



**Monitoring report form for CDM programme of activities
(Version 04.0)**

MONITORING REPORT		
Title of the PoA	International Water Purification Programme	
UNFCCC reference number of the PoA	5962	
Version numbers of the PoA-DD applicable to this monitoring report	07	
Version number of this monitoring report	01	
Completion date of this monitoring report	21/05/2021	
Monitoring period number	6 th monitoring period	
Duration of this monitoring period	01/01/2019 – 31/12/2020	
Monitoring report number for this monitoring period	01	
Coordinating/managing entity	Pure Water Ltd.	
Host Parties	Host Party of the PoA	Is this the host Party of a CPA covered in this monitoring report? (yes/no)
	Cambodia	Yes
	Chile	No
	Egypt	No
	El Salvador	No
	Ethiopia	No
	Gambia	No
	Iran	No
	Kenya	No
	Madagascar	No
	Malawi	No
	Mexico	No
	Nicaragua	No
	South Africa	No
	Uganda	No
	Vietnam	No
Applied methodologies and standardized baselines	AMS-III.AV. “Low greenhouse gas emitting safe drinking water production systems” (EB69, version 03)	
Sectoral scopes	Sectoral scope 3: Energy demand	

Amount of GHG emission reductions or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	0	36,185	0
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report	32,608		

PART I Monitoring of programme of activities (PoA)

SECTION A. Description of PoA

A.1. General description of PoA

This PoA seeks to further the access of households and communities to clean and safe drinking water, by promoting low greenhouse gas emitting water purification technologies. This PoA is thus primarily designed for the long-term improvement of the living conditions of local people. The targeted users of such technologies will be households and/or communities. Examples of technologies include, but are not limited to, water filters (e.g. membrane, activated carbon, ceramic filters), solar technologies (Ultra violet disinfection devices, solar water disinfection SODIS), photocatalytic disinfection equipment, pasteurization appliances, chemical disinfection methods (e.g. chlorination), combined treatment approaches (e.g. Flocculation plus disinfection), etc.

The PoA reduces the use and demand for fossil fuels and non-renewable biomass that would have been used to boil water as a mean of water purification in the absence of the Programme of Activities. This directly leads to reduced greenhouse gas emissions.

A.1.1. Corresponding generic component project activities (CPAs)

Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Sectoral scopes	Applied methodologies and standardized baselines
International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	07	3	AMS-III.AV. "Low greenhouse gas emitting safe drinking water production systems" (EB69, version 03) This methodology refers to the following methodology and tools: <ul style="list-style-type: none"> AMS-I.E. Switch from Non-Renewable biomass for thermal applications by the user (version 05)¹ Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion (version 02)² Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)³

A.1.2. CPAs included in the PoA

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Title: Gravity Driven Membrane Filters in Uganda - CPA 1 UNFCCC reference number: 5962-P1-0001-	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 01/11/2013 – 30/10/2020	No

¹ http://cdm.unfccc.int/filestorage/5/e/HSVPWKBG6X7Q8YEFMOT214IA3R0ZDL.pdf/EB%2068_repan22_Rev_AMS-I.E_ver05.0.pdf?t=YIZ8cDV2azNofDCY7BS-SiAAH--3PykSDitm

² <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf>

³ <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf>

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
CP1 Version of the CPA-DD: 06				
Title: Chlorine Dispensers in Uganda – CPA 2 UNFCCC reference number: 5962-P1-0002-CP1 Version of the CPA-DD: 06.1	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 17/07/2014 – 16/07/2021	No
Title: Chlorine Dispensers in Uganda – CPA 3 UNFCCC reference number: 5962-P1-0003-CP1 Version of the CPA-DD: 06.1	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 15/04/2015 – 14/04/2022	No
Title: Chlorine Dispensers in Malawi – CPA 5 UNFCCC reference number: 5962-P1-0004-CP1 Version of the CPA-DD: 05	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 19/11/2015 – 18/11/2022	No
Title: Chlorine Dispensers in Kenya - CPA 6 UNFCCC reference number: 5962-P1-0005-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 21/01/2016 – 20/01/2023	No
Title: Chlorine Dispensers in Kenya - CPA 7 UNFCCC reference number: 5962-P1-0006-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 21/01/2016 – 20/01/2023	No
Title: Chlorine Dispensers in Malawi – CPA 8	07	International water purification programme The approved PoA-DD (version	Renewal 21/01/2016	No

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
UNFCCC reference number: 5962-P1-0007-CP1 Version of the CPA-DD: 04		07, 13/04/2015): PART II. Generic component project activity (CPA)	– 20/01/2023	
Title: Chlorine Dispensers in Uganda – CPA 9 UNFCCC reference number: 5962-P1-0008-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 13/09/2016 – 12/09/2023	No
Title: Chlorine Dispensers in Uganda – CPA 10 UNFCCC reference number: 5962-P1-0009-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 13/09/2016 – 12/09/2023	No
Title: Chlorine Dispensers in Malawi – CPA 11 UNFCCC reference number: 5962-P1-0010-CP1 Version of the CPA-DD: 02	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 13/09/2016 – 12/09/2023	No
Title: Chlorine Dispensers in Kenya - CPA 12 UNFCCC reference number: 5962-P1-0011-CP1 Version of the CPA-DD: 02	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 13/09/2016 – 12/09/2023	No
Title: Chlorine Dispensers in Kenya - CPA 13 UNFCCC reference number: 5962-P1-0012-CP1 Version of the CPA-DD: 02	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 13/09/2016 – 12/09/2023	No

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Title: Chlorine Dispensers in Kenya - CPA 14 UNFCCC reference number: 5962-P1-0013-CP1 Version of the CPA-DD: 02	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 13/09/2016 – 12/09/2023	No
Title: Water Kiosks in Cambodia – CPA 4 UNFCCC reference number: 5962-P1-0014-CP1 Version of the CPA-DD: 05	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 01/01/2017 – 31/12/2023	Yes
Title: Chlorine Dispensers in Kenya - CPA 15 UNFCCC reference number: 5962-P1-0015-CP1 Version of the CPA-DD: 01	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 01/02/2017 – 31/01/2024	No
Title: Chlorine Dispensers in Kenya - CPA 20 UNFCCC reference number: 5962-P1-0016-CP1 Version of the CPA-DD: 02	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 01/02/2017 – 31/01/2024	No
Title: Chlorine Dispensers in Uganda – CPA 21 UNFCCC reference number: 5962-P1-0017-CP1 Version of the CPA-DD: 02	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 01/02/2017 – 31/01/2024	No
Title: Chlorine Dispensers in Uganda – CPA 22 UNFCCC reference number: 5962-P1-0018-CP1	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 01/02/2017 – 31/01/2024	No

Title and UNFCCC reference number of the CPA	Version of the PoA-DD	Title and reference number of the corresponding generic CPA	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Version of the CPA-DD: 02				
Title: Chlorine Dispensers in Kenya - CPA 16 UNFCCC reference number: 5962-P1-0019-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 06/06/2017 – 05/06/2024	No
Title: Chlorine Dispensers in Kenya - CPA 17 UNFCCC reference number: 5962-P1-0020-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 06/06/2017 – 05/06/2024	No
Title: Chlorine Dispensers in Kenya - CPA 18 UNFCCC reference number: 5962-P1-0021-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 06/06/2017 – 05/06/2024	No
Title: Chlorine Dispensers in Kenya - CPA 19 UNFCCC reference number: 5962-P1-0022-CP1 Version of the CPA-DD: 03	07	International water purification programme The approved PoA-DD (version 07, 13/04/2015): PART II. Generic component project activity (CPA)	Renewal 06/06/2017 – 05/06/2024	No

A.2. Coordinating/managing entity

Pure Water Ltd. (CME)

SECTION B. Implementation of PoA**B.1. Description of implemented PoA****Management system**

The management system has been implemented as described in the validated PoA-DD ('Operational and management plan') and in accordance with applicable provisions on the implementation of the management system in the Project Standard. The PoA is managed by the CME (Pure Water Ltd.) with CPA Managers responsible for the coordination with the CPA

Implementer (UV + Solaire SAS). Detailed roles and responsibilities of CME and CPA Implementer are described in the PoA-DD.

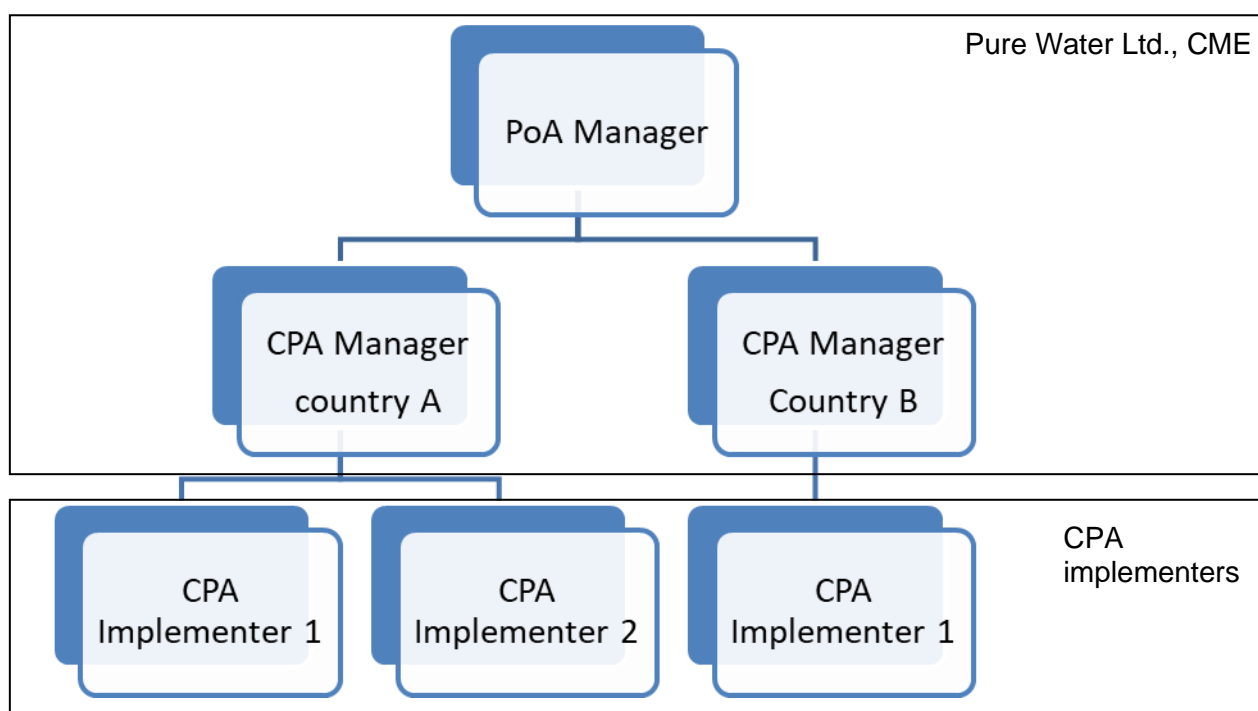


Figure 1: Overview of organizational structure

In order to ensure that CPAs comply with the double counting avoidance requirement stated in the PoA-DD, the CPA Manager checked every new CPA against the CPAs in the existing PoA database and the list of project activities that are under validation or registered at UNFCCC.

