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. The high-efficiency technology to replace existing equipment must be new equipment not transferred from another activity.

2. The total lumen output of the efficient lighting device should be equal to or more than that of the lighting device being replaced, according to the table below:

Baseline Technology-Incandescent Lamp (Watt)	Minimum Light Output (Lumen)
40	415
60	715
75	940
100	1350

3. Project participants are encouraged to replace incandescent lamps with the lowest eligible wattage of the efficient lighting equipment that delivers the equivalent or better lumen than the baseline lamp, as this would result in maximum emission reductions.

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

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

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

5. High quality lamps that have been independently tested must be used. To ensure this:

(i) 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. 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[3], 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 incandescent bulbs will be returned, stored and monitored before destruction. Measures to replace the defective equipment shall be explained. It shall also be explained how the proposed measures eliminate any possibilities for double accounting of emission reductions.

8. The project activity must be designed to limit undesired secondary market effects (e.g., leakage) and free riders:

(i) By ensuring that replaced lamps are exchanged and destroyed;

(ii) By direct installation, charging at least a minimal price[4] for efficient lighting equipment and restricting the number of lamps per household distributed through the project activity; and

(iii) By ensuring incandescent bulbs will not be replaced by an efficient lamp in spots where the (daily) utilization hours can be expected to be very low.[5]

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

[5] For example lamps in toilets, 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)

Boundary

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

Crediting Period

10. This methodology is applicable to only one crediting period of up to 10 years. Certified Emission reductions can be earned only for the rated lifetime (rated life to 50% failures) of efficient lighting equipment.

Emission Reductions

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

(i) 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;

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

(iii) Calculate the net electricity saving (NES) by correcting the gross electricity savings for leakage, free ridership and transmission & distribution losses;

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

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

Where:

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

[6] Use lower of the following: a) 3.5 hours per 24 hrs period; b) Daily usage hours determined by the baseline survey. A different value for 'daily operating hours', 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).

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 under the project activity (units)
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)
TD_y	The factor for Transmission & distribution loss in year *y* (fraction); Td*y* = 1/[1 - (T&D losses) *y*], The T&D losses should not contain non-technical losses such as commercial losses (e.g., theft/pilferage). The T&D losses should be estimated using recent, accurate and reliable data available within the Host country. It can be estimated either by a national utility or an official governmental body. Reliability of the data used e.g. appropriateness, accuracy/uncertainty, and exclusion of non-technical T&D losses shall be established and documented by the project participant. A default value may be used for technical T&D losses, if no recent data is available or the data cannot be regarded as accurate and reliable. The maximum value for T& D losses in any given year *y* shall not exceed 0.1
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; b) Daily usage hours determined by the baseline survey. A different value for 'daily operating hours', 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)

BP Baseline penetration factor[7] (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:

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

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

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

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

[7] This factor catpures 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.

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)

12. 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.

13. *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 light bulbs will provide a figure 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;

(ii) Subsequent *ex post* monitoring surveys are carried out at the following intervals until such time as CERs are being requested, (choose shorter of the two):

1. Once every 3 years;

2. Once for every 30% of the elapsed rated lifetime;[8]

14. On the basis of *ex post* monitoring surveys, the net electricity savings are adjusted considering the actual lamp failure data. If the failure rates are higher than the *ex ante* estimate, subsequent emission reduction claims will compensate for the overestimations (linear failure rates of lamps may be assumed).

Monitoring

15. Monitoring includes (i) an *ex ante* baseline survey, (ii) recording of lamp distribution data, and (iii) *ex post* monitoring surveys as defined in paragraph 13:

(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:

[8] For example assuming a rated lifetime of 8000 hours and annual hours of operation of 1095, since the first *ex post* monitoring survey is done in year 1, the subsequent surveys take place in years 4, 6 and 8 as appropriate in accordance with the rated lifetime.

- 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

16. 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;
- 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

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

(a) 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;

(b) 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;

(c) Leakage on account of cross effects (interactive effects, for example increased heating load due to introduction of efficient lighting technologies) shall be considered[9] 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 are 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.

[9] 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						

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 ☐
4.1	Dining Room					
4.2						
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.x. 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.x. Demand-side activities for efficient lighting technologies (cont)

History of the document

Version	Date	Nature of revision
01	EB 41, Annex 16 02 August 2008	Initial adoption.