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 hot water savings devices

Technology/measure

1. This methodology comprises activities for direct installation of low-flow hot water savings devices that are used in residential buildings. These devices may include low-flow devices used for personal bathing (i.e. low-flow showerheads), kitchen faucets, and/or bathroom faucets and are collectively referred to in this methodology as low-flow devices. Such low-flow devices are to permanently replace baseline faucets.

2. The low-flow devices must contain integral, non-removable flow restrictions. Removable, flow restriction inserts are not included as an allowable technology under this methodology.

3. Only retrofit projects are allowable, new construction (Greenfield) projects are not included under this methodology. The baseline is the continued use of existing showerheads and faucets.

4. 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.

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

6. The project proponent shall ensure that the project low-flow devices:

   (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 to baseline devices. For low-flow showerheads equivalent level of service is defined as same functional comfort and cleaning performance;

   (c) Are used to control the flow of heated water;

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

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

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

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

7. The Project Design Document (PDD) shall explain the proposed method of direct installation of low-flow devices. The PDD shall also explain the method for collection, destruction and/or recycling of baseline devices, which shall allow for verification. An example method is collection of baseline devices, 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 device destruction, the destruction can precede verification.

8. At all locations where low-flow devices 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.

9. 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 devices.

Boundary

10. The project boundary is the location of each installed low-flow device and the associated water heating system.

Crediting Period

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

Emission Reductions

12. 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.

13. 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).

[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.M. Demand-side energy efficiency activities for installation of low-flow hot water savings devices (cont)

14. Calculation of Energy Savings and Emission Reductions. Measurements of a statistically valid sample of baseline device and project low-flow device parameters are used to calculate annual energy savings per low-flow device. This value for energy savings per device is multiplied by the emissions factor of the displaced electricity or fossil fuel and by the number of low-flow devices 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 devices 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 device. These equations are used for each type of low-flow device (e.g. showerhead, bathroom faucet, and kitchen faucets).

$$ES_y = \Delta W_y * \Delta T * Cp \quad \textbf{(1)}$$

$$\Delta T = T_{out,measured} - T_{in,measured} \quad \textbf{(2)}$$

$$\Delta W_y = \frac{W_{BL,calculated} - W_{P,measured}}{Days_{monitoring}} * 365 \quad \textbf{(3)}$$

$$W_{BL,calculated} = FR_{BL,measured} * \frac{W_{p,measured}}{FR_{P,measured}} \quad \textbf{(4)}$$

Where:

y	Each year of the crediting period
ES_y	Energy savings in year y (MWh)
ΔW_y	Difference between annual heated water flow through project low-flow device and baseline device (litres per year)
ΔT	Annual average difference in water temperature between water entering the water heating unit used to heat water and the water exiting the low-flow device (^oC)
$T_{out,measured}$	Annual average temperature of water exiting project low-flow device (per paragraph 15) (^oC)
$T_{in,measured}$	Annual average temperature of water entering water heating device (per paragraph 15) (^oC)
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)

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

$W_{BL,calculated}$	Calculated amount of heated water that would flow through the baseline faucet during the number of days equal to $Days_{monitoring}$ (litres)
$W_{P,measured}$	Measured amount of heated water that flows through the project low-flow device (per paragraph 15) during the number of days equal to $Days_{monitoring}$ (litres)
$FR_{BL,measured}$	Measured flow rate of baseline device (per paragraph 15) (litres/minute)
$FR_{P,measured}$	Measured flow rate of low-flow device (per paragraph 15) (litres/minute)

(b) Emission reductions are calculated with equation (5) or (6) for water heated with electricity or for water heated with fossil fuel, respectively. Determination of the number of low-flow devices installed and operating during each year of the crediting period is required per paragraph 16.

$$ER(e)_y = N_y * ES_y * EF_{CO2,ELEC,y} / (1 - l_Y) \quad \textbf{(5)}$$

$$ER(ff)_y = N_y * ES_y * 3{,}600{,}000 \frac{kJ}{MWh} * EF_{CO2,FF} / EFF_{Default} \quad \textbf{(6)}$$

Where:

$ER(e)_y$ 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 devices installed and operating in year *y*
$EF_{CO2,ELEC,y}$	Emission factor in year *y* calculated in accordance with the provisions in AMS-I.D or AMS-I.F (tCO_2/MWh)
$EF_{CO2,FF}$	Emission factor for fossil fuels (tCO_2/kJ)

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II.M. Demand-side energy efficiency activities for installation of low-flow 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 a fixed value of 0.75

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 devices are replaced with project low-flow devices. 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".

Parameter name	**Parameter definition**	**Measurement method**
$FR_{BL,measured}$	Measured flow rate of baseline device (litres/minute)	Measurement, using calibrated instrumentation, of flow rate of installed low-flow device. 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 device (litres/minute)	Measurement, using calibrated instrumentation, of flow rate of eisting (baseline) device to be replaced by project low-flow device. 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

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

Parameter name	Parameter definition	Measurement method
$W_{P,measured}$	Measured amount of water used by project device during the number of days equal to $Days_{monitoring}$ (litres)	Measurement of water flowing through project low-flow device 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 exiting the project low-flow device. 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	There are three options for determining this parameter. No mater which of the methods is used the minimum temperature allowable is 10°C. If a method involving measurements is used then the measurement is to be made using calibrated instrumentation of the temperature of the water entering the water heating system (cold water inlet) and at least three measurements should be taken, for each temperature data point, and average of three measurements is used. The three methods are: (1) Measurement of temperature of cold water during different time periods during the year of project installation to ensure that seasonal and weather factors are included in the temperature data points obtained. Average value for year shall be calculated; (2) Measurement of temperature of cold water during a time period when the water temperature is expected to be at an annual high temperature, such as during a hot season. This data point will be used as the annual value; (3) Use of a scientifically validated study for the temperature of incoming cold water in residential systems in the project activity location
$EF_{CO2,FF}$	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

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

16. In any given year, emission reductions can only be claimed for project low-flow devices 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 devices 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 devices are installed can be used to determine the percentage of systems operating. Such percentage will be used to determine N_y for each type of low-flow device (e.g. showerhead, bathroom faucet, and kitchen faucets). That is N_y equals the number of project low-flow devices, of each type, documented to have been installed in the year of project implementation multiplied by the percentage of project low-flow devices 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 devices with an original project marking can be counted as installed (per paragraph 6 (e)). While project low-flow devices replaced as part of a regular maintenance or warranty program can be counted as operating, project low-flow devices 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 project low-flow devices distributed under the project activity, identified by the manufacturer and model number and the date of supply;

(b) The number of replaced devices; 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.M. Demand-side energy efficiency activities for installation of low-flow 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 62, Annex # 15 July 2011	To be considered at EB 62.
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