All CPA-related data are stored electronically and/or in hard copy formats. The water kiosk database of CPA 4 contains details about the unique numbering or identification system and installation dates for the water purification devices in which the water kiosks were installed.

Implementation of sampling approach

There was no sampling approach/plan applied for this CPA.

Technology

The included CPA 4 entails installation of the water purification system using solar energy powered UV (ultraviolet) disinfection device. The technology process and list of installed equipment/hardware are described under section C.1.

B.2. Post-registration changes to PoA

B.2.1. Corrections

No corrections were made to the PoA-DD version 07 (including the generic CPAs) during the current monitoring period.

B.2.2. Inclusion of monitoring plan

No monitoring plan was included to the PoA-DD version 07 during the current monitoring period.

B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

No permanent changes were made to the monitoring plan as described in the PoA-DD version 07, applied methodology, or applied standardized baseline during the current monitoring period.

B.2.4. Changes to programme design

No changes were made to the programme design of the PoA-DD version 07 during the current monitoring period.

There was a change to the programme design to include additional host parties for Cambodia and Malawi which the revised PoA-DD version 07 was approved on 05/11/2015.

Link to the approval detail: <https://cdm.unfccc.int/PRCCContainer/DB/prcp705942171/view>

B.2.5. Changes specific to afforestation or reforestation activities

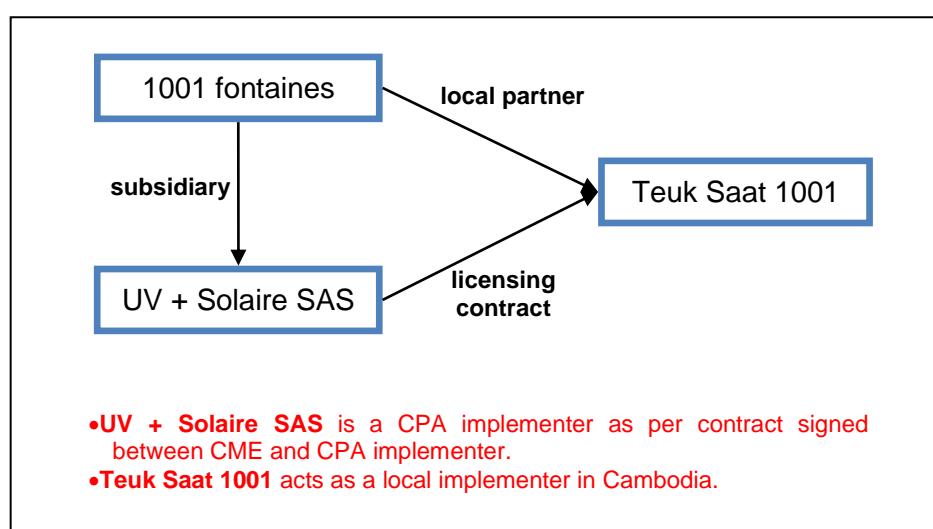
This section was not applicable for the PoA.

PART II Monitoring of CPAs

SECTION C. Implementation of CPAs

C.1. Description of implemented CPAs

The implementation of the project activity of CPA 4 Water Kiosks in Cambodia (CDM 5962-P1-0014-CP1) (hereafter referred as CPA) is developed under the Small-Scale Programme of Activities (PoA) titled “International water purification Programme”. The CPA is a voluntary initiative taken by the coordinating/managing entity (CME) of the PoA, Pure Water Ltd., and implemented on a voluntary basis by UV + Solaire SAS which is a subsidiary of 1001 fontaines. Local implementation shall be conducted through Teuk Saat 1001, Cambodian NGO as a local partner of 1001 fontaines. UV+Solaire SAS and Teuk Saat has licensing contract for the use of intellectual property.



It consists of the installation of small-scale water treatment stations (“water kiosks”) in Cambodia and distribution of purified water in disinfected water containers.

The purification process illustrated in the following diagram.



Water purification unit - schema

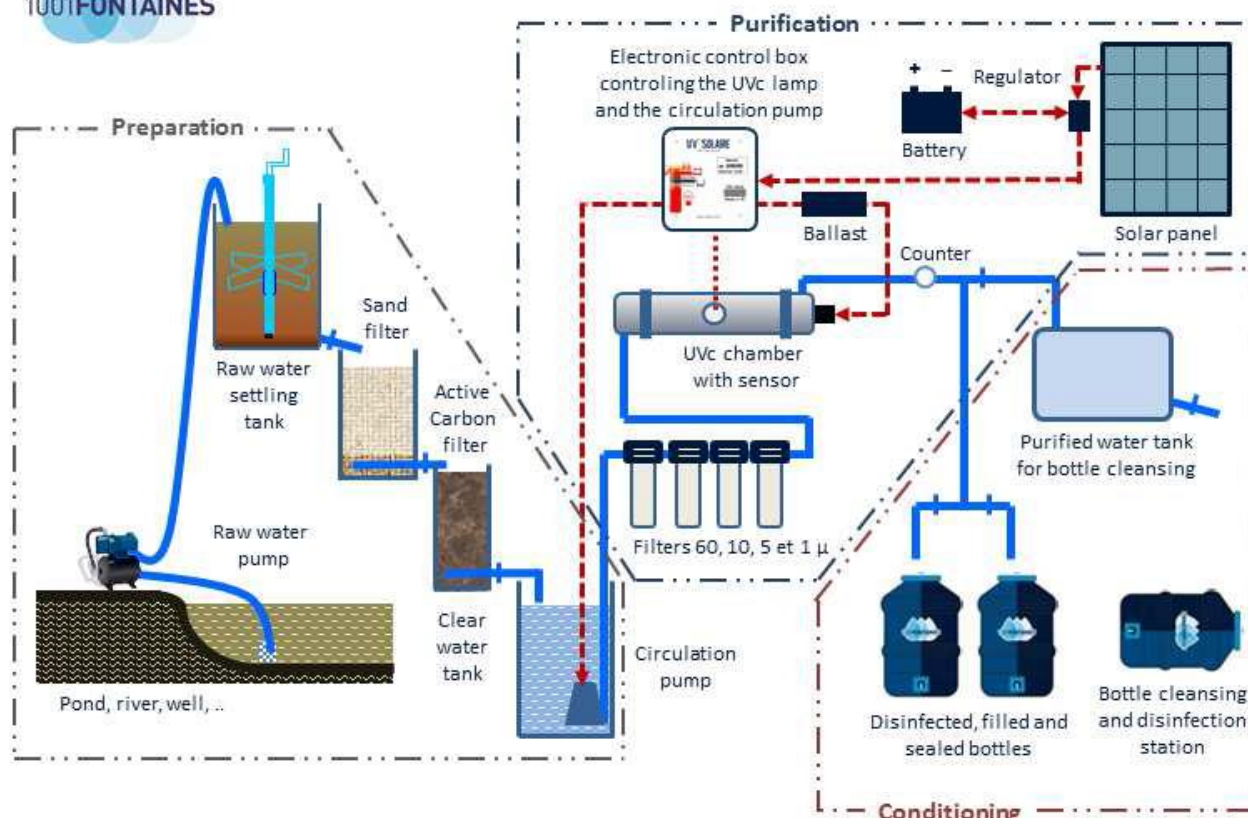


Figure 2: Purification process

Water Treatment Process

The applied treatment process consists of a flocculation, sand filtration, activated carbon filtration, micro-filter and UV disinfection. The purified water is filled into disinfected water 20 L containers and sold at the water kiosk and/or distributed locally. The treatment process may be adapted (e.g. by adding an iron-removing process) depending on the site-specific raw water quality as different water sources are used (borehole, bottled water, dug well, piped into dwelling, public tap, rainwater, surface water, and water vendor).

Operation and Maintenance

The local operator is responsible for the daily operation and maintenance of the water treatment plant and for the delivery of the purified water to the homes. The platform team by Teuk Saat 1001 provides monitoring, quality control, and support services to the operator. The life time of hardware/equipment of the water kiosk is maintained and replaced as per schedule recommended by CPA implementer.

