

**AM0086**

## Large-scale Methodology

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# Distribution of zero energy water purification systems for safe drinking water

Version 03.0

Sectoral scope(s): 03



**United Nations**  
Framework Convention on  
Climate Change

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## 1. Introduction

1. The following table describes the key elements of the methodology:

**Table 1. Methodology key elements**

<b>Typical projects</b>	Zero-energy water purification systems are distributed to consumers to provide safe drinking water
<b>Type of GHG emissions mitigation action</b>	Energy efficiency. Displacement of more GHG intensive technologies to provide safe drinking water

## 2. Scope, applicability, and entry into force

### 2.1. Scope

2. This methodology is applicable to project activities that distribute zero-energy (i.e. without input of thermal or electrical energy) water purification systems to provide safe drinking water (SDW), including point-of-use treatment systems for residential or institutional applications such as systems installed at a water kiosk, a school or a community centre. The examples include, but are not limited to water filters (e.g. membrane, activated carbon, ceramic filters), solar energy powered ultraviolet disinfection devices, solar disinfection techniques, photocatalytic disinfection equipment, pasteurization appliances, chemical disinfection methods (e.g. chlorination), combined treatment approaches (e.g. flocculation plus disinfection).
3. The project participants either: (a) purchase the zero energy water purification systems from a manufacturer and only arrange for their sale or distribution in the host country; or (b) both manufacture and sell or distribute the zero energy water purification systems. The consumers of the water purification systems distributed or sold under the project activity are not the project participants.
4. A project activity implementation plan which specifies how the project is implemented should be established and documented in the CDM-PDD, including, inter alia, information on:
  - (a) The type of water purification systems that are distributed or sold by the project participants, including information on the manufacturer, any label, the life span, technology, capacity, etc.;
  - (b) The total number of water purification systems by type that are planned to be distributed by the project activity over each year of the first crediting period;
  - (c) Conditions under which users are eligible to participate in the project activity (e.g. households with a certain income, etc.);
  - (d) How the water purification systems will be distributed or sold to consumers.

## 2.2. Applicability

5. The methodology is applicable under the following conditions:
- (a) Prior to the implementation of the project activity, no public distribution network supplying SDW exists within the project boundary. If during the crediting period SDW is made available through a public distribution network, the emission reductions pertaining to the households/institutions supplied by the public system cannot be claimed from that point onwards. This condition should be checked annually during the crediting period;
  - (b) It shall be demonstrated based on laboratory testing or official notifications (for example notifications from the national authority on health) that the application of the project technology/equipment achieves compliance with either: (i) any of the performance targets as per World Health Organisation (WHO) specifications,<sup>1</sup> or (ii) an applicable national standard or guideline;
  - (c) Emission reductions pertaining to the use of a replacement water purification system can be claimed only if there are documented measures in place by the project proponent to ensure that end users have access to replacement purification systems of comparable quality;
  - (d) Only for water purifiers sold or distributed within the first crediting period are eligible for claiming emissions reductions;
  - (e) The project participants shall implement a management system to coordinate the distribution and to ensure the installation of the zero energy water purification systems to the consumers. A contractual agreement with manufacturers, intermediary distributors and consumers and unique project identification of the systems shall ensure that there is no double counting of emission reductions.
6. In addition, the applicability conditions included in the tools referred to apply.

## 2.3. Entry into force

7. The date of entry into force of the revision is the date of the publication of the EB 76 meeting report on 8 November 2013.

## 3. Normative references

8. This baseline and monitoring methodology is based on the following approved baseline and monitoring methodologies and proposed new methodologies:
- (a) "NM0280: Installation of zero energy water purifier in India" prepared by Hindustan Unilever Limited & their Associate Consultants;
  - (b) "AM0046: Distribution of efficient light bulbs to households" prepared by Perspectives Climate Change GmbH, Hamburg, Germany;

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<sup>1</sup> "Evaluating household water treatment options: Health based targets and microbiological performance specifications", WHO, 2011  
<[http://www.who.int/water\\_sanitation\\_health/publications/2011/evaluating\\_water\\_treatment.pdf](http://www.who.int/water_sanitation_health/publications/2011/evaluating_water_treatment.pdf)>.

- (c) “AMS-III.AV: Low greenhouse gas emitting safe drinking water production systems”.

