HEQING SOLAR COOKER PROJECT II

Document Prepared By Clean Air Trade, Inc.

Project Title	Heqing Solar Cooker Project II
Version	1
Report ID	N/A
Date of Issue	7-Janurary-2019
Project ID	Not registered under VCS yet
Monitoring Period	01-December-2017 to 31-July-2018
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The project installed 49,000 solar cookers for the poor rural residents in north-western China. The rated power of each solar cooker is 910 W and the total capacity of the project is 44.59 MW thermal. The project enabled the rural residents to efficiently substitute solar energy for the fossil fuel (coal) used in daily cooking and water boiling, avoiding CO_2 emission generated by fossil fuel consumption.

The preparation of project implementation started since July 2011 by placing order of cookers, arrangement for distribution of cookers, and training of the monitoring team members, etc. The continued operation period for the project is 01/12/2017 – 31/07/2018 which is the current (8^{th}) monitoring period. There were 7 monitoring periods prior to the current monitoring period. The total emission reductions achieved in this monitoring period is 102,557 tCO_2e.

1.2 Sectoral Scope and Project Type

Sectoral scope: 1 - Energy industries (renewable / non-renewable sources)
Project type: I - Renewable Energy Projects
The project is not a grouped project.

1.3 Project Proponent

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1.4 Other Entities Involved in the Project

N/A

1.5 Project Start Date

15-August-2011 (starting date in the project's CDM PDD, Section C.1.1)

1.6 Project Crediting Period

Crediting period start date: 22-September-2011
Crediting period end date: 21-September-2021
Total number of years: 10 years

1.7 Project Location

The Project is located in Gaotai County and Linze County of Zhangye in Gansu province of P.R. China. The approximate locations of the centers of the townships in which the project is located are:

Linze County

Township	**Longitude(E)** **Degree**	**Latitude(N)** **Degree**
Shahe	100° 9'20.91"E	39° 8'52.05"N
Xinhua	100° 1'22.76"E	39°11'38.83"N
Banqiao	100°17'5.00"E	39°16'33.04"N
Pingchuan	100° 5'57.48"E	39°20'10.51"N
Lia oquan	100° 3'50.44"E	39°19'8.67"N
Yanuan	100°14'12.34"E	39°16'21.08"N
Nijiaying	100° 7'50.99"E	39° 1'49.03"N

Gaotai County

Township	**Longitude(E)** **Degree**	**Latitude(N)** **Degree**
Xiangdao	99°49'50.50"E	39°21'57.07"N
Heli	99°51'0.41"E	39°23'30.79"N
Nanhua	99°48'2.86"E	39°18'23.85"N
Xinba	99°52'46.83"E	39°14'37.51"N
Luotuocheng	99°37'29.90"E	39°21'9.83"N
Xuanhua	99°42'14.01"E	39°25'50.49"N
Heiquan	99°37'44.68"E	39°31'57.18"N
Luocheng	99°35'20.67"E	39°41'1.59"N

1.8 Title and Reference of Methodology

Small-scale CDM baseline methodology "AMS-I.C.(Version 18, EB56), Thermal energy production with or without electricity". For more information regarding the methodology, please refer to the link:
http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

1.9 Other Programs

- Emission Trading Programs and Other Binding Limits: This project activity is completely voluntary, and it is not required by any law or regulation.
- Other Forms of Environmental Credit: The project will not claim any other form of GHG-related environmental credit for GHG emission reductions claimed under the VCS Program, i.e., the emission reductions generated from the project will not be double counted.
- Participation under Other GHG Programs: The project has been registered under CDM. The reference number is 5106.

1.10 Sustainable Development

The development of the proposed project is in line with the priority choice of Chinese energy sector, and it will facilitate the sustainable development of the project site as well as the host country in the following aspects:

- Providing rural residents with a clean, practical and convenient way to meet the energy demand of their daily cooking;
- Improving the indoor hygiene of rural residents;
- Improving the living condition and quality of rural residents;
- Mitigating GHG emission.

The proposed project will significantly contribute to sustainable development of this region. It will serve as a model for future project and stimulate the interests of investors in solar energy projects. It will promote the use of clean energy, educate and train the rural population on solar energy technology, and build awareness in environmental protection among the rural population. Those who will be directly benefited from the proposed project are 49,000 low-income households or about 196,000 villagers (average household has 4-5 people). The rural residents will get clean and reliable energy supply for their daily cooking. The technology and experience gained from this project can be transferred to future projects. The experienced personnel trained by this project can assist other projects in the future.