Installed hardware specification	
UV lamp	Lamp power: 36W, 6A Life time: about 8000 hours of using
Motor pump	Maximum flow rate: 1500 l/min Life time: 3 years
Solar panel	12 VDC supply with regulator Life time: 20 years
Designed capacity	4,800 l/day (assuming 600 liters per hours over 8 hours a day)

Relevant dates for the project activity

Event	Date	Reference
Start date of the CPA 4	17/11/2011	The earliest date ⁴ of signed construction contract for water kiosk (F9)
Inclusion under the PoA	05/12/2016	UNFCCC website
Start date of CDM crediting period	01/01/2017	UNFCCC website
1 st monitoring period of the CPA 4 (4 th monitoring period of the PoA)	01/06/2016 - 31/12/2017	Monitoring report and detail at UNFCCC website
2 nd monitoring period of the CPA 4 (5 th monitoring period of the PoA)	01/01/2018 - 31/12/2018	Monitoring report and detail at UNFCCC website

C.2. Location of CPAs

The physical boundary of the CPA 4 is the households and communities that use the purified water where water kiosks are installed in 19 provinces in Cambodia. A database containing the GPS coordinates and unique IDs for all included water kiosks is available at the Teuk Saat office.

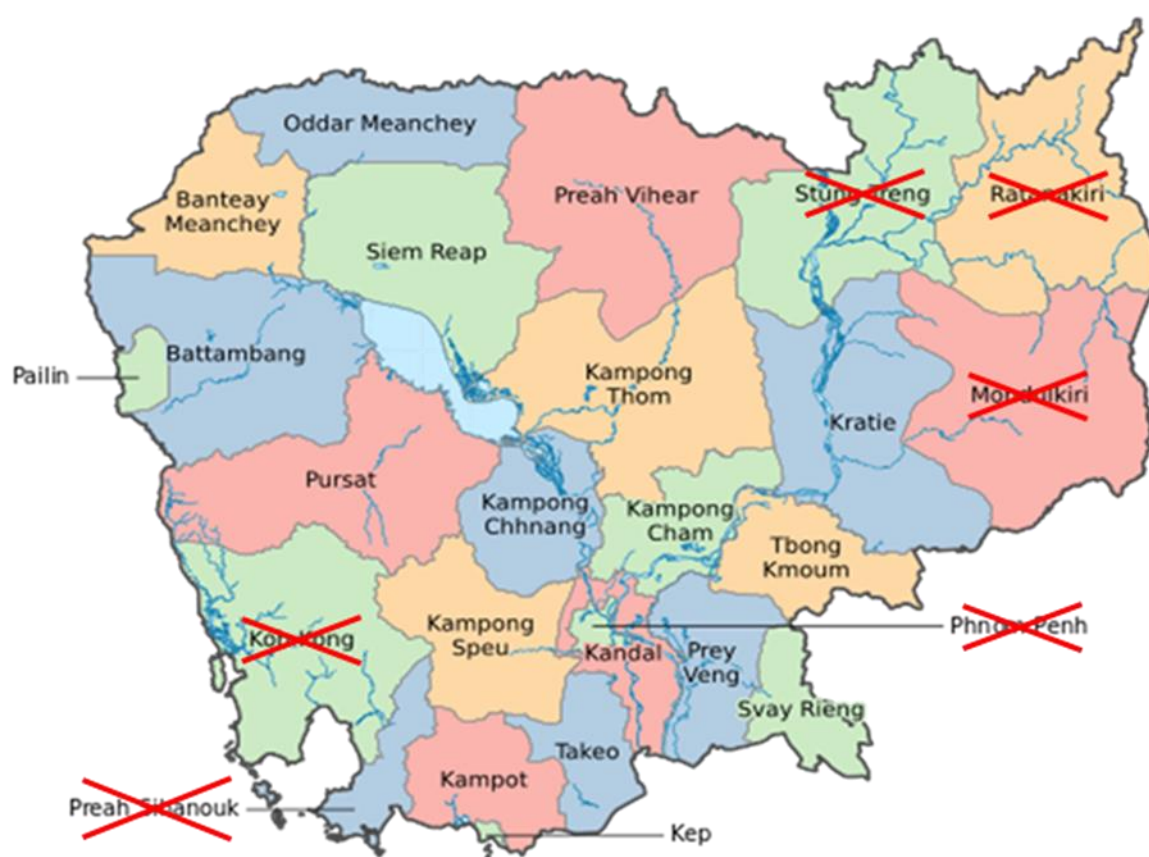


Figure 3: Project location 19 provinces in Cambodia

The map above shows 19 provinces in Cambodia where water kiosks shall be set up by 2022.

The coordinates of the Teuk Saat office in Phnom Penh are: N11.537762, E104.913265 and the coordinates of each kiosk included in the CPA are updated in the water kiosk database with the accessible link

⁴ The start date of the CPA is after the start date of the registered CDM PoA (29/07/2011) in line with the eligibility criteria for inclusion of CPAs in the registered PoA.

<https://www.google.com/maps/d/u/0/viewer?hl=en&mid=1wGpGbMP-qpc5CBr1depF6j6pXbg&ll=12.589506678719578%2C104.3279245&z=6>

The list of water kiosks included in this monitoring period are provided in Appendix 2.

C.3. Post-registration changes to CPAs

C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies, standardized baselines or other methodological regulatory documents

No temporary deviations from registered monitoring plan or applied methodology were necessary for the involved CPA since the start date of the project activity.

C.3.2. Corrections

There was correction in typographical error for the source of data for the parameter fuel consumption (FC) and minor editorial changes were done in line with the requirements of new template version of CPA-DD form available at the time of PRC validation. All the corrections were addressed in the revised CPA-DD version 05 date 19/03/2019.

The corrections were notified to the secretariat as applicable from this monitoring period.

The approval date of the PRC: 03/06/2019

The reference number of the PRC: PRC-5962-004

<https://cdm.unfccc.int/PRCContainer/DB/prcp78888327/view>

C.3.3. Changes to the start date of the crediting period

No changes to the start date of the crediting period were applied since the start date of the project activity.

C.3.4. Inclusion of monitoring plan

No monitoring plan was included into the specific-case CPAs that was not included at registration.

C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

There are the permanent changes applied for the measurement methods and procedures of the parameter quantity of the purified water (QPW), fuel consumption (FC), and electricity consumption (EC). The details of changes were addressed in the revised CPA-DD version 05 date 19/03/2019.

The changes were notified to the secretariat as applicable from this monitoring period.

The approval date of the PRC: 03/06/2019

The reference number of the PRC: PRC-5962-004

<https://cdm.unfccc.int/PRCContainer/DB/prcp78888327/view>

C.3.6. Changes to project design

No changes to project design of the specific-case CPAs were made.

C.3.7. Changes specific to afforestation or reforestation CPA

This section was not applicable for the CPA.

SECTION D. Description of monitoring system of CPAs

It is responsibility of the UV + Solaire SAS to monitor and record all parameters included in section B.5.1 of the revised CPA-DD version 05 date 19/03/2019, under the guidance of the CME.

The monitoring is done as per the requirement of AMS-III.AV, Version 3 and related tools to calculate project emissions. The detail of monitoring plan is described below:

AMS-III.AV, Version 3

Parameter	Means of monitoring	Monitoring frequency
QPW _y	<p>Purified water quantity shall be based on the number of 20L purified water bottles.</p> <p>The number of 20L purified water bottles delivered/sold is monitored and recorded on daily basis by the water kiosk operators. The quantity of purified water is verified by the platform team (Teuk Saat 1001), reported to the Teuk Saat office and kept in the SIMS.</p>	Monthly
N _y	<p>The database of sites is maintained, with site currently in operation listed. In case any kiosk is found to be non-functional, it will be recorded and highlighted in monthly update and excluded from the emission reduction calculation.</p> <p>In case of any failure, kiosk operator can contact the Teuk Saat project manager to assess the cause of failure and fix or replace equipment.</p>	Monthly
Existence of public distribution network of supplying safe drinking water	<p>Sites where a public water distribution network is present shall be documented in the kiosk site database. Existing sites is checked annually for new public distribution systems.</p> <p>In the event that distribution networks are providing safe water, the percentage of households connected to the network will be recorded and subtracted from the emissions calculations.</p>	Annually
POP _y	The database keeps a monthly record of the number of individuals provided with water by re-establishment of the monitored data every three months.	Monthly
Water quality	<p>The chosen indicator is E. coli, and water must contain less than 10 coliform forming units (CFUs) of E. coli per 100 ml sample.</p> <p>Monthly water quality testing is conducted at the Teuk Saat laboratory with providing the number and list of sites that successfully met the water quality standard, and list of instances where the standard was not met.</p> <p>In the event that the fraction of water quality measurement providing water of insufficient quality shall be excluded from the emission reduction calculation.</p>	Monthly

Methodological tool: Project and leakage emissions from transportation of freight

Parameter	Means of monitoring	Monitoring frequency
FC _{i,j,y}	Project emission is calculated using the fossil fuel consumption, net calorific value and the emission factor of the fuel	Monthly

Parameter	Means of monitoring	Monitoring frequency
	The actual fuel expense is logged in daily expense record for each time by the operator of each kiosk and summarized to monthly record. The monthly expense is verified by the platform team (Teuk Saat 1001), reported to the Teuk Saat office and kept in the SIMS. The actual monthly expense is calculated for the equivalent of consumption by using the published source/reports for the fuel price.	

