JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	The Kingdom of Cambodia
Name of the methodology proponents submitting this form	Tokyo Carbon Management Ltd (TCM)
Sectoral scope(s) to which the Proposed Methodology applies	3. Energy demand
Title of the proposed methodology, and version number	Energy Saving by Introduction of Low Greenhouse gas-emitting safe drinking water production systems, version 01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☒Additional information:
Date of completion	23/02/2024

History of the proposed methodology

Version	Date	Contents revised
01.0	31/07/2023	First edition

A. Title of the methodology

Energy Saving by Introduction Low Greenhouse gas-emitting safe drinking water production systems, version 01.0

B. Terms and definitions

Terms	Definitions
Point of Use (POU)	Devices treat only the water intended for direct consumption, typically at a single tap or limited number of taps
Point of Entry (POE)	Devices are typically installed to treat all water entering a single home, business, school, or facility (USEPA, 2006)
Distribution network	It is a public service which is provided by government to people living within its jurisdiction, either directly or through an authorized party
Water kiosk	It is a facility to treat water to be delivered or sold to final consumers in appropriate conditions of sealed storage and/or residual capacity of disinfection, in such a way as to prevent recontamination before the final consumption as drinking water

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	The intention of the project activity involves the installation of low greenhouse gas emitting safe drinking water purifiers (SDWPs) to provide clean drinking water to the households/communities/ schools/institutions (hereafter "users"). For this reason, project activity aims at reducing the wood fuel consumption of traditional stove users by distributing water purifiers to households and/or schools and/or institutions.
Calculation of reference emissions	The reference emission is calculated for each project water purifier by using the following parameters: ・ Total quantity of water purified by the project ・ Fraction of functional appliances that are providing the safe

	drinking water ・ Fraction of the population served by the project activity for which the common practice of water treatment is or would have been water boiling ・ Specific energy consumption required to boil one litre of water ・ Proportions of reference fuel (NRB and/or fossil fuels) used in the absence of the project activity ・ Fraction of non-renewable fuel used in the absence of the project activity ・ Emission factor of the fuel substituted
Calculation of project emission	The project emission is calculated for each project water purifier by using the following parameters: ・ Emissions from fossil fuel combustion ・ Emissions from electricity consumption
Monitoring parameters	・ Number of population who consumes the purified water serviced by the project activity ・ Quantity of purified water ・ Fraction of functional appliances that are providing the safe drinking water ・ Usage time ・ Check for SDW public distribution network ・ Quality of safe drinking water ・ Date of commissioning of the project device

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	This methodology comprises introduction of low greenhouse gas emitting water purification systems to provide safe drinking water (SDW). Water purification technologies that involve point-of use (POU) or point-of-entry (POE) treatment systems for residential or institutional applications such as systems installed at a school or a community centre, institutions are included. The examples include, but are not limited to, water filters (e.g. membrane, activated carbon, ceramic filters), solar energy powered ultraviolet (UV) disinfection devices, solar disinfection techniques, photocatalytic disinfection equipment, pasteurization appliances, chemical disinfection methods (e.g. chlorination), combined treatment approaches

	(e.g. flocculation plus disinfection). The methodology is also applicable to water kiosks that treat water using one or more of the following technologies: chlorination, combined flocculant/disinfection powders and solar disinfection.[1] In case the water kiosk is using solar disinfection, project proponents need to implement measures to prevent recontamination (e.g. disinfecting containers, sealing containers and hygiene training);
Criterion 2	Soil filtration schemes (boreholes, wells) that include container disinfection (e.g. chlorination) may be applied. Project proponents demonstrate ex ante that rehabilitation and/or construction of the wells complies with relevant national and/or international standards and that measures are taken to ensure that water and well are not contaminated;
Criterion 3	Prior to the implementation of the project activity, a public distribution network supplying SDW to the project boundary does not exist;
Criterion 4	It is 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 either with: (i) the Comprehensive Protection performance target as per "Evaluating household water treatment options: Health based targets and microbiological performance specifications" (WHO, 2011) and "International Scheme to Evaluate Household Water Treatment Technologies" (WHO, 2014); or (ii) an applicable national standard or guideline. Applicable national standard should be based on laboratory efficacy testing that, at a minimum, includes quantitative microbial measures of pre- and post-treatment challenge waters that are representative of potential drinking water sources, and that includes measured reductions based on at least one pathogen class (bacteria, viruses, protozoa);
Criterion 5	In cases where the life span of the water treatment technologies of the project activity is shorter than the period mentioned in the Bilateral Document, documented measures are in place to ensure that end users have access to replacement purification systems of comparable quality;
Criterion 6	It should be demonstrated that the project appliances use technologies that meet the technology standards and that they deliver microbiologically safe

