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

TYPE II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS

Project participants shall apply the general guidelines to SSC CDM methodologies, information on additionality (attachment A to Appendix B) and general guidance on leakage in biomass project activities (attachment C to Appendix B) provided at <http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html> *mutatis mutandis*.

II.M. Demand-side energy efficiency activities for installation of low-flow showerhead hot water savings devices

Technology/measure

1. This methodology comprises activities for direct installation of low-flow showerhead, hot water saving devices that are used for personal bathing in residential buildings. Such low-flow showerheads are to permanently replace inefficient showerheads. The low-flow showerheads must contain integral, non-removable flow restrictions.

2. The aggregate energy savings by a single project may not exceed the equivalent of 60 GWh per year for electrical end use energy efficiency technologies. For fossil fuel end use energy efficient technologies, the limit is 180 GWh thermal per year in fuel input.

3. Project low-flow showerheads shall have a minimum of a one year warranty.[1]

4. The project proponent shall ensure that the project low-flow showerheads:

   (a) Qualify as a water saving device through reference to applicable standards (see example standards in Annex 1);

   (b) Provide an equivalent level of service in terms of functional comfort and cleaning performance while reducing the amount of water consumed;

   (c) Are directly installed and tested to be functional at the time of installation;

   (d) Are marked for clear unique identification for the project activity.

5. The Project Design Document (PDD) shall explain the proposed method of direct installation of low-flow showerheads. The PDD shall also explain the method for collection, destruction and/or recycling of baseline showerheads, which shall allow for verification. An example method is collection of baseline showerheads, storage in decentralised or centralised locations, and destruction by third-party recycling facility with certificate of disposal of all salvaged and scrap materials. With recorded documentation of baseline showerhead destruction, the destruction can precede verification.

[1] At a minimum warranty shall cover free replacement or repair of any failed low-flow showerheads with equivalent devices.

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II.C. Demand-side energy efficiency activities for installation of low-flow showerhead hot water savings devices (cont)

6. At all locations where low-flow showerheads are installed, water shall be heated exclusively by electricity or fossil fuels, prior to the project start and for the duration of the crediting period. Locations where renewable energy sources (e.g. biomass, solar, geothermal) or non-renewable biomass are used for water heating purposes are not eligible.

7. The PDD shall also explain how the proposed procedures eliminate double counting of emission reductions, for example due to manufacturers, wholesale providers or others possibly claiming credit for emission reductions for the project showerheads.

Boundary

8. The project boundary is the physical, geographical location of each low-flow showerhead installed and the associated water heating system.

Crediting Period

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

Emission Reductions

10. Emission reductions are calculated as the energy savings associated with a reduction in the amount of water that requires heating, which result from the project implementation, multiplied by an emission factor for the electricity or fossil fuel displaced.

11. For calculating the emission factor for displaced fossil fuels, reliable local or national data shall be used. IPCC default values shall be used only when country or project specific data are documented to be either not available or not reliable. For the emission factor for displaced electricity, an annual emission factor shall be calculated in accordance with the provisions in AMS-I.D or AMS-I.F[2] (tCO_2/MWh).

12. Energy savings that result from the project implementation shall be determined using one of following two methods and the choice of a method shall be made *ex ante* and specified in the PDD and cannot be changed during the crediting period. The methods are:

(a) Default Energy Savings Value;

(b) Calculated Energy Savings Value Using Measured Data.

13. Default Energy Savings Method. With this method a default annual, energy savings value per low-flow showerhead is multiplied by the emissions factor of the displaced electricity or fossil fuel and by the number of low-flow showerheads installed as part of the project activity and

[2] AMS-I.D "Grid connected renewable electricity generation" and AMS-I.F "Renewable electricity generation for captive use and mini-grid"

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II.C. Demand-side energy efficiency activities for installation of low-flow showerhead hot water savings devices (cont)

demonstrated to be operating, per equation (1) for water heated with electricity in the project and per equation (2) for water heated with fossil fuel. Determination of the number of low-flow showerheads installed and operating during each year of the crediting period is required per paragraph 16.

$$ER(e)_y = N_y * ES_{Default} * EF_{CO2,ELEC,y} \div (1 - l_Y) \quad \textbf{(1)}$$

$$ER(ff)_y = N_y * ES_{Default} * 3{,}600{,}000 \frac{kJ}{MWh} * EF_{CO2,FF} \div EFF_{Default} \quad \textbf{(2)}$$

Where:

y	Each year of the crediting period
$ER(e)_y$ and $ER(ff)_y$	Emission reductions in year y in tCO_2. *ER(e)* is for electric water heating and *ER(ff)* is for fossil fuel water heating
N_y	Number of low-flow showerheads installed and operating in year y
$ES_{Default}$	Default energy savings value and equal to 0.20 MWh/year[3]
$EF_{CO2,ELEC,y}$	Emission factor in year y calculated in accordance with the provisions in AMS-I.D (tCO_2/MWh)
$EF_{CO2,FF}$	Emission factor for fossil fuels (tCO_2/kJ)

[3] This conservative default value is based on a reduction in water flow through showerhead of 5 liters/minute, a temperature difference between shower head and source water temperature of 15°C, and 500 showers per year each at a duration of five minutes. All values are considered together to provide a conservative value for energy savings and should not be considered independently of each other.