Tool to calculate baseline, project and/or leakage emissions from electricity consumption

Parameter	Means of monitoring	Monitoring frequency
EC _{pi,y}	Project emission will be calculated using the electricity consumption, the applicable emission factor and transmission losses shall be determined in line with the Tool to calculate baseline, project and/or leakage emissions from electricity consumption. The actual electricity expense is logged in daily expense record by the operator of each kiosk and summarized to monthly record. The monthly expense is verified by the platform team (Teuk Saat 1001), reported to the Teuk Saat office and kept in the SIMS. The actual monthly expense is calculated for the equivalent of consumption by using the published sources/reports for the electricity price.	Monthly
TDL _{j,y}	As per the guidance given in the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, most recent data available within the host country is used during monitoring and verification	Annually

SECTION E. Data and parameters

E.1. Data and parameters fixed ex ante

Data/Parameter	EF _{projected_fossilfuel}
Unit	tCO ₂ /TJ
Description	Emission factor as per AMS-I.E procedures when NRB is displaced or the emission factor of the fossil fuel substituted
Source of data	AMS-I.E for NRB displacement, IPCC for other fossil fuel displaced
Value(s) applied	81.6
Choice of data or measurement methods and procedures	As per AMS-I.E, this value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis.
Purpose of data/parameter	Conversion of energy demand for boiling water (TJ) to carbon dioxide emissions (tCO ₂). Required for calculation of baseline emissions.
Additional comments	-

Data/Parameter	WH
Unit	kJ/L °C
Description	Specific heat of water
Source of data	AMS-III.AV version 03

Value(s) applied	4.186
Choice of data or measurement methods and procedures	Default value
Purpose of data/parameter	Used for the calculation of the Specific Energy Consumption (SEC) of boiling water. Required for calculation of baseline emissions.
Additional comments	-

Data/Parameter	T_f
Unit	°C
Description	Final temperature
Source of data	AMS-III.AV version 03
Value(s) applied	100
Choice of data or measurement methods and procedures	Default value. Boiling point of water at standard conditions.
Purpose of data/parameter	Used for the calculation of the Specific Energy Consumption (SEC) of boiling water. Required for calculation of baseline emissions.
Additional comments	-

Data/Parameter	T_i
Unit	°C
Description	Initial temperature
Source of data	AMS-III.AV version 03
Value(s) applied	20
Choice of data or measurement methods and procedures	Default value.
Purpose of data/parameter	Used for the calculation of the Specific Energy Consumption (SEC) of boiling water. Required for calculation of baseline emissions.
Additional comments	-

Data/Parameter	WHE
Unit	kJ/L
Description	Latent heat of water evaporation
Source of data	AMS-III.AV version 03
Value(s) applied	2,260
Choice of data or measurement methods and procedures	Default value. The latent heat required to boil one liter 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) ⁵
Purpose of data/parameter	Used for the calculation of the Specific Energy Consumption (SEC) of boiling water. Required for calculation of baseline emissions.
Additional comments	-

⁵WHO guidelines for Emergency Treatment of drinking water at point of the use
www.searo.who.int/LinkFiles/List_of_Guidelines_for_Health_Emergency_Emergency_treatment_of_drinking_water.pdf

Data/Parameter	η_{wb}
Unit	-
Description	Efficiency of the water boiling system being replaced
Source of data	Baseline survey in 2014
Value(s) applied	13.31%
Choice of data or measurement methods and procedures	<p>The prevalence of different cook stove types in the project area was determined in the baseline survey (see Appendix 1).</p> <p>A 0.10 default value is 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 i.e. without a grate as well as a chimney; for the rest of the systems using woody biomass 0.20 default value is used. 0.50 default value will be used if the replaced system or the system that would have been used is a fossil fuel combusting system. Use weighted average values if more than one type of systems are encountered.</p>
Purpose of data/parameter	Used for the calculation of the Specific Energy Consumption (SEC) of boiling water. Required for calculation of baseline emissions.
Additional comments	The water boiling systems and the fuel used in the baseline have been established via a baseline survey in July 2014.

Data/Parameter	f_{NRB}
Unit	-
Description	Non Renewable Biomass factor
Source of data	EB 67 Report Annex 22
Value(s) applied	76%
Choice of data or measurement methods and procedures	Fraction of woody biomass used in the absence of the project activity in year y for Cambodia as per "Information note: Default values of fraction of non-renewable biomass for least developed countries and small island developing states (version 01.0)"
Purpose of data/parameter	Adjustment factor for baseline emission calculation. Required for calculation of baseline emissions.
Additional comments	-

Data/Parameter	L_P
Unit	Liters/appliance/day
Description	Capacity of the water purification equipment
Source of data	Manufacturer's specifications
Value(s) applied	4,800 (designed capacity)
Choice of data or measurement methods and procedures	Capacity of the water purification equipment as per manufacturer's specifications shall be used in case where direct monitoring of the quantity of purified water is not possible.
Purpose of data/parameter	Used to monitor the quantity of purified drinking water together with the number of functional project appliances in case where direct monitoring of the quantity of purified water is not possible. Required for calculation of baseline emissions.
Additional comments	-

Data/Parameter	POP _p
Unit	Person
Description	Number of persons supplied with purified water from each of the functional project appliances
Source of data	Ex-ante Survey
Value(s) applied	4,000
Choice of data or measurement methods and procedures	For project activities falling under Case 2 per paragraph 3 (b), the number of persons supplied with purified water from each of the functional project appliances will be determined ex-ante.
Purpose of data/parameter	Used to calculate the cap of purified drinking water consumed for drinking purposes according to paragraph 6 in AMS-III.AV version 03. Required for calculation of baseline emissions.
Additional comments	The project activity falls under Case 2 per paragraph 3(b) in AMS-III.AV version 03, therefore this parameter is determined ex-ante.

Data/Parameter	DW _{POP}
Unit	Liters/person/day
Description	Average volume of drinking water per person per day
Source of data	Official data, WHO, minimum water quantity needed
Value(s) applied	3.5
Choice of data or measurement methods and procedures	Official data used on average volumes of drinking water per person per day in emergency situation published by World Health Organization. ⁶ Conservative value as according to AMS-III.AV Version 03 a value of 5.5 liters per person per day shall not be exceeded.
Purpose of data/parameter	Used to calculate the cap of purified drinking water consumed for drinking purposes according to paragraph 6 in AMS-III.AV version 03. Required for calculation of baseline emissions.
Additional comments	-

Data/Parameter	POP _{Boiling}
Unit	-
Description	Proportion of total population attended by the project that is serviced at households/buildings where water boiling would have been the purification practice.
Source of data	Official data (Table 2.6 Household drinking water of Cambodia Demographic and Health Survey 2010)
Value(s) applied	65.1%
Choice of data or measurement methods and procedures	Official data for percentage of household in rural area using method of boiling to treat drinking water
Purpose of data/parameter	Adjustment factor applied to the cap of the quantity of purified water. Required for calculation of baseline emissions.
Additional comments	Only relevant for Case 2

⁶ WHO SEARO, Minimum water quantity needed for domestic uses, 3 – 4 liters per person per day http://ec.europa.eu/echo/files/evaluation/watsan2005/annex_files/WHO/WHO5%20-%20Minimum%20water%20quantity%20needed%20for%20domestic%20use.pdf (last retrieved 17/08/2018)

Data/Parameter	$\rho_{i,y}$
Unit	kg/L
Description	Density of diesel
Source of data	Table A3.8 of Energy Statistics Manual by OECD/IEA, 2005 ⁷
Value(s) applied	0.8439
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Used to quantify the project emissions.
Additional comments	-

Data/Parameter	$NCV_{i,y}$
Unit	GJ/t
Description	Net calorific value of diesel
Source of data	table 1.2 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC ⁸
Value(s) applied	43.0
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Used to quantify the project emissions.
Additional comments	-

Data/Parameter	$EF_{CO_2,diesel,y}$
Unit	tCO ₂ /GJ
Description	Emission factor of diesel
Source of data	table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC ⁹
Value(s) applied	74.1
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Used to quantify the project emissions.
Additional comments	-

Data/Parameter	$EF_{grid,CM,y}$
Unit	tCO ₂ /MWh
Description	Emission factor for grid electricity in Cambodia
Source of data	Grid Emission Factor of the Phnom Penh Electricity Grid dated March 2011 ¹⁰
Value(s) applied	0.6568 (Combined margin: All other projects for the first crediting period)

⁷ http://www.iea.org/publications/freepublications/publication/statistics_manual.pdf (last retrieved 17/08/2018)

⁸ http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf (last retrieved 17/08/2018)

⁹ http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf (last retrieved 17/08/2018)

¹⁰ https://pub.iges.or.jp/system/files/publication_documents/pub/policyreport/2140/gef-cambodia_2011.pdf (last retrieved 17/08/2018)

Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Used to quantify the project emissions.
Additional comments	

Data/Parameter	Leakage
Unit	-
Description	Fractional increase in NRB usage by households outside the project boundary
Source of data	AMS-I.E Version 5
Value(s) applied	0.95
Choice of data or measurement methods and procedures	Leakage related to the non-renewable woody biomass saved by the project activity will be assessed based on a net to gross adjustment factor of 0.95 to account for leakages. In this case surveys are not required. This is in line with the provisions in AMS-I.E Version 05.0.
Purpose of data/parameter	Calculation of leakage
Additional comments	

E.2. Data and parameters monitored

Data/Parameter	QPW_y						
Unit	Litres						
Description	Quantity of purified water in year y						
Measured/calculated/default	The number of 20L purified water bottles delivered/sold was measured						
Source of data	Site Information Management System (SIMS) database						
Value(s) of monitored parameter	<table border="1"> <thead> <tr> <th>Monitorin period</th><th>Value (litres)</th></tr> </thead> <tbody> <tr> <td>01/01/2019 - 31/12/2019</td><td>123,050,700</td></tr> <tr> <td>01/01/2020 - 31/12/2020</td><td>121,989,870</td></tr> </tbody> </table>	Monitorin period	Value (litres)	01/01/2019 - 31/12/2019	123,050,700	01/01/2020 - 31/12/2020	121,989,870
Monitorin period	Value (litres)						
01/01/2019 - 31/12/2019	123,050,700						
01/01/2020 - 31/12/2020	121,989,870						
Monitoring equipment	n/a						
Measuring/reading/recording frequency	The number of 20L purified water bottles delivered/sold was monitored and recorded on a daily basis by the water kiosk operators. The quantity of purified water was verified by the platform team (Teuk Saat 1001) and reported to the Teuk Saat office.						
Calculation method (if applicable)	n/a						
QA/QC procedures	The quantity of purified water was verified by the platform team (Teuk Saat 1001), reported to the Teuk Saat office and kept in the SIMS.						
Purpose of data/parameter	Calculation of baseline emissions						
Additional comments	-						