[1] According to "A toolkit for monitoring and evaluating household water treatment and safe storage programmes" (WHO – 2012) – Annex A - Summary of HWTS methods, the use of these technologies can provide protection against recontamination.

	drinking water;
Criterion 7	It should be demonstrated that the proposed method for distribution of project devices including the method to avoid double counting of emission; reductions such as unique identifications of product and end-user locations (e.g. programme logo);
Criterion 8	It should be demonstrated that the proposed procedures prevent double counting of emission reductions, for example to avoid that project stove manufacturers, wholesale providers or others claim credit for emission reductions from the project devices.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Fossil fuel and/or non-renewable biomass (NRB) consumption for boiling water	CO_2
	NO_2
	CH_4
Project emissions	
Emission sources	GHG types
Fossil fuel combustion and electricity consumption for boiling water	CO_2
	NO_2
	CH_4

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

The reference emissions are calculated for each reference water purifier by multiplying the quantity of purified water, the fraction of functional appliances providing the safe drinking water, fraction of the population served by the project activity which the common practice of water treatment is/would have been water boiling, specific energy consumption required to boil one litre of water, proportion of fuel type used in the absence of the project activity, fraction of non-renewable fuel in the absence of the project activity, and emission factor of fuel substituted. It is assumed that in the absence of project activity, the reference scenario is the continued use of fossil fuel and/or non-renewable biomass (NRB) to boil drinking water as means of water

purification. Since the efficiency of the water boiling systems being replaced are inversely proportional to the amount of reference emissions. Thus, the efficiency of the reference water boiling systems is conservatively set as a default value in the following manner to ensure the net emission reductions.

1. 0.10 default value may be optionally used if the replaced system or the system that would have been used is a three-stone fire or a conventional system for woody biomass lacking improved combustion air supply mechanism and flue gas ventilation system that is without a grate as well as a chimney; for the rest of the systems using woody biomass 0.2 default value may be optionally used.
2. 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
3. The efficiency of the water boiling system will use weighted average values if more than one type of system is encountered.

F.2. Calculation of reference emissions

$$RE_p = 0.95 * QPW_p \times m \times X_{boil} \times SEC \times \sum_i BL_{fuel,i} \times f_i \times EF_{projected\ fossil\ fuel,i} \times 10^{-9}$$ **Equation (1)**

Where:

RE_p = Reference emissions during the period *p* (tCO_2e/p)

QPW_p = Total quantity of water purified by the project in the period *p* (L/p), calculated based on the following option:

Option 1: Directly monitored

Option 2: Indirectly monitored following the procedures described in Option below:

Option 2.1:

$$QPW_p = \sum q_{,i} \times t$$ **Equation (2)**

Where:

- q_i: Capacity of the water purification device (L/hour) provided by the manufacturer
- t_p: Usage time during the period *p* (hours/p)

Option 2.2:

$$QPW_p = P_p \times \min(QWP_{pp}; 5.5) \times D_p \quad \textbf{Equation (3)}$$

Where:

- P_p: Population who consumes the purified water serviced by the project activity in the period p
- QPW_{pp}: Average volume of drinking water per person per day (L/person/day) determined at the time of validation through a survey
- D_p: Number of operating days during the period p

