nameplate/rated power rating of the CFL ~~new lighting equipment~~ with that of the baseline incandescent lamp and multiplying by annual hours of operation;

(iv) Calculate the net electricity saving (NES) by correcting the gross electricity savings for leakage, ~~free ridership~~ net-to-gross adjustment (NTG) factor and transmission & distribution losses.

The electricity saved by the project activity in year *y* is calculated as follows:

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

Where:

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

Where:

NES_y Net electricity saved in year *y* (kWh)

$Q_{PJ,i}$ Number (quantity) of pieces of equipment of type *i* distributed ~~and commissioned~~ 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

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)

[7] To use a different value for 'daily operating hours' other than 3.5 hrs/day, continuous measurement of usage hours of baseline lamps for a minimum of 90 days at representative sample households is required (a random sample that determines an estimate within ± 10% of the actual value with a 90% confidence). The days-selected for measurement of operating hours shall be representative of the annual variation of daylight hours in the region.

TD_y Average annual technical grid losses (transmission and distribution) during year *y* for the grid serving the locations where the devices are installed, expressed as a fraction. This value shall not include non-technical losses such as commercial losses (e.g., theft/pilferage). The average annual technical grid losses shall be determined using recent, accurate and reliable data available for the host country. This value can be determined from recent data published either by a national utility or an official governmental body. Reliability of the data used (e.g., appropriateness, accuracy/uncertainty, especially exclusion of non technical grid losses) shall be established and documented by the project participant. A default value of 10% shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable.

NTG Net-to-gross adjustment factor, a default value of 0.95 to be used unless a more appropriate value based on a lighting use survey from the same region and not older than 2 years is available

$P_{i, BL}$ Rated power of the baseline lighting devices of the group of "*i*" lighting devices (Watts)

$P_{i, PJ}$ Rated power of the project lighting devices of the group of "*i*" lighting devices (Watts)

O_i Average daily operating hours of the lighting devices replaced by the group of "*i*" lighting devices, use ~~lower of the following: a)~~ 3.5 hours per 24 hrs period or the measured value determined from the representative sample ~~b) Daily usage hours determined by the baseline survey.~~ ; 'daily operating hours' other than 3.5 hrs/day, corrected for seasonal variation of lighting hours if any, may be used only if it is based on continuous measurement of usage hours of baseline lamps for a minimum of 90 days at representative sample households (sampling determined by minimum 90% confidence interval and 10% maximum error margin). For the latter option i.e. to use the measured value, the measurements shall be repeated at the representative sample[8] households 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, a value greater than 5 hours per 24 hrs period shall be used under this methodology.

~~*BP* Baseline Penetration Factor[9] (BP = 1-(# of pieces of screw-in or lock-in efficient lighting equipment /total # of pieces of screw-in or lock-in lighting equipment), based on *ex ante* representative sample survey; BP is only applicable to 'Project Activity under Programme of Activities (CPA of PoA)' and in other cases set BP to '1.0'~~

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

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

[8] households chosen as samples for the ex ante measurement are excluded

[9] ~~This factor captures the penetration of the project technology in the baseline situation. This factor is only applicable for project activities under a program of activities i.e. CPA of a PoA.~~

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

II.J. Demand-side activities for efficient lighting technologies (cont)

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

Where:

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

L_i Rated average life for equipment type i (hours)

R_i % of lamps of type i operating at the rated lifetime (use a value of 50)

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

y Counter for year

(v) Emissions reduction is net electricity savings (*NES*) times an emission factor (*EF*) calculated in accordance with provisions under AMS-I.D.

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

Where:

$EF_{CO2,ELEC,y}$ 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_2e)

13. 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.

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

(i) 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 lamps placed in service and operating under the project activity. The results of this survey are used to determine the quantity of lamps ($Q_{PJ,i}$) in the emission reduction calculation; The survey 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, CFLs cannot be replaced as part of the survey process and counted as operating.