Data/Parameter	N_y
Unit	-
Description	Number of functional project appliances (Kiosks) in year y
Measured/calculated/default	Measured
Source of data	Kiosk database

Value(s) of monitored parameter	<table><tr><th rowspan="2">Monitorin period</th><th colspan="2">Value (kiosks)</th></tr><tr><th>Monitored</th><th>Applied</th></tr><tr><td>01/01/2019 - 31/12/2019</td><td>173 - 205</td><td>173</td></tr><tr><td>01/01/2020 - 31/12/2020</td><td>178 - 195</td><td>178</td></tr></table>		Monitorin period	Value (kiosks)		Monitored	Applied	01/01/2019 - 31/12/2019	173 - 205	173	01/01/2020 - 31/12/2020	178 - 195	178
	Monitorin period	Value (kiosks)											
		Monitored	Applied										
	01/01/2019 - 31/12/2019	173 - 205	173										
	01/01/2020 - 31/12/2020	178 - 195	178										
<p>The number of kiosks during the monitoring period ranging from 173 to 205 kiosks/month in 2019 and 178 to 195 was included the operational and eligible (the purified water qualified by regular test) in a given month, which the monthly value could be found in the emission reduction calculation sheet.</p> <p>However, since the parameter was used for estimation of a cap on quantity of purified water ($QPW_{y,cap}$) which was part of baseline emission calculations, the minimum value of 173 and 178 was applied for conservative approach.</p>													
Monitoring equipment	n/a												
Measuring/reading/recording frequency	The number of functional water kiosks was maintained by kiosk database and was updated on monthly basis to the Teuk Saat office. It was checked that the water kiosks were still operating or replaced by an equivalent service appliance.												
Calculation method (if applicable)	n/a												
QA/QC procedures	<p>In case a water kiosk was not operating and was not replaced, it was excluded from the emission reduction calculation for the whole monitoring period considered, unless evidence of the date it broke down can be provided. The start date of each water kiosk, i.e. date of installation, was considered to calculate the total amount of water purified during the year.</p> <p>Data was collected using the standard procedures and kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurred later.</p>												
Purpose of data/parameter	Calculation of baseline emissions.												
Additional comments	-												

Data/Parameter	Existence of public distribution network supplying safe drinking water						
Unit	-						
Description	Existence of public distribution network supplying safe drinking water to the project boundary in year y						
Measured/calculated/default	n/a						
Source of data	Interviews with officials, end-users, NGOs, or local experts or published reports, maps, pictures, official documents, kiosk site database						
Value(s) of monitored parameter	<table> <tr> <th>Monitorin period</th><th>Value</th></tr> <tr> <td>01/01/2019 - 31/12/2019</td><td>0</td></tr> <tr> <td>01/01/2020 - 31/12/2020</td><td>0</td></tr> </table> <p>There was no public distribution network supplying safe drinking water to the project boundary.</p>	Monitorin period	Value	01/01/2019 - 31/12/2019	0	01/01/2020 - 31/12/2020	0
Monitorin period	Value						
01/01/2019 - 31/12/2019	0						
01/01/2020 - 31/12/2020	0						
Monitoring equipment	n/a						
Measuring/reading/recording frequency	Annually						
Calculation method (if applicable)	<p>In case a safe drinking water network is found to exist, households receiving SDW will be identified via map, surveys, and/or pictures.</p>						

QA/QC procedures	In case a SDW network was found to be existing, households related to this SDW was identified via map, surveys, pictures, and emission reductions related to those households was discounted accordingly considering the number of households linked to the network and the date the network became operational. It was checked annually if new households from the project boundary were being linked to the network.
Purpose of data/parameter	Adjustment factor for baseline emission calculation
Additional comments	There was no SDW made available through a public distribution network during the monitoring period.

Data/Parameter	POP _y											
Unit	-											
Description	Number of persons supplied with purified water from each of the functional project appliances											
Measured/calculated/default	n/a											
Source of data	Site Information Management System (SIMS) database											
Value(s) of monitored parameter	<table><tr><th rowspan="2">Monitorin period</th><th colspan="2">Value (persons per kiosk)</th></tr><tr><th>Monitored</th><th>Applied</th></tr><tr><td>01/01/2019 - 31/12/2019</td><td>1,802 - 2,020</td><td>1,802</td></tr><tr><td>01/01/2020 - 31/12/2020</td><td>1,944 - 2,087</td><td>1,944</td></tr></table>	Monitorin period	Value (persons per kiosk)		Monitored	Applied	01/01/2019 - 31/12/2019	1,802 - 2,020	1,802	01/01/2020 - 31/12/2020	1,944 - 2,087	1,944
	Monitorin period		Value (persons per kiosk)									
		Monitored	Applied									
	01/01/2019 - 31/12/2019	1,802 - 2,020	1,802									
	01/01/2020 - 31/12/2020	1,944 - 2,087	1,944									
	The number of persons supplied with purified water ranging from 1,802 to 2,020 persons/kiosk/month in 2019 and 1,944 to 2,087 in 2020 which the monthly value could be found in the emission reduction calculation sheet.											
	However, since the parameter was used for estimation of a cap on quantity of purified water (QPW _{y,cap}) which was part of baseline emission calculations, the minimum value of 1,802 and 1,944 was applied for conservative approach.											
Monitoring equipment	n/a											
Measuring/reading/recording frequency	According to the registered moniotirng plan and applied methodology, the monitoring frequency was required at least once every two years. However, the data was re-established every three months during the monitoring period.											
Calculation method (if applicable)	The total number of persons supplied with purified water was re-established every three months and was divided by the number of operational kiosks in order to obtain an average number of persons supplied with purified water per one kiosk.											
QA/QC procedures	Data was collected using the standard procedures and kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.											
Purpose of data/parameter	Adjustment factor for baseline emission calculation											
Additional comments	For project activities falling under Case 2 per paragraph 3 (b), The number of persons supplied with purified water from each of the functional project appliances is re-established for all devices at least once every two years.											

Data/Parameter	Water quality
Unit	-
Description	Water quality
Measured/calculated/default	Measured
Source of data	Test report

Value(s) of monitored parameter	Monitorin period		Value (%)	
			Average	Applied
	01/01/2019 - 31/12/2019		98	95
	01/01/2020 - 31/12/2020		99	97
	The minimum average value during the monitoring period of 98% was applied for baseline emission calculation as a conservative approach.			
Monitoring equipment	n/a			
Measuring/reading/recording frequency	<p>Monthly</p> <p>The purified water was collected and tested by Teuk Saat laboratory on a monthly basis. At least biannual test was sent out and tested by accredited laboratory.</p> <p>The applied technology complies with the “interim” performance target as per “Evaluating household water treatment options: Health based targets and microbiological performance specifications” (WHO, 2011). A presence/absence test for E. coli colony forming units (CFU) in 10 ml of water or an equivalent quantitative test for E. coli CFU is used. A presence of up to 10 E. coli CFU/100 ml in the treated water is acceptable.</p>			
Calculation method (if applicable)	The number of sites that do not exceed 10 E. coli CFU/100 ml was divided by the number of operational kiosks on monthly basis in order to obtain the fraction of sufficient water quality.			
QA/QC procedures	At least biannual test was sent out and tested by accredited laboratory. The fraction of water quality measurements providing water of insufficient quality was excluded from the calculation of emission reductions.			
Purpose of data/parameter	Adjustment factor for baseline emission calculation			
Additional comments	Since the data was used for baseline emission calculation, the minimum fraction of water quality measurements during the monitoring period was applied for the calculation as a conservative approach.			

Data/Parameter	FC _{i,j,y}
Unit	litres
Description	Quantity of diesel consumed for delivery of bottling water and water pump
Measured/calculated/default	The actual expenses is measured and calculated for the equivalent of consumption.
Source of data	Site Information Management System (SIMS) database
Value(s) of monitored parameter	
Monitoring equipment	n/a
Measuring/reading/recording frequency	The actual expense was recorded by the water kiosk operators for each time of fuel purchase and summarized to monthly record which was verified by the platform team (Teuk Saat 1001) and reported to the Teuk Saat office and kept in the SIMS. The actual monthly expense was calculated for the equivalent of consumption in litres by using the published source/reports for the fuel price.
Calculation method (if applicable)	The actual expense of the fuel consumption was recorded and converted to the equivalent of consumption in litres based on fuel price.
QA/QC procedures	Data was collected using the standard procedures and kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurred later.
Purpose of data/parameter	Used to quantify the project emissions
Additional comments	The data of fuel expense and the published resource of the fuel price in 2018 was used for calculation of fuel consumption in litres

Data/Parameter	EC _{pi,y}						
Unit	MWh						
Description	Quantity of electricity consumed for water purification process						
Measured/calculated/default	The actual expenses is measured and calculated for the equivalent of consumption.						
Source of data	Site Information Management System (SIMS) database						
Value(s) of monitored parameter	<table> <tr> <th>Monitorin period</th><th>Value (MWh)</th></tr> <tr> <td>01/01/2019 - 31/12/2019</td><td>70</td></tr> <tr> <td>01/01/2020 - 31/12/2020</td><td>124</td></tr> </table>	Monitorin period	Value (MWh)	01/01/2019 - 31/12/2019	70	01/01/2020 - 31/12/2020	124
Monitorin period	Value (MWh)						
01/01/2019 - 31/12/2019	70						
01/01/2020 - 31/12/2020	124						
Monitoring equipment	n/a						
Measuring/reading/recording frequency	The monthly expense was recorded by the water kiosk operators. The record was verified by the platform team (Teuk Saat 1001) and reported to the Teuk Saat office to keep in the SIMS. The actual monthly expense was calculated for the equivalent of consumption in kWh by using the published source/reports for the electricity price.						
Calculation method (if applicable)	The actual expense of the electricity consumption was recorded and converted to the equivalent of consumption in kWh from unit (KWh) rate of electricity						
QA/QC procedures	Data was collected using the standard procedures and kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurred later.						
Purpose of data/parameter	Used to quantify the project emissions						
Additional comments	The data of electricity expense and the published resource of the electricity price in 2018 was used for calculation of electricity consumption in kWh.						