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II.C. Demand-side energy efficiency activities for installation of low-flow showerhead hot water savings devices (cont)

l_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 0.1 shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable

$EFF_{Default}$ Efficiency of the fossil fuel-based water heater and equal to 0.80

14. Calculated Energy Savings Value Using Measured Data Method. With this method measurements of a statistically valid sample of baseline and project showerhead parameters are used to calculate annual energy savings per low-flow showerhead. This value for energy savings is multiplied by the emissions factor of the displaced electricity or fossil fuel and by the number of low-flow showerheads installed as part of the project activity and demonstrated to be operating in each crediting period year. Determination of the parameters and the number of low-flow showerheads installed and operating during each year of the crediting period is required per paragraphs 15 and 16.

(a) The following equations are used to determine energy savings per low-flow showerhead:

$$ES_y = \Delta W_y * \Delta T * Cp \quad \textbf{(3)}$$

$$\Delta T = T_{out,measured} - T_{in,measured} \quad \textbf{(4)}$$

$$\Delta W_y = \left(365 \div Days_{monitoring}\right) * \left(W_{BL,calculated} - W_{P,measured}\right) \quad \textbf{(5)}$$

$$W_{BL,calculated} = FR_{BL,measured} * \left(W_{p,measured} \div FR_{P,measured}\right) \quad \textbf{(6)}$$

Where:

ES_y Energy savings in year *y* (MWh)

ΔW_y Difference in annual heated water flow through showerhead between project low-flow showerhead and baseline showerhead (litres per year)

ΔT Difference in water temperature between water entering the water heating unit used to heat shower water and the water exiting the

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II.C. Demand-side energy efficiency activities for installation of low-flow showerhead hot water savings devices (cont)

	showerhead (^{o}C)
$T_{out,measured}$	Temperature of water exiting project low-flow showerhead (per paragraph 15) (^{o}C)
$T_{in,measured}$	Temperature of water entering water heating device (per paragraph 15) (^{o}C)
Cp	Specific heat of water (4.186 kJ/litre)
$Days_{monitoring}$	Number of days during which the value of $W_{P,measured}$ is determined (per paragraph 15) (days)
$W_{BL,calculated}$	Calculated amount of water that would be used by baseline showerhead during the number of days equal to $Days_{monitoring}$ (litres)
$W_{P,measured}$	Measured amount of heated water used by project showerhead (per paragraph 15) during the number of days equal to $Days_{monitoring}$ (litres)
$FR_{BL,measured}$	Measured flow rate of baseline showerhead (per paragraph 15) (litres/minute)
$FR_{P,measured}$	Measured flow rate of project showerhead (per paragraph 15) (litres/minute)

(b) Emission reductions are calculated with equation (7) or (8) for water heated with electricity or for water heated with fossil fuel, respectively. Determination of the number of low-flow showerheads installed and operating during each year of the crediting period is required per paragraph 16.

$$ER(e)_y = N_y * ES_y * EF_{CO2,ELEC,y} \div (1 - l_Y) \quad \textbf{(7)}$$

$$ER(ff)_y = N_y * ES_y \times 3{,}600{,}000 \frac{kJ}{MWh} * EF_{CO2,FF} \div EFF_{Default} \quad \textbf{(8)}$$

15. The following parameters shall be determined once and remain fixed during the crediting period. The parameters shall be determined for a sample of the residential buildings where baseline showerheads are replaced with project low-flow showerheads. The sample shall be selected so that a 90% confidence interval and 10% margin of error shall be achieved for determining the average value of each parameter. Such sampling shall take into consideration occupancy and demographics differences, as per the relevant requirement for sampling in the "General guidelines for sampling and surveys for SSC project activities".