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

As stated in section 1.1, the preparation of project implementation started since July 2011 by placing order of cookers, arrangement for distribution of cookers, and training of the monitoring

team members, etc. The continued operation period for the project is 01/12/2017 – 31/07/2018 which is the current (8th) monitoring period. There were 7 monitoring periods prior to the current monitoring period. The total emission reductions achieved in this monitoring period is 102,557 tCO_2e. There is no event or situations that occurred during this monitoring period, which may impact the applicability of the methodology.

2.2 Deviations

2.2.1 Methodology Deviations

None.

2.2.2 Project Description Deviations

None.

2.3 Grouped Project

N/A

2.4 Safeguards

2.4.1 No Net Harm

There are no negative environmental and socio-economic impacts due to the project activity.

2.4.2 Local Stakeholder Consultation

The project owner discussed the project with local government of Zhangye and the feedback was very positive.

In April 2010, the stakeholder survey was conducted on the rural residents in places where the project was planned to carry out. The surveys were done by randomly visiting the villagers as well as assembling the villagers and interviewing them. Totally 100 survey forms (corresponding to more than 80% confidence level) were distributed and collected. The backgrounds of the local villagers surveyed are: Gender: 83% male and 17% female; Age: 7% less than 30, 48% between 30 and 40, 31% between 40 and 50, 14% more than 50; Education: 20% elementary school, 56% junior high school, 19% senior high school, 5% two-year college or higher. The comments of local stakeholders in the form of the result of questionnaires are summarized in the following paragraphs.

1) Do you know about the Project?
(Know a lot: 2%; Know some: 26%; Never heard of it: 72%)

2) Do you know about solar cooker?
(Don't know: 0%; heard of it: 63%; have seen it: 31%; have used it: 6%)

3) Which effect will be brought on your life by the proposed project (multiple choices allowed)?
(Save energy: 53; Reduce pollution: 23; Reduce expenses: 89; Enhance the living condition: 17; Other: 0; None: 0. Note: the value reported here are the numbers of selections on each choice)

4) Which negative effect will be brought by the proposed project?
(Inconvenient to use: 0%, Inconvenient to repair: 5%, Occupy space: 3%, None: 92%)

5) The significance of negative effect brought by this project
(Considerable effect: 0%, some partial effect which can be resolved: 0%, basically no effect: 100%)

6) The overall impacts of the proposed project?
(Positives far outweigh negatives: 100%, Basically no impact: 0%, Negatives far outweigh positives: 0%)

7) Do you support the proposed project?
(Support: 100%, Oppose: 0%, Doesn't matter to me: 0%)

In summary of the key result, 100% of those surveyed supported the project and thought that its positive impacts far outweighed the negative impacts.

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data / Parameter	1.R
Data unit	W/m^2
Description	Standard solar irradiance rate used to calculate rated power of solar cooker
Source of data	National Standard of the People's Republic of China, GB No.: NY/T219-2003
Value applied	700
Justification of choice of data or description of measurement methods and procedures applied	According to National Standard of P.R. China (GB), GB No.: NY/T219-2003, for calculating the rated power of solar cookers, 700 W/m2 should be used for as the standard value of solar irradiance rate.
Purpose of the data	Calculation of baseline emissions

Comments	

Data / Parameter	2. η
Data unit	N/A
Description	Solar cooker's thermal efficiency
Source of data	National Standard of P.R. China (GB), GB No.: NY/T219-2003
Value applied	65%
Justification of choice of data or description of measurement methods and procedures applied	This is the requirement of National Standard of P.R. China (GB), GB No.: NY/T219-2003. The project owner will also require in the technical specification that the solar cookers to be manufactured for this project have an efficiency of at least 65%.
Purpose of the data	Calculation of baseline emissions
Comments	

Data / Parameter	3. $\eta_{BL,thermal}$
Data unit	N/A
Description	Thermal efficiency for the traditional coal furnace
Source of data	The highest value of measured data.
Value applied	14.6%
Justification of choice of data or description of measurement methods and procedures applied	According to paragraph 26 of methodology AMS-I.C.(version 18), for household cooking stoves, the efficiency of the baseline units can be determined by the highest measured operational efficiency over the full range of operating conditions of a representative sample of units with similar specifications. As a prestigious academic institution in Zhangye area, Hexi University (HXU) measured the efficiency of cooking stove in rural Zhangye. The thermal efficiencies of 100 representative cooking stoves at rural households of Zhangye (including Ganzhou where the project is located) were measured, and the measurement meets the requirements of Chinese National Standard "Test method for household coal and stoves" (GB 6412-2009). The measurement results are: the highest efficiency is 14.6%, the

	lowest efficiency is 9.8%, and the average is 12.6%. With the above measurement data, according to paragraph 22 of methodology AMS-I.C. (version 18), 14.6% shall be chosen as the baseline thermal efficiency for the coal stoves.
Purpose of the data	Calculation of baseline emissions
Comments	