Data/Parameter	TDL _{i,y}
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to the project activity
Measured/calculated/default	Default
Source of data	Recent data available within the host country
Value(s) of monitored parameter	23.4% (based on most recent value for Cambodia in 2014 ¹¹)
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually As per the guidance given in the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", most recent data available within the host country was used during monitoring and verification
Calculation method (if applicable)	n/a
QA/QC procedures	n/a
Purpose of data/parameter	Used to quantify the project emissions
Additional comments	-

E.3. Implementation of sampling plan

There is no sampling plan applied for the project activity.

¹¹ <http://wdi.worldbank.org/table/5.11>

SECTION F. Calculation of emission reductions or net anthropogenic removals

F.1. Calculation of baseline emissions or baseline net removals

The baseline emissions shall be calculated as follows, according to AMS.III-AV version 03:

$$BE_y = QPW_y * SEC * f_{NRB,y} * EF_{projected_fossilfuel} * 10^{-9} \quad (1)$$

Where:

BE_y	Baseline emissions during the year y in (t CO ₂ e)
QPW_y	Quantity of purified water in year y (litres)
SEC	Specific energy consumption required to boil one litre of water (kJ/L)
$f_{NRB,y}$	Fraction of woody biomass used in the absence of the project activity in year y
$EF_{projected_fossilfuel}$	Emission factor as per AMS-I.E procedures when NRB is displaced or the emission factor of the fossil fuel substituted (t CO ₂ /TJ). A default value of 81.6t CO ₂ /TJ is used.

1) Water quality

The water quality was monitored on a monthly basis for contamination with Escherichia coli (E.coli). A presence/absence test for E. coli colony forming units (CFU) in 10 ml of water or an equivalent quantitative test for E. coli CFU was used. A presence of up to 10 E. coli CFU/100 ml was acceptable. The fraction of water quality measurements providing water of insufficient quality were excluded from the calculation of emission reductions.

During the monitoring period, as per the test results for all functional water kiosks, the minimum fraction of water quality test with lower than 10 CFU/100ml was 98%¹².

2) Quantity of purified water, QPW_y

The total amount was subject to a cap derived from the population serviced by the project equipment POP_P multiplied by the average volume of drinking water per person per day based on official data.

During the monitoring period, the average volume of drinking water was set at 3.5 liters per person per day as a default value and each water kiosk serviced average 1,676 people. It was monitored that there were 179 operational and eligible water kiosks at the end of the monitoring period, however, 148 as the minimum number of operational and eligible kiosks was applied for conservative approach.

Therefore, the Cap on quantity of purified water is calculated as follows:

$$QPW_{y,cap} = N_y * POP_Y * POP_{BOILING} * DW_{POP} * 365$$

Parameter	Unit	Applied value	
		2019	2020
N_y	kiosks	173	178
POP_Y	people	1,802	1,944
$POP_{BOILING}$	%	65.1%	65.1%
DW_{POP}	L/day	3.5	3.5
$QPW_{y,cap}$	L	259,201,250	287,848,220

¹² This was conservative value as per the detail provided in section E.2.

Since this CPA fell into Case 2 (more than 60% of the CPA population is using an improved drinking water source), the quantity of purified water was the monitored parameter as per section B.5.1 of the revised CPA DD version 05 date 19/03/2019 and the monitored values for all functional water kiosks was shown as follows:

Parameter	Unit	Applied value	
		2019	2020
QPW _{y,monitored}	L	123,050,701	121,989,872

To be conservative, the lower value between QPW_{y,monitored} and QPW_{y,cap} was taken as the value of QPW_y.

Therefore, QPW_y = min (QPW_{y,cap}, QPW_{y,monitored})

Parameter	Unit	Applied value	
		2019	2020
QPW _{y,cap}	L	259,201,250	287,848,220
QPW _{y,monitored}	L	123,050,701	121,989,872
QPW _y	L	123,050,701	121,989,872

3) Specific energy consumption, SEC

Specific energy consumption required to boil one litre of water is to be calculated as follows:

$$SEC = [WH * (T_f - T_i) + 0.01 * WHE] / \eta_{wb} \quad (2)$$

Where:

WH Specific heat of water (kJ/L °C). Default value of 4.186 kJ/L °C is used.
 T_f Final temperature (°C). Default value of 100 °C¹³ is used.
 T_i Initial temperature of water (°C). Default value of 20 °C is used.
 WHE Latent heat of water evaporation, a default value of 2,260 kJ/L is used
 η_{wb} Efficiency of the water boiling systems being replaced

According to the ex-ante survey conducted, the water boiling systems that were replaced were mostly three stone fire systems and the biomass used was wood.

Therefore, an efficiency of 13.31% was used. Please refer to Appendix 1.

Therefore SEC = 2,686 kJ/L

4) Establishment of the Non Renewable Biomass factor, f_{NRB}

The fraction of woody biomass used in the absence of the project activity was taken from the information note of the EB 67 Report Annex 22: "Default values of fraction of non-renewable biomass for least developed countries and small island developing states (version 01.0)", which was available at the time of CPA inclusion.

A value of f_{NRB} = 76% was used for Cambodia.

5) Determination of emission factors (EF_{projected_fossilfuel})

The emission factor as per AMS-I.E procedures was taking the default value as 81.6 tCO₂/TJ.

¹³ Boiling point of water at standard conditions.

Therefore the annual baseline emission was calculated as follows:

$$BE_y = QPW_y * SEC * f_{NRB,y} * EF_{projected_fossilfuel} * 10^{-9} * \text{Correction Factor}_{\text{water quality}}$$

Parameter	Unit	Applied value	
		2019	2020
QPW _y	L/year	123,050,701	121,989,872
SEC	kJ/L	2,686	2,686
f _{NRB,y}	%	76%	76%
EF _{projected_fossilfuel}	t CO ₂ /TJ	81.6	81.6
Correction Factor-water quality	%	95%	97%
BE_y	t CO₂e	19,375	19,677

F.2. Calculation of project emissions or actual net removals

If the operation of the project water purification system involves consumption of fossil fuels and/or electricity, project emissions include:

- CO₂ emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the tool “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”

The project activity was not involve on-site consumption of fossil fuels, the project emissions are zero.

- CO₂ emissions from electricity consumption by the project activity using the latest version of the tool “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”.

$$PE_{EC,y} = \sum EC_{pj,y} \times EF_{grid,CM,y} \times (1 + TDL_{j,y})$$

where:

PE _{EC,y}	Project emissions from electricity consumption in year y (t CO ₂ /yr)
EC _{pj,y}	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)
EF _{grid,CM,y}	Combined margin emission factor for the grid in year y (t CO ₂ /MWh)
TDL _{j,y}	Average technical transmission and distribution losses for providing electricity to source j in year y

Therefore, the PE_{EC,y} was calculated as follows:

Parameter	Unit	Applied value	
		2019	2020
EC _{pj,y}	MWh	70	124
EF _{grid,CM,y}	t CO ₂ /MWh	0.6568	0.6568
TDL _{j,y}	%	23.4	23.4
PE_{EC,y}	t CO₂e	57	101

However, the project activity involves transportation by road for delivery of bottling water, where transportation is not the main project activity. Therefore, the project emissions from transportation was calculated as per the tool “Methodological tool: Project and leakage emissions from transportation of freight” using option A: monitoring fuel consumption.

$$PE_{FC,i,y} = PE_{TR,m} = \sum FC_{i,j,y} \times COEF_{i,y}$$

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

where:

$PE_{TR,m}$	Project emissions from road transportation of freight in monitoring period m (t CO ₂)
$FC_{i,j,y}$	Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)
$COEF_{i,y}$	CO ₂ emission coefficient of fuel type i in year y (t CO ₂ /mass or volume unit)
$NCV_{i,y}$	Net calorific value of the fuel type i in year y (GJ/mass or volume unit)
$EF_{CO_2,i,y}$	CO ₂ emission factor of fuel type i in year y (t CO ₂ /GJ)

Therefore, the $PE_{TR,m}$ was calculated as follows:

Parameter	Unit	Applied value	
		2019	2020
$FC_{i,j,y}$	L	144,547	136,330
$\rho_{i,y}$	kg/L	0.8439	0.8439
$NCV_{i,y}$	GJ/t	43	43
$FC_{i,j,y}$	GJ	5,245	4,947
$EF_{CO_2,i,y}$	t CO ₂ /GJ	74.1	74.1
$PE_{FC,j,y} = PE_{TR,m}$	t CO ₂ e	389	367

F.3. Calculation of leakage emissions

Leakage relating to the non-renewable woody biomass is assessed as per the relevant procedures of AMS-I.E version 5 explained below:

BE_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. Therefore, the leakage is calculated as follows:

$$\text{Leakage} = BE_y * (1-95\%)$$

Parameter	Unit	Applied value	
		2019	2020
BE_y	t CO ₂ e	70	124
Factor	%	95%	95%
Leakage	t CO ₂ e	969	984

F.4. Calculation of emission reductions or net anthropogenic removals

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)			
				Before 01/01/2013	From 01/01/2013 until 31/12/2020	From 01/01/2021	Total amount
5962-P1-0014-CP1	39,052	914	1,953	0	36,185	0	36,185
Total	39,052	914	1,953	0	36,185	0	36,185

F.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the included CPA-DDs

CPA UNFCCC reference number	Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the CPA-DD (t CO ₂ e)
5962-P1-0014-CP1	36,185	32,608

Total	36,185	32,608
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F.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the CPA-DD”

According to the ex-ante estimated amount of annual GHG emission reductions of 7,321 t CO₂e, it was averaged over the first crediting period. In order to calculate the ex ante ERs for this monitoring period, it was re-calculated to be in line with the estimation of the annual ex ante GHG emission reductions in the registered CPA-DD by using the same equations for the ex ante calculation.