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II.C. Demand-side energy efficiency activities for installation of low-flow showerhead hot water savings devices (cont)

Parameter name	Parameter definition	Measurement method
$FR_{BL,measured}$	Measured flow rate of baseline showerhead (litres/minute)	Measurement, using calibrated instrumentation, of flow rate of installed low-flow showerhead. Measurements taken with water control valve(s) in full open position(s). At least three measurements taken and average of three measurements is used. Measurements taken at time of project installation
$FR_{P,measured}$	Measured flow rate of project showerhead (litres/minute)	Measurement, using calibrated instrumentation, of flow rate of installed existing (baseline) showerhead to be replaced by project low-flow showerhead. Measurements taken with water control valve(s) in full open position(s). At least three measurements taken and average of three measurements is used. Measurements taken at time of project installation
$W_{P,measured}$	Measured amount of water used by project showerhead during the number of days equal to $Days_{monitoring}$ (litres)	Measurement of water flowing through showerhead over a period of time equal to at least 60 days. Measurements are taken for at least 30 days during summer season and 30 days during winter season and totalled for determining $W_{P,measured}$. Measurements are taken with calibrated totalizing flow meter installed inline to the shower water supply line
$T_{out,measured}$	Temperature of hot water	Measurement using calibrated instrumentation of the temperature of the water existing the project low-flow showerhead. Measurements taken with water control valve(s) in full open position(s). At least three measurements taken and average of three measurements is used. Measurements taken at time of project installation. The maximum temperature allowable is 40°C
$T_{in,measured}$	Temperature of cold water	Measurement using calibrated instrumentation of the temperature of the water entering the water heating system (cold water inlet). At least three measurements taken and average of three measurements is used. Measurements taken at time of project installation. The minimum temperature allowable is 10°C
$EF_{CO2,FF}$	Emission factor for fossil fuels (tCO_2/kJ)	Reliable local or national data for the emission factor shall be used; IPCC default values should be used only when country or project specific data are not available or difficult to obtain

16. In any given year, emission reductions can only be claimed for project low-flow showerheads that are demonstrated to be in place and operational on an annual or biennial (every other year) basis during the crediting period. Compliance with this requirement shall be

implemented via an annual or biennial inspection of a sample of the project low-flow showerheads that were installed during the installation period. When biennial inspection is chosen, following the inspection during the year of project installation, the inspections can be done in years 3, 5, 7, and 9 and the results of such inspections can be applied to crediting years 3 and 4, 5 and 6, 7 and 8, and 9 and 10, respectively. A statistically valid sample of the residences where the project low-flow showerheads are installed can be used to determine the percentage of systems operating. Such percentage will be used to determine N_y. That is N_y equals the number of project low-flow showerheads documented to have been installed in the year of project implementation multiplied by the percentage of project low-flow showerheads found to installed and operating in year *y*.

Sample selection shall take into consideration occupancy and demographics differences, as per the relevant requirement for sampling in the "General guidelines for sampling and surveys for SSC project activities".

When biennial inspection is chosen a 95% confidence interval and 5% margin of error shall be achieved for the sampling parameter. When annual inspections are used, a 90% confidence interval and 10% margin of error shall be achieved for the sampling parameter.

Only project low-flow showerheads with an original project marking can be counted as installed (per paragraph 4d). While project low-flow showerheads replaced as part of a regular maintenance or warranty program can be counted as operating, project low-flow showerheads cannot be replaced as part of the survey process and counted as operating.

In addition, the annual or biennial inspections shall confirm that only fossil fuel or electricity continues to be used to heat the domestic water used for showers in the project residences.

17. The following parameters shall be documented at time of project implementation.

    (a) Number of pieces of project low-flow showerheads distributed under the project activity, identified by the manufacturer and model number and the date of supply;

    (b) The number of replaced showerheads; and

    (c) Data to unambiguously identify the recipient of the equipment distributed under the project activity.

Project activity under a Programme of Activities

18. No special considerations required.

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II.C. Demand-side energy efficiency activities for installation of low-flow showerhead hot water savings devices (cont)

Annex 1

Examples of minimum water performance level for showerheads stipulated in various mandatory and voluntary standards.

Measure	Standard	Minimum water performance level for showerheads
Mandatory		
Australia WELS	AS/NZS 3662:2005	6 to 7 l/min
New Zealand WELS	AS/NZS 3662:2005	6 to 7 l/min
USA Energy Policy Act	ASME and ANSI standards	9.5 l/min
Voluntary		
Water sense (USA)	ASME A112.18.1/CSA B125.1	≤ 7.6 l/min
Singapore WELS	SS and AS/NZS 3662:2005	5 to 9 l/min
Korea Green Label	Korean certification criteria	≤ 9.5 l/min
Thailand Green Label	Thai Industrial standards	≤7.0 l/min

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History of the document

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01	EB 61, Annex # 03 July 2011	To be considered at EB 61.
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