(ii) Subsequent *ex post* monitoring surveys are carried out at the following intervals to determine the *ex post* Lamp Failure Rate ($LFR_{i,y}$) and where relevant *ex post* average daily operating hours (O_i) ~~quantity of lamps ($Q_{PJ,i}$) in operation~~ for use in ~~subsequent~~ *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)[10]:

1. Once every 3 years;
2. Once for every 30% of the elapsed rated lifetime of the lamp.

15. On the basis of *ex post* monitoring surveys, the net electricity savings are adjusted considering the actual lamp failure data. If the *ex post* failure rates ($LFR_{i,y}$) are higher or lower than the *ex ante* estimate, subsequent emission reduction claims ~~will compensate for the overestimations~~ shall be based on linear failure rate curve reconstructed for the remaining period of the crediting period[11] ~~(linear failure rates of lamps may be assumed~~). However, under no circumstances can a estimate of $LFR_{i,y}$ value be lower than that indicated in the mortality curve[12] of the CFL determined as per the independent tests referenced in paragraph 5 of this methodology.

Monitoring

16. Monitoring includes ~~(i) an *ex ante* baseline survey,~~ (i) recording of lamp distribution data, and (ii) *ex post* monitoring surveys as defined in paragraph 14:

(i) ~~An *ex ante* baseline representative sample survey will be conducted to provide key information about existing equipment. The survey should be sufficient to determine daily average lighting usage, type of baseline technology and power rating of the equipment as specified in the Annex 1. Where applicable it should also collect data to determine the Baseline Penetration Factor (BP);~~

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

- Number of pieces of equipment distributed under the project activity, identified by the type of equipment and the date of supply;
- The number and power of the replaced devices;
- Data to unambiguously identify the recipient of the equipment distributed under the project activity;

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

Generic instructions for conducting the surveys

17. The following survey principles shall be followed:

- 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;

[10] For example assuming a rated lifetime of ~~8000~~ 10,000 hours and annual hours of operation of ~~1095~~ 1,278, since the first *ex post* monitoring survey is done in year 1, the subsequent surveys take place in years 4 and 7 with the crediting period ending in year 8. ~~as appropriate in accordance with the rated lifetime.~~

[11] Crediting period ends at rated lifetime as in the *ex ante* calculation.

[12] Percentage of lamps operating over time.

- 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 conducted by site visits;
- Only persons over age 12 are interviewed;
- The project document must contain the design details of the survey.

A generic questionnaire is included in Annex 1. This questionnaire should be used adapting it to local circumstances as necessary.

Project Activity under Programme of Activities

Avoidance of leakage through scrapping of replaced equipment is addressed under paragraph 7, no special provisions are required therefore.

~~18. If the methodology is applied to a project activity (CPA) under a programme of activities (PoA):~~

~~An assessment of Baseline Penetration Factor (BP) shall be done for each of the CPA of PoA separately through *ex ante* baseline survey for use in emission reduction calculation as per Equation 1.~~

~~(a) Monitoring should include a verification that the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. The scrapping of replaced equipment should be documented and independently verified;~~

~~(b) Leakage on account of cross effects (interactive effects, for example increased heating load due to introduction of efficient lighting technologies) shall be considered[13] unless it is demonstrated that any one of the following conditions are met:~~

~~(i) Heating Degree Days (HDDs) to base 18^0C in the geographic location of the project is equal to or less than 1000 in a year;~~

~~(ii) The *ex ante* survey determines that space heating in the project location is not done for more than two months in a year;~~

~~(iii) There is less than 10% penetration of space heating equipment in the location of the project activity;~~

~~(iv) The number of CFLs distributed per household is four or less.~~

~~[13] Consideration of interactive effects may be proposed through the request for revision process.~~

Annex I

~~***Ex ante* baseline survey and *Ex post* Monitoring Survey Templates**~~

~~***Ex ante* Baseline Survey Template**~~

~~**General Information**~~

- ~~Interviewer;~~
- ~~Date of interview;~~
- ~~Name and Address (or description of location of dwelling);~~
- ~~Ownership status (owner / tenant / other).~~