$\boldsymbol{m}$ = Fraction of functional appliances that are providing the SDW. Only project appliances that (i) use technologies that meet the technology standards and (ii) are operating or replaced by an equivalent in service appliance and (iii) deliver microbiologically safe drinking water, are counted for emission reductions

$\boldsymbol{X_{boil}}$ = Fraction of the population served by the project activity for which the common practice of water treatment is or would have been water boiling. It is determined ex ante through surveys

$\boldsymbol{SEC}$ = Specific energy consumption required to boil one litre of water (kJ/L), to be calculated according equation below:

$$SEC = [WH \times (T_f - T_i) + 0.01 \times WHE]/\eta_{wb} \quad \textbf{Equation (4)}$$

Where:

- WH: Specific heat of water (kJ/L ºC). Use a default value of 4.186 kJ/L ºC
- T_f: Final temperature (ºC). Use a default value of 100 °C
- T_i: Initial temperature of water (°C). Use annual average ambient temperature; or use a default value of 20°C
- WHE: Latent heat of water evaporation (kJ/L). Use a default value of 2260 kJ/L. The latent heat required to boil one litre of water for five minutes is assumed to be equivalent to latent heat for the evaporation of 1% of the water volume (WHO recommends a minimum duration of

		five minutes of water boiling) - $\eta_{wb:}$ Efficiency of the water boiling systems being replaced, estimated ex ante.
$\boldsymbol{BL_{fuel,i}}$	=	Proportions of reference fuel type *i* (NRB and/or fossil fuels) used in the absence of the project activity (fraction)
$\boldsymbol{f_i}$	=	Fraction of non-renewable fuel type *i* used in the absence of the project activity in the period *p*. For biomass, it is the fraction of woody biomass that can be established as non-renewable biomass (f_{NRB}). If the reference fuel is fossil fuel, the value to be applied is 1.
$\boldsymbol{EF_{projected\ fossil\ fuel,i}}$	=	Emission factor of the fuel type i substituted (tCO_2e/TJ)
0.95	=	Discount factor to account for potential use of biomass by non- project households/communities

G. Calculation of project emissions

If the operation of the project water purification system involves consumption of fossil fuels and/or electricity, CO_2 emissions from on-site consumption of fossil fuels and electricity due to the project activity will be accounted for as project emissions.

$$\boldsymbol{PE_p = PE_{FF,p} + PE_{EC,p}} \qquad \textbf{Equation (5)}$$

Where:

$\boldsymbol{PE_p}$ = Project emissions during the period *p* (tCO_2e/p)

$\boldsymbol{PE_{FF,p}}$ = Emissions from fossil fuel combustion. CO_2 emissions from fossil fuel combustion in process are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels

$$\boldsymbol{PE_{FF,p} = \sum_i FC_{i,p} \times COEF_i} \qquad \textbf{Equation (6)}$$

- $\boldsymbol{FC_{i,p}}$**:** the quantity of fuel type *i* combusted during the period *p* (mass or volume unit/p)
- $\boldsymbol{COEF_i}$: the CO_2 emission coefficient of fuel type *i* (tCO_2/mass or volume unit)
- ***i***: the fuel types combusted in process during the period *p*

$PE_{EC,p}$ = Emissions from electricity consumption

$$PE_{EC,p} = \sum_j EC_{PJ,j,p} \times EF_{EF,j} \times (1 + TDL_j) \quad \textbf{Equation (7)}$$

- $EC_{PJ,j,p}$: Quantity of electricity consumed by the project electricity consumption source *j* in the period *p* (MWh/p)
- $EF_{EF,j}$: Emission factor for electricity generation for source *j* (tCO_2/MWh)
- TDL_j: Average technical transmission and distribution losses for providing electricity to source *j*
- ***j***: Sources of electricity consumption in the project during the period *p*

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p \quad \textbf{Equation (8)}$$

Where:

ER_p = Emission reductions in the period *p* (tCO_2e/p)

RE_p = Reference emissions in the period *p* (tCO_2e/p)