9. This methodology also refers to the latest approved versions of the following tools:

- (a) “Tool to calculate the emission factor for an electricity system”;
- (b) Methodological tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”.

10. For more information regarding the proposed new methodologies and the tools as well as their consideration by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) please refer to <<http://cdm.unfccc.int/goto/MPappmeth>>.

### 3.1. Selected approach from paragraph 48 of the CDM modalities and procedures

11. “Existing actual or historical emissions, as applicable”.

## 4. Definitions

12. The definitions contained in the Glossary of CDM terms shall apply.

13. For the purpose of this methodology, the following definitions apply:

- (a) **Safe drinking water (SDW)** - water that conforms to drinking water quality specified in relevant national microbiological quality standards of the host country. In case a national standard is not available, the water shall comply with the performance target as per “Evaluating household water treatment options: Health based targets and microbiological performance specifications”;<sup>1</sup>
- (b) **Improved drinking-water source, urban area and rural area** - are defined in accordance with the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation.<sup>2</sup>

## 5. Baseline methodology

### 5.1. Project boundary

- 14. The spatial extent of the project boundary encompasses the physical, geographical location of each zero energy water purification system installed under the project activity.
- 15. The greenhouse gases included in or excluded from the project boundary are shown in Table 2.

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<sup>2</sup> <<http://www.wssinfo.org/>>.

**Table 2. Emission sources included in or excluded from the project boundary**

Source		Gas	Included	Justification/Explanation
<b>Baseline</b>	Emissions from electricity/fossil fuels utilized for obtaining safe drinking water displaced due to project activity	CO <sub>2</sub>	Yes	Major source of emissions
		CH <sub>4</sub>	No	Minor source of emissions
		N <sub>2</sub> O	No	Minor source of emissions
<b>Project activity</b>	Emissions from operating project water purification systems	CO <sub>2</sub>	No	No thermal or electrical energy is required.
		CH <sub>4</sub>	No	No thermal or electrical energy is required
		N <sub>2</sub> O	No	No thermal or electrical energy is required

## 5.2. Identification of the baseline scenario and demonstration of additionality

16. The project activity is considered additional if:

- (a) Within the project boundary, there is no public distribution network supplying SDW; and
- (b) Within the project boundary, the proportion of the population using improved drinking-water sources is equal to or less than 60 per cent; and
- (c) Within the project boundary, the fraction of population served by point-of-use zero-energy water purification technologies is less than 50 per cent before the implementation of the project activity.

17. To demonstrate that the proportion of the population using improved drinking-water sources is equal to or less than 60 per cent, the project boundary shall be divided into urban areas and rural areas, as defined by JMP, and for each area one of the following data sources shall be used:

- (a) Proportion of populations using an improved drinking-water source is less than 60 per cent, based on the most recent year for which data is available from JMP;<sup>3</sup> in this case, the country-level proportion for urban and rural areas may be used for all project urban and rural areas, respectively;
- (b) Official data such as publicly available statistical data from a government agency or an independently commissioned study by an international organization or a university;
- (c) Survey methods, implemented by the project proponent, following the “Standard for sampling and surveys for CDM project activities and programme of activities”, surveying the proportion of the population using improved drinking-water sources in the project boundary.

<sup>3</sup> <<http://www.wssinfo.org/data-estimates/table/>>.

18. It is assumed that electricity, fossil fuel or biomass is used to boil water as means of water purification in the absence of the project activity.

### 5.3. Baseline emissions

19. The baseline emissions are calculated based on the energy demand for boiling water, multiplied by the weighted emission factor of the baseline energy source mix. Only purified water consumed for drinking and/or cooking purposes can be used in the baseline calculation.
20. The baseline emissions shall be calculated as follows:

$$BE_y = f_{PS} \times QPW_y \times SEC \times EF_{SDW} \times 10^{-9} \quad \text{Equation (1)}$$

Where:

$BE_y$	=	Baseline emissions during the year $y$ in (t CO <sub>2</sub> e)
$f_{PS}$	=	Factor accounting for the fraction of population served by point-of-use zero-energy water purification technologies in the absence of the project activity (fraction)
$QPW_y$	=	Quantity of purified water consumed for drinking and/or cooking in year $y$ (L)
$SEC$	=	357.48, specific energy consumption required to boil one litre of water <sup>4</sup> (kJ/L)
$EF_{SDW}$	=	Emission factor associated with the baseline water purification technologies (t CO <sub>2</sub> /TJ)