The ex ante number of operational kiosks were replaced in the formula by using the number of the sites at the end of the monitoring period (December 2019 and 2020) to estimate the quantity of purified water (QPW_y) in line with the approach for calculation of the ex ante annual emission reductions. The same was applied to estimate the project emission from electricity and fossil fuel consumption. The calculation of amount estimated ex ante for this monitoring period can be found in the emission reduction calculation sheet.

F.6. Remarks on increase in achieved emission reductions

The measured emission reducing during the monitoring period are higher than the amount estimated ex ante. For the ex ante calculation, the conservative value of kiosk capacity (1,625 L/kiosk) was applied, while the design value (4,800 L/kiosk) is much greater. With applying the conservative value, it resulted in lower amount of the purified water (QPW_y) for estimation of overall ex ante emission reductions from the project activity.

F.7. Remarks on scale of small-scale CPAs

The small-scale threshold defined by the methodology applied, AMS-III.AV version 03, is the annual emissions reductions 60,000 tCO₂e. The total GHG emission reductions claimed during this monitoring period was 36,185 tCO₂e which remained under the limit of the small-scale project type III.

Appendix 1. Further background information on ex ante calculation of emission reductions

Baseline Survey

A baseline study was conducted by 1001 fontaines on July 3rd - 26th 2014, in order to determine the type of stoves and fuel used to boil water prior to the project implementation in target households in the CPA 4 project boundary. The baseline survey also investigated the prevalence of boiling among the target households to cross-check the value for POP_{Boiling} applied in the emission reduction calculation (DHS Cambodia 2010).

Target Population

As per the kiosk database¹⁴, the communities that are or will be using the up to 772 water kiosks to be installed by 1001 fontaines over the next years in 18 provinces of Cambodia¹⁵. The project area comprises rural villages which can be considered as similar in terms of their living conditions, access to water and water treatment methods. The target population comprises a total of around 1.3 million households (based on the average number of households per water kiosk determined as part of the inspection of potential construction sites).

Sampling Method and Size

A multi-stage sampling approach has been chosen as the most suitable sampling method as per Guidelines for *Sampling and Surveys for CDM Project Activities and Programme of Activities (Version 2.0)*, EB 69, Annex 5. It has been chosen to survey 10 households per site. Literature data and communications with local stakeholders suggested that three stone stoves fired by wood are most prevalent in the CPA project boundary. Improved stoves fired by wood, charcoal stoves and other type of stoves (e.g. LPG or electricity) were expected to be rare. Further, even though almost all households included in the sampling frame have or will have access to a water kiosk at one point in future, it is not possible to determine actual users of the kiosks ex-ante.

The required sample size was estimated using formula (16) on page 21 in *Sampling and Surveys for CDM Project Activities and Programme of Activities (Version 2.0)*, EB 69, Annex 5. In order to achieve a 90% confidence interval and a 10% precision, a sample size of 17 water points with 10 households surveyed at each water point is required (based on the parameters listed in Table 1).

Table 1: Parameters to determine a sample size achieving 90/10 confidence/precision¹⁶

Parameter	Value	Justification
Error Margin	10%	<i>Sampling and Surveys for CDM Project Activities and Programme of Activities (Version 2.0)</i> , EB 69, Annex 5
Confidence Level	1.645	<i>Represents the 90% confidence required. Sampling and Surveys for CDM Project Activities and Programme of Activities (Version 2.0)</i> , EB 69, Annex 5
Total number of groups	772	<i>Total number of existing and potential water kiosk sites as shown in the kiosk database</i>

¹⁴ Electronic file '140623_Kiosk Database' has been submitted to DOE during validation.

¹⁵ Data planned for designing the survey for baseline study. However, during the validation the CPA implementer has provided updated data to be 19 provinces as mentioned in section A.7.

¹⁶ The calculation sheet '140618_Sample Size MultiStage Baseline' for designing a sample size has been submitted to DOE during validation.

<i>Average units per group</i>	1,683	<i>Average number of households per site as shown in the kiosk database</i>
<i>Expected overall proportion</i>	90%	<i>Expected proportion of households using a conventional, unimproved cook stove for boiling water. The remaining 10% are expected to use improved cook stoves fired by wood or charcoal.</i>
<i>Expected unit variance</i>	0.02	<i>Expected variance between users of different sites</i>
<i>Expected average of the group variances</i>	0.15	<i>Expected average variance of users of the same site</i>

The project team decided to invest some more time and resources in the baseline survey in order to achieve a higher precision of the result. In total 30 sites were selected randomly and at each water point 10 randomly selected households were visited.

Sampling Frame

From a comprehensive database¹⁷ containing all 772 existing and potential sites of the water kiosks, a total of 30 villages were selected randomly using Microsoft Excel. All sites were sorted on a random number generated with the RAND() function which generates a random distribution. The lowest thirty values emerging out of this randomization then provided the 30 water points selected for the sample.

In each selected village 10 randomly selected households were visited and interviewed.

The following baseline survey was conducted to determine baseline stove efficiency¹⁸.

<i>Cluster Number</i>	<i>Province</i>	<i>Commune</i>	<i>Code</i>	<i>Sampling Date</i>	<i>Number of households in the village</i>	<i>Conventional stoves fired by wood</i>	<i>Improved stoves fired by wood</i>	<i>Conventional stoves fired by charcoal</i>	<i>Improved stove fired by charcoal</i>	<i>Gas (LPG)</i>	<i>Biogas or electricity</i>	<i>Total</i>
1	Banteay Mean Chey	Srah Chik	010305	23/07/2014	1,331	6	0	3	0	1	0	10
2	Battambang	Bansay Traeng	020209	17/07/2014	1,948	9	0	1	0	0	0	10
3	Battambang	Chrey	020204	17/07/2014	3,011	7	0	1	0	2	0	10
4	Battambang	Ou Char	020309	17/07/2014	3,114	4	0	3	0	3	0	10
5	Battambang	Ta Kream	020108	17/07/2014	4,078	6	0	3	0	1	0	10
6	Kampong Cham	Bos Khnaor	030201	08/07/2014	4,315	10	0	0	0	0	0	10
7	Kampong Cham	Chamkar Andoung	030202	09/07/2014	3,274	10	0	0	0	0	0	10
8	Kampong Cham	Khvet Thum	031304	08/07/2014	1,293	10	0	0	0	0	0	10
9	Kampong Cham	Krouch	031306	08/07/2014	1,349	10	0	0	0	0	0	10
10	Kampong Cham	Preah Theat	031107	07/07/2014	3,380	9	0	0	0	0	1	10
11	Kampong Cham	Soupheas	031512	08/07/2014	2,262	10	0	0	0	0	0	10
12	Kampong Chhnang	Dar	040402	16/07/2014	1,366	10	0	0	0	0	0	10
13	Kampong Chhnang	Longveaek	040505	26/07/2014	1,526	9	0	0	0	1	0	10
14	Kampong Speu	Krang Chek	050505	10/07/2014	2,675	8	0	2	0	0	0	10
15	Kampong Thom	Kakaoh	060704	09/07/2014	2,364	9	0	1	0	0	0	10
16	Kampot	Angkor Meas	070509	04/07/2014	1,425	8	1	0	0	0	1	10
17	Kandal	Preaek Anhchanh	080703	10/07/2014	2,986	6	0	0	0	3	1	10

¹⁷ Refer to the kiosk database which electronic file '140623_Kiosk Database' has been submitted to DOE during validation.

¹⁸ Refer to the baseline survey results. Electronic file '140808_Baseline Results CPA4' has been submitted to DOE during validation.

Cluster Number	Province	Commune	Code	Sampling Date	Number of households in the village	Conventional stoves fired by wood	Improved stoves fired by wood	Conventional stoves fired by charcoal	Improved stove fired by charcoal	Gas (LPG)	Biogas or electricity	Total
18	Kratie	Sandan	100408	25/07/2014	1,442	10	0	0	0	0	0	10
19	Preah Vihear	Kampong Sralau Muoy	130207	24/07/2014	518	4	0	5	0	1	0	10
20	Preah Vihear	Kampong Sralau Pir	130208	24/07/2014	327	5	0	5	0	0	0	10
21	Prey Veng	Preaek Changkran	141207	07/07/2014	1,550	10	0	0	0	0	0	10
22	Pursat	Sna Ansa	150309	16/07/2014	1,010	10	0	0	0	0	0	10
23	Siem Reap	Samraong	171109	22/07/2014	1,844	10	0	0	0	0	0	10
24	Svay Reang	Kraol Kou	200510	14/07/2014	2,446	9	0	0	0	0	1	10
25	Svay Reang	Prasat	200804	14/07/2014	491	9	0	0	0	1	0	10
26	Svay Reang	Svay Rieng	200601	14/07/2014	2,936	7	1	0	0	1	1	10
27	Takeo	Angk Ta Saom	210901	03/07/2014	3,157	7	1	0	0	1	1	10
28	Takeo	Kampong Reab	210606	03/07/2014	1,421	6	2	0	0	1	1	10
29	Takeo	Kdanh	210607	03/07/2014	1,418	8	2	0	0	0	0	10
30	Takeo	Leay Bour	210904	03/07/2014	4,225	9	1	0	0	0	0	10
Total (Number)						245	8	24	0	16	7	300
Total (%)						81.7%	2.7%	8.0%	0.0%	5.3%	2.3%	100%
Default stove efficiency (%)						10%	20%	10%	20%	50%	n.a.	
Fraction of non-renewable fuels (%)						77%	77%	77%	77%	100%	0%	
Weighted average stove efficiency			12.17%									

Wood is the predominant fuel in the project area, used in 84.3% of all households. Charcoal stoves (8.0%) and LPG stoves (5.3%) are only seen in rare occasions. 89.7% of all firewood and charcoal stoves sampled are considered as conventional (= 10% efficiency) and 2.7% as improved (= 20% efficiency). The LPG stoves are assumed to have a thermal efficiency of 50% (according to the applied methodology), however, the fraction of non-renewable biomass is 100% in these cases, thus f_{NRB} is adjusted to 78.3%. 7 out 300 households use electricity or biogas for cooking. As this is a very small number and the applied methodology does not provide further guidance on such cases, these households were excluded from the baseline calculation.