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

II.J. Demand-side activities for efficient lighting technologies (cont)

Lamp Hours of Operation and Baseline Penetration

Lamp	Location (categories to be adapted to suit local needs)	Type of Lamp: e.g. Incandescent (I) Fluorescent Tube Light (FTL) CFL Energy Saving (CFL) Other (O) – please describe	Type of Fitting: Screw (S) Pin (P) Other (O)	Lamp Wattage	Average Use (hours per day)	In Working Condition? y/n □ or □
1.1	Bedrooms					
1.2						
1.X						
2.1	Kitchen					
2.2						
2.X						
3.1	Family Room					
3.2						
3.X						
4.1	Dining Room					
4.2						

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

II.J. Demand-side activities for efficient lighting technologies (cont)

Lamp	Location (categories to be adapted to suit local needs)	Type of Lamp: e.g. Incandescent (I) Fluorescent Tube Light (FTL) CFL Energy Saving (CFL) Other (O) – please describe	Type of Fitting: Screw (S) Pin (P) Other (O)	Lamp Wattage	Average Use (hours per day)	In Working Condition? y/n □ or □
4.X						
5.1	Bathroom & Other					
5.2						
5.X						

(Add rows as needed to capture all bulbs)

- Identify the most well used lamps in the household;
- Determine total number of light sockets in the household;
- Determine total number of incandescent lamps in service;
- Determine total number of CFLs.

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

II.J. Demand-side activities for efficient lighting technologies (cont)

~~**CFL Awareness and Lamp Purchase Habits**~~

- ~~Have you heard about energy saving CFLs (compact fluorescent lamps)?~~
- ~~If yes:~~
  - ~~Where did you first hear about them?~~
  - ~~Do you regularly purchase them?~~
  - ~~What are the main reasons that you do/don't regularly purchase CFLs?~~
- ~~If no, would you be willing to buy an energy saving CFL that is more expensive than a conventional incandescent bulb?~~
- ~~Regarding your last purchase of lamps:~~
  - ~~What type of lamp was it?~~
  - ~~Where did you purchase it?~~
  - ~~What was the cost?~~

~~**Other data**~~

- ~~Where applicable question/s on the space heating practice in the region may be added~~

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

II.J. Demand-side activities for efficient lighting technologies (cont)

Ex post monitoring survey template

General Information

- Interviewer;
- Date of interview;
- Name and Address (or description of location of dwelling);
- Ownership status (owner/tenant/other).

Proper Installation/Operation

- Check whether each CFL distributed under the project activity is installed (based on records on the type/number of efficient lamps distributed to each individual household);
- Record whether CFLs distributed under the project activity are operational;
- Determine whether defective CFLs were replaced by the end-user and, if so, with what type/wattage of lamp.

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

II.J. Demand-side activities for efficient lighting technologies (cont)

Lamp ID	Installed/ operational? (if No complete next column)	Reasons for failures (Defective, poor performance, in reserve, sold/given away)	Replacement Lamp Type Installed by Household* Incadescent (I) Fluorescent Tube Light (FTL) CFL Energy Saving (CFL) Light Emitting Diodes (LED) Other (O) – please describe	Replacement Lamp Wattage Installed by Household	Replacement CFL Bulb Installed at Time of Survey? □or □	Replacement CFL Wattage
1						
2						
3						
4						
5						
6						

(Add rows to match number of efficient lamps distributed to each household under the CDM project activity)

- If other than efficient lamps, also ask why an efficient lamp like CFL was not used?

- - - - -

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

II.J. Demand-side activities for efficient lighting technologies (cont)

History of the document

Version	Date	Nature of revision
03	EB 47, Annex 21 28 May 2009	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	EB 44, Annex 22 28 November 2008	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	EB 41, Annex 16 02 August 2008	Initial adoption.