21. The quantity of water purified shall be calculated as follows:

$$QPW_y = \min(QPW_{M,y}, (n_y \times P \times (1 - PFR_y) \times \min(QPW_{PP}, 5.5))) \quad \text{Equation (2)}$$

Where:

$QPW_y$	=	Quantity of purified water consumed for drinking and/or cooking in year $y$ (L)
$QPW_{M,y}$	=	Monitored quantity of purified water consumed for drinking and/or cooking in year $y$ (L)
$n_y$	=	Number of project water purification systems distributed by year $y$
$P$	=	Population serviced by one project water purification system

<sup>4</sup> Specific energy consumption required to boil one litre of water is to be calculated as follows: Heating water with specific heat of 4.186 kJ/L°C from assumed initial temperature of 20°C to 100°C, boiling point at standard conditions. Also, the latent heat required to boil one litre of water for five minutes is assumed to be equivalent to latent heat for the evaporation (2260kJ/L) of 1 per cent of the water volume. WHO recommends a minimum duration of five minutes of water boiling, according to WHO guidelines for Emergency Treatment of drinking water at point of the use. See <[http://www.searo.who.int/LinkFiles/List\\_of\\_Guidelines\\_for\\_Health\\_Emergency\\_Emergency\\_treatment\\_of\\_drinking\\_water.pdf](http://www.searo.who.int/LinkFiles/List_of_Guidelines_for_Health_Emergency_Emergency_treatment_of_drinking_water.pdf)>.

$QPW_{PP}$	=	Average volume of drinking water per person per day (L)
5.5	=	Cap of water use per person per day <sup>5</sup> (L)
$PFR_y$	=	Failure rate of the project water purification systems in year $y$ (fraction)

22. The factor for accounting for the fraction of population served, prior to the implementation of the project activity, by point-of-use zero-energy water purification technologies shall be determined as follows:

$$f_{PS} = \begin{cases} 1, & PS < 0.2 \\ \frac{0.5 - PS}{0.3}, & 0.5 > PS \geq 0.2 \\ 0, & PS \geq 0.5 \end{cases} \quad \text{Equation (3)}$$

Where:

$f_{PS}$	=	Factor accounting for the fraction of population served by point-of-use zero-energy water purification technologies in the absence of the project activity (fraction)
$PS$	=	Fraction of population served by point-of-use zero-energy water purification technologies prior to the implementation of the project activity (fraction)

23. The SDW emission factor shall be calculated as follows:

$$EF_{SDW} = \sum_i f_{FF,i} \times EF_{FF,i} / \eta_{WB,i} \quad \text{Equation (4)}$$

Where:

$EF_{SDW}$	=	Emission factor associated with the baseline water purification (t CO <sub>2</sub> /TJ)
$f_{FF,i}$	=	Fraction of population which would use electricity or fossil fuel type $i$ to boil water, prior to the implementation the project activity
$EF_{FF,i}$	=	Emission factor of electricity or fossil fuel type $i$ (t CO <sub>2</sub> /TJ). Where the fraction $f_{FF,i}$ refers to grid electricity, the respective $EF_{FF,i}$ shall be determined according to the "Tool to calculate the emission factor for an electricity system", and converted to t CO <sub>2</sub> /TJ
$\eta_{WB,i}$	=	Efficiency of the baseline water boiling system using fuel type $i$ (fraction)

<sup>5</sup> Based on WHO recommendations (Domestic Water Quantity, Service Level and Health, Table 2: Volumes of water required for hydration, WHO 2003).



24. The survey for determining  $f_{FF,i}$  shall be conducted in a manner which represents various socio-economic conditions in the project boundary. For instance, if the project provides service for both urban and rural households, the sampling shall be designed to be representative of the part of the urban and rural households. Additionally, if a household is using several fuels, the consumption of each fuel type shall be counted separately.
25. Furthermore, the population served by point-of-use zero-energy water purification technologies shall be excluded when establishing the fossil fuel fractions, as it is already accounted for when calculating  $f_{PS}$ .