The required 90/10 confidence/precision requirement is clearly met with 90% confidence that the prevalence of unimproved cook stoves is 90.8% (+/- 5.0%).

The weighted average stove efficiency in the project area of CPA 4 is estimated to be 12.17% and the f_{NRB} adjusted to 78.3%.

The baseline survey suggests that 61% of the target population is or would be boiling their drinking water if they had sufficient time and money. Even though this value does not fulfill the required 90/10 confidence/precision requirement, it confirms that the applied value of 65.1% (DHS Cambodia 2010) is an appropriate estimate for $POP_{Boiling}$ in the project area.

During the DOE site visit on June 9th - 11th 2015 the DOE conducted a sampling survey¹⁹ in the provinces of Kampong Cham, Kampong Speu and Kandal and the DOE noted that 80% of the population were using improved cook-stoves. The baseline survey conducted above (during July 3rd - 26th 2014) however showed that more than 80% of households rely on conventional cook stoves.

To further substantiate this, we have provided additional supportive documents as below:

¹⁹ Electronic file 'Survey result_Jun2015' was submitted to DOE during validation for inclusion of the CPA.

- page 27 of <https://cleancookstoves.org/binary-data/RESOURCE/file/000/000/225-1.pdf>
- page 4 of <https://cleancookstoves.org/binary-data/RESOURCE/file/000/000/224-1.pdf>

It can be clearly seen that more than 80% of the population still uses traditional cook-stoves. Furthermore, if we refer to the project id - GS 103000000001910²⁰, page 18 of the PDD shows that 60% are traditional stoves using wood as the fuel. It should also be noted that we have not applied factors for suppressed demand in Cambodia and therefore our estimates are conservative.

For the sake of conservativeness and to take into account the observations from the DOE's site visit we have revised the number of households using improved cookstoves in the provinces visited by the DOE, and the resulting efficiency is 13.31%²¹.

²⁰ https://mer.markit.com/br-reg/public/project.jsp?project_id=103000000001910

²¹ Electronic file '140808_Baseline Results CPA4_updated' was submitted to DOE during validation for inclusion of the CPA.

Appendix 2. List of water kiosks included in this monitoring period

No.	Site Code	Province	Installation year
1	F1	Pursat	2011
2	F2	Pursat	2011
3	F3	Battambang	2011
4	F6	Siem Reap	2011
5	F7	Odor Meanchey	2011
6	F8	Siem Reap	2011
7	F9	Kampong Thom	2011
8	F10	Kampong Thom	2011
9	G1	Kampong Thom	2012
10	G2	Kampong Thom	2012
11	G4	Kratie	2012
12	G5	Kratie	2012
13	G6	Kandal	2012
14	G7	Kandal	2012
15	G8	Kandal	2012
16	G9	Kandal	2012
17	G10	Kandal	2012
18	G11	Prey Veng	2012
19	G12	Kandal	2012
20	G13	Kandal	2012
21	G14	Prey Veng	2012
22	G15	Prey Veng	2012
23	G16	Kratie	2012
24	G17	Kratie	2012
25	G18	Kampong Thom	2012
26	G19	Kandal	2012
27	G20	Kandal	2012
28	G21	Kandal	2012
29	G22	Kandal	2012
30	G23	Kandal	2012
31	G24	Prey Veng	2012
32	G25	Prey Veng	2012
33	G26	Prey Veng	2012
34	G27	Prey Veng	2012
35	G28	Prey Veng	2012
36	H1	Kampong Speu	2013
37	H2	Kampong Speu	2013
38	H3	Kampong Speu	2013
39	H4	Kampong Speu	2013
40	H5	Kampong Speu	2013
41	H6	Kampong Cham	2013
42	H7	Kampong Cham	2013

No.	Site Code	Province	Installation year
43	H8	Kampong Cham	2013
44	H9	Kampong Cham	2013
45	H10	Kampong Cham	2013
46	H11	Kampong Chhnang	2013
47	H12	Takeo	2013
48	H13	Kampong Cham	2013
49	H15	Kampong Cham	2013
50	H16	Kampong Cham	2013
51	H17	Tboung Khum	2013
52	H18	Prey Veng	2013
53	H19	Prey Veng	2013
54	H20	Kandal	2013
55	H22	Kandal	2013
56	H23	Kampong Thom	2014
57	H24	Kratie	2013
58	H25	Tboung Khum	2013
59	H26	Tboung Khum	2013
60	H27	Kampong Cham	2013
61	H28	Kampong Cham	2013
62	H29	Kampong Cham	2013
63	H30	Kandal	2013
64	H31	Kandal	2013
65	H32	Kandal	2013
66	H33	Kandal	2014
67	H34	Kandal	2013
68	I1	Tboung Khum	2013
69	I3	Tboung Khum	2014
70	I4	Tboung Khum	2014
71	I5	Kampong Cham	2014
72	I8	Kampong Speu	2014
73	I9	Kampong Speu	2014
74	I10	Kampong Speu	2014
75	I11	Takeo	2014
76	I12	Kandal	2014
77	I13	Prey Veng	2014
78	I14	Battambang	2015
79	I16	Battambang	2014
80	I17	Battambang	2014
81	I18	Battambang	2014
82	I19	Battambang	2014
83	I20	Pursat	2014
84	I21	Pursat	2015
85	I22	Pursat	2015
86	I23	Pursat	2015
87	I24	Tboung Khum	2014
88	I25	Siem Reap	2015
89	I28	Odor Meanchey	2015

No.	Site Code	Province	Installation year
90	I29	Siem Reap	2015
91	I30	Siem Reap	2015
92	J1	Banteaymean chey	2015
93	J2	Banteaymean chey	2015
94	J3	Preah Vihear	2015
95	J4	Prey Veng	2015
96	J5	Prey Veng	2015
97	J6	Prey Veng	2015
98	J7	Prey Veng	2015
99	J8	Prey Veng	2015
100	J9	Kandal	2015
101	J10	Kandal	2015
102	J11	Kandal	2015
103	J12	Kandal	2015
104	J13	Kandal	2015
105	K1	Kampong Cham	2016
106	K2	Kampong Cham	2016
107	K3	Kampong Cham	2016
108	K4	Kampong Cham	2016
109	K5	Kampong Cham	2016
110	K6	Kampong Cham	2016
111	K7	Kampong Cham	2016
112	K8	Kandal	2016
113	K9	Prey Veng	2016
114	K10	Kampong Cham	2016
115	K11	Kampong Thom	2016
116	K12	Kampong Thom	2016
117	K13	Kampong Thom	2016
118	K14	Kampong Thom	2016
119	K15	Kampong Thom	2016
120	K16	Kampong Thom	2016
121	K17	Kampong Thom	2016
122	K18	Kampong Chhnang	2016
123	K19	Kampong Chhnang	2016
124	K20	Kampong Chhnang	2016
125	K21	Kampong Cham	2016
126	K22	Tboung Khum	2016
127	K23	Kratie	2016
128	K24	Kratie	2016
129	K26	Kratie	2016
130	K27	Kratie	2016
131	K28	Kratie	2016
132	K29	Prey Veng	2016
133	K30	Prey Veng	2016
134	L1	Kampong Cham	2017
135	L2	Kampong Cham	2017
136	L3	Kampong Cham	2017

No.	Site Code	Province	Installation year
137	L4	Kampong Cham	2017
138	L5	Kampong Cham	2017
139	L6	Tboung Khum	2017
140	L7	Tboung Khum	2017
141	L8	Tboung Khum	2017
142	L9	Kratie	2017
143	L10	Kratie	2017
144	L11	Takeo	2017
145	L12	Takeo	2017
146	L13	Takeo	2017
147	L14	Takeo	2017
148	L15	Takeo	2017
149	L16	Takeo	2017
150	L17	Takeo	2017
151	L18	Takeo	2017
152	L19	Takeo	2017
153	L20	Kandal	2017
154	L21	Battambang	2017
155	L22	Battambang	2017
156	L23	Battambang	2017
157	L24	Battambang	2017
158	L25	Banteay Meanchey	2017
159	L26	Kampong Thom	2017
160	L27	Banteay Meanchey	2017
161	L28	Pursat	2017
162	L29	Pursat	2017
163	L30	Pursat	2017
164	L31	Pursat	2017
165	L32	Pursat	2017
166	L33	Pursat	2017
167	L34	Pursat	2017
168	L35	Pursat	2017
169	M1	Kratie	2018
170	M2	Tbong Khmum	2018
171	M3	Siem Reap	2018
172	M4	Siem Reap	2018
173	M5	Kampong Thom	2018
174	M6	Oddar Meanchey	2018
175	M7	Oddar Meanchey	2018
176	M8	Oddar Meanchey	2018
177	M9	Preah Vihear	2018
178	M10	Preah Vihear	2018
179	M11	Svay Rieng	2018
180	M12	Svay Rieng	2018
181	M13	Svay Rieng	2018
182	M14	Prey Veng	2018
183	M16	Tbong Khmum	2018

No.	Site Code	Province	Installation year
184	M17	Tbong Khmum	2018
185	M18	Tbong Khmum	2018
186	M19	Tbong Khmum	2018
187	M20	Tbong Khmum	2018

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	6 April 2021	Revision to: <ul style="list-style-type: none"> Reflect the "Clarification: Regulatory requirements under temporary measures for post-2020 cases" (CDM-EB109-A01-CLAR).
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