PE_p = Project emissions in the period *p* (tCO_2e/p)

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
QPW_{pp}	Average volume of drinking water per person per day	Estimated through ex ante survey or official data, or peer reviewed literature or local expert opinion. Alternatively, a default value of 3 litres per person per day[2] can be used. The maximum value of 5.5 litres per person per day are not to be exceeded
LS	Life span of water treatment technologies	Manufacturer's specifications. In cases where the life span of the water treatment technologies of the project activity is shorter than the period mentioned in the

[2] Based on WHO recommendations (Technical Notes on Drinking Water, Sanitation and Hygiene in Emergencies. Table 9.1: Simplified table of water requirements for survival (per person).

		Bilateral Document, documented measures are in place to ensure that end users have access to replacement purification systems of comparable quality
η_{wb}	Efficiency of the water boiling systems being replaced	Use one of the options below: (a) The efficiency of the water boiling system shall be established using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of system is encountered; (b) 0.10 default value may be optionally used if the replaced system or the system that would have been used is a three-stone fire or a conventional system for woody biomass lacking improved combustion air supply mechanism and flue gas ventilation system that is without a grate as well as a chimney; for the rest of the systems using woody biomass 0.2 default value may be optionally used; (c) 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
$BL_{fuel,i}$	Proportions of reference fuel type *i* (NRB and fossil fuel)	Estimated ex ante through a survey or official data or peer reviewed literature or local expert opinion
f_i	Fraction of non-renewable fuel type *i*	If the reference fuel is fossil fuel use a default value of 1.0 Other case, the parameter is calculated by third party or based on national data
$EF_{projected\ fossil\ fuel,i}$	Emission factor of the fuel(s) type *i* substituted	If the fuel displaced is NRB, this parameter can be sourced from table below: Emission factor of fossil fuels projected to substitute non-renewable woody

		biomass by similar consumers (tCO2e/TJ) Middle East and North Africa: 63.9 East Asia and the Pacific: 85.7 Europe and Central Asia: 57.8 Latin America and the Caribbean: 68.6 South Asia: 64.4 Sub-Saharan Africa: 73.2
X_{boil}	Fraction of the population serviced by the project activity for which the common practice of water purification is or would have been water boiling	Established ex ante through survey
q_i	Capacity of the water purification device	Manufacturer's specification
0.95	Discount factor to account for potential use of biomass by non-project households/communities	Based on page 09 of UNFCCC approved methodology AMS-III.AV version 08.0
$COEF_i$	the CO_2 emission coefficient of fuel type *i*	The parameter is calculated using the latest version of the "CDM tool 03: Tool to calculate project or leakage CO_2 emission from fossil fuel combustion"
TDL_j	Average technical transmission and distribution losses for providing electricity to source *j*	Applied the latest version of the "CDM Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", choose one value of the following case: - In case of electricity consumption from off-grid captive power plants, assume

		TDL_j = 0 as a simplification - In case of electricity consumption from the grid or both the grid and captive power plant(s), use as default values of 20%
$EF_{EF,j}$	Emission factor for electricity generation for source *j*	The most recent value available at the time of validation is applied and fixed for the monitoring period thereafter. The data is sourced from "Grid Emission Factor of Cambodia"
WH	Specific heat of water. Use a default value of 4.186 kJ/L°C	Applied the CDM Methodology AMS-III.AV
T_f	Final temperature. Use a default value of 100°C	Boiling point of water at standard conditions
T_i	Initial temperature of water. Use a default value of 20°C	Ambient temperature data must be from globally accepted data sources, for example data published by the National Aeronautics and Space Administration (NASA) or the National Renewable Energy Laboratory (NREL). Data can be used only if they are for a location that can be demonstrated to be representative of the project location
WHE	Latent heat of water evaporation	Use a default value. The latent heat required to boil one litre of water for five minutes is assumed to be equivalent to latent heat for the evaporation of 1% of the water volume (WHO recommends a minimum duration of five minutes of water boiling)