#### **5.4. Project emissions**

26. Project emissions ( $PE_y$ ) are assumed to be zero, because it is required that no thermal or electrical energy is used for the operation of the project water purification systems.

#### **5.5. Leakage**

27. No leakage is considered.

#### **5.6. Emission reductions**

28. As project emissions and leakage are zero, emission reductions equal the baseline emissions.

#### **5.7. Generic instructions for conducting sampling**

29. The “Standard for sampling and surveys for CDM project activities and programme of activities” shall be followed while conducting the sampling.
30. A project database shall be established containing all relevant information for estimating baseline emissions and for sampling the project water purification systems, including, inter alia:
  - (a) Details of each user of the water purification systems (name, address, contact details);
  - (b) Model and serial number of the water purification device;
  - (c) Life span of the water purification device;
  - (d) Date of installation/distribution of the water purification device;
  - (e) Dates of expiration, replacement or drop-out of the device if such events occur;
  - (f) If applicable, dates of distribution and/or changes of filters;
  - (g) Checks of operational status.

#### **5.8. Changes required for methodology implementation in 2<sup>nd</sup> and 3<sup>rd</sup> crediting periods**

31. Consistent with guidance by the Board, project participants shall use the latest version of the methodological tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period”.

## 5.9. Data and parameters not monitored

32. In addition to the parameters listed in the tables below, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

**Data / Parameter table 1.**

<b>Data / Parameter:</b>	<b>PS</b>
Data unit:	fraction
Description:	The fraction of population served by point-of-use zero-energy water purification technologies prior to the implementation of the project activity
Source of data:	Sample survey of the population in the project boundary, before the implementation of the project
Measurement procedures (if any):	The market share shall include all point-of-use water zero-energy purification technologies systems which reliably supply SDW
Any comment:	-

**Data / Parameter table 2.**

<b>Data / Parameter:</b>	<b>P</b>
Data unit:	number
Description:	Population serviced by one project water purification system
Source of data:	Estimated using surveys
Measurement procedures (if any):	For water purifiers distributed to households, the survey would determine the average size of households targeted by the project activity. If the water purifiers are distributed to water kiosks, community centres etc., which do not allow clear ex ante identification the population serviced, the parameter has to be monitored during the project activity
Any comment:	-

**Data / Parameter table 3.**

<b>Data / Parameter:</b>	<b>QPW<sub>PP</sub></b>
Data unit:	L
Description:	Average volume of drinking water per person per day
Source of data:	Estimated using surveys, official data, peer reviewed literature or local expert opinion
Measurement procedures (if any):	-
Any comment:	-

**Data / Parameter table 4.**

<b>Data / Parameter:</b>	$f_{FF,i}$
Data unit:	fraction
Description:	Fraction of population which would use electricity or fuel type $i$ to boil water, prior to the project activity
Source of data:	Sample survey of the population in the project boundary, before the implementation of the project
Measurement procedures (if any):	-
Any comment:	-

**Data / Parameter table 5.**

<b>Data / Parameter:</b>	$EF_{FF,i}$
Data unit:	t CO <sub>2</sub> /TJ
Description:	Emission factor of fuel type $i$
Source of data:	Regional or national default values, or IPCC default values at the upper limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. Where the fraction $f_{FF,i}$ refers to grid electricity, the respective $EF_{FF,i}$ shall be determined according to the “Tool to calculate the emission factor for an electricity system”, and converted to t CO <sub>2</sub> /TJ
Measurement procedures (if any):	-
Any comment:	-

**Data / Parameter table 6.**

<b>Data / Parameter:</b>	$\eta_{WB,i}$
Data unit:	fraction
Description:	Efficiency of the baseline water boiling system using fuel type $i$
Source of data:	-
Measurement procedures (if any):	Efficiency of the water boiling systems being replaced shall be determined using one of the following options, use average weighted values if more than one type of systems are encountered: (a) The efficiency of the water boiling system shall be established using representative sampling methods or based on referenced literature values; (b) 0.5 default value may be used if the replaced system or the system that would have been used is a fossil fuel combusting system; (d) 1.0 default value may be used if the replaced system or the system that would have been used is an electric heating system
Any comment:	-

**Data / Parameter table 7.**

<b>Data / Parameter:</b>	<b><math>EF_{FF,i}</math></b>
Data unit:	t CO <sub>2</sub> /TJ
Description:	Emission factor of fuel type <i>i</i>
Source of data:	Regional or national default values, or IPCC default values at the upper limit of the uncertainty at a 95 per cent confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. Where the fraction $f_{FF,i}$ refers to grid electricity, the respective $EF_{FF,i}$ shall be determined according to the “Tool to calculate the emission factor for an electricity system”, and converted to t CO <sub>2</sub> /TJ
Measurement procedures (if any):	-
Any comment:	-

## 6. Monitoring methodology

33. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. All measurements should be conducted with calibrated measurement equipment according to relevant industry standards.
34. Furthermore, all parameters required by tools referred to by this methodology shall be monitored.

### 6.1. Data and parameters monitored

**Data / Parameter table 8.**

<b>Data / Parameter:</b>	<b><math>QPW_{M,y}</math></b>
Data unit:	L
Description:	Monitored quantity of purified water consumed for drinking and/or cooking in year <i>y</i>
Source of data:	-

Measurement procedures (if any):	<p>The monitored quantity of water purified shall be monitored directly for all systems or a sample of the systems. This could be inter alia:</p> <ul style="list-style-type: none"> <li>(a) Integrated flow meters;</li> <li>(b) Count of cleaning kits replacements and a cleaning kit's capacity;</li> <li>(c) Count of purification cycles and the volume of each cycle;</li> <li>(d) Capacity of the equipment established by manufacturers' specifications.</li> </ul> <p>The precise measurement procedure depends on the information available for the specific purification system used by the project activity. The most precise method available shall be used, for instance when integrated flow meters exist, they should be used, and not manufacturer's specifications.</p> <p>The failure rate of the project water purification systems shall be taken into consideration, if the monitoring procedure does not account for failed systems. For example, if all systems are monitored, the quantity of purified water is derived directly, whereas if only a sample of the functional systems is taken, it has to be multiplied with <math>PFR_y</math>.</p>
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 9.

<b>Data / Parameter:</b>	<b><math>PFR_y</math></b>
Data unit:	Fraction
Description:	Failure rate of the project water purification systems in year $y$
Source of data:	Directly monitored or survey
Measurement procedures (if any):	-
Monitoring frequency:	At least annually
QA/QC procedures:	-
Any comment:	Replacement water purification system can be claimed to be operating only if there are documented measures in place by the project proponent to ensure that end users have access to replacement purification systems of comparable quality

Data / Parameter table 10.

<b>Data / Parameter:</b>	<b><math>n_y</math></b>
Data unit:	-
Description:	Number of project water purification systems distributed by year $y$
Source of data:	Latest project database
Measurement procedures (if any):	-
Monitoring frequency:	At least annually
QA/QC procedures:	-
Any comment:	-

**Data / Parameter table 11.**

<b>Data / Parameter:</b>	<b>Check for public distribution system providing SDW</b>
Data unit:	(Dimensionless)
Description:	-
Source of data:	-
Measurement procedures (if any):	-
Monitoring frequency:	Annual
QA/QC procedures:	-
Any comment:	The project participants should determine whether new public distribution system has been introduced within the project boundary and whether SDW is made available through the public distribution network. In case the SDW is made available through the public distribution network, no claim for emission reduction can be claimed for the households/buildings/institutions supplied by the public system

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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	8 November 2013	EB 76, Annex 6 Revision to: <ul style="list-style-type: none"> <li>Introduce standardized approaches to demonstrate additionality and to quantify emission reduction from the use of water purification systems;</li> <li>Change the title from “AM0086: Installation of zero energy water purifier for safe drinking water application” to “AM0086: Distribution of zero energy water purification systems for safe drinking water”.</li> </ul>
02.0.0	23 November 2012	EB 70, Annex 18 Revision to delete the restriction to one single crediting period and provide guidance with regard to the renewal of the crediting period.
01.1.0	26 November 2010	EB 58, Annex 5 Revision to improve the clarity and correct the units of several parameters.
01	26 March 2010	EB 53, Annex 5 Initial adoption
Decision Class: Regulatory Document Type: Standard Business Function: Methodology Keywords: residential consumer, water		