3.2 Data and Parameters Monitored

Data / Parameter	1. n
Data unit	Not applicable
Description	Number of solar cookers in operation in the proposed project
Source of data	Sales contract and invoice of the solar cookers and monitoring records of monitoring team
Description of measurement methods and procedures to be applied	Simple random sampling method was used to measure this parameter. To determining the total number of solar cookers operating with a 90/10 confidence/precision level, 79 samples are sufficient according to statistical principles. Therefore, a set of 79 samples (sample set A) were randomly selected from the entire population, and these samples were inspected.
Frequency of monitoring/recording	At least once a year
Value monitored	The following table shows the number of cookers in operation out of the 79 samples:

Township	**Number**
Shahe	7
Xinhua	9
Banqiao	7
Pingchuan	5
Liaoquan	2
Yanuan	7
Nijiaying	8
Xiangdao	7
Heli	6
Nanhua	9
Xinba	1
Luotuocheng	5
Xuanhua	2
Heiquan	4
Total number of cookers in operation out of the 79	**79**

	sample users |
	Percentage of cookers in operation out of 79 sample users | **100%**
	Total number of operational cookers based on sample user result | **49000**
Monitoring equipment	Monitoring equipment is not necessary, and thus not used.
QA/QC procedures to be applied	● Before implementing the project, the personnel of monitoring teams were trained on how to properly conduct the monitoring process. ● The solar cookers used for the project were tested before the operation of the project by authorities to ensure their specs and quality meets the requirements of the project. ● There are maintenance and repair plan ready for the solar cookers. This plan will ensure the cookers in the project can remain in operational condition. ● For missing or damaged data record, zero value is used for the missing or damaged data, which is the most conservative approach.
Purpose of the data	Calculation of baseline emissions
Calculation method	The percentage of number of solar cookers in operation out of the 79 samples was calculated, and then the number of solar cookers in operation in the proposed project was calculated by using the abovementioned percentage multiplying 49000, the total number of cookers.
Comments	Records were kept in electronic form and paper form.

Data / Parameter	2. t_i
Data unit	Hour
Description	The monthly operating time of each solar cooker
Source of data	Monitoring result of the usage time of the sampled cookers selected by the sampling survey
Description of measurement methods and procedures to be applied	To determining the average monthly hours of operation of the solar cookers with a 90/10 confidence/precision level, 79 samples are sufficient according to statistical principles. Therefore, a set of 79 samples (sample set B) were randomly selected from the entire population, and the usage time of these samples were monitored.
Frequency of monitoring/recording	The usage time of cookers were measured and recorded daily. At the end of each month, all the daily data of the past month were summarized to produce the monthly usage time.
Value monitored	Dec-2017 | 145.47

	<table><tr><td>Jan-2018</td><td>134.41</td></tr><tr><td>Feb-2018</td><td>131.25</td></tr><tr><td>Mar-2018</td><td>138.84</td></tr><tr><td>Apr-2018</td><td>136.77</td></tr><tr><td>May-2018</td><td>136.77</td></tr><tr><td>Jun-2018</td><td>136.88</td></tr><tr><td>Jul-2018</td><td>128.29</td></tr></table>
Monitoring equipment	Clock or watch
QA/QC procedures to be applied	To ensure the completeness of data, monitoring forms were filled out daily by the monitoring team to record the daily usage data of the sample users. The sampled users and monitoring team were properly trained to collect and record the data strictly according to the monitoring plan of PDD. The data records were checked to ensure the legibility and correctness. The sampled users were requested to further explain the reasons for the data out of normal range (for details, please refer to item 5 of the next subsection "Process conducted for data records that are missing, damaged, or out of normal range"). Reliability checking was performed to ensure the data precision meet requirement of PDD. Process conducted for data records that are missing, damaged, or out of normal range: 1. The general principle is that zero value is used for the missing or damaged data. This is most conservative approach. The monitoring personnel were trained before the starting of the project operation to ensure that each team member is fully aware of and able to strictly follow this conservative principle. During the monitoring process, the monitoring personnel were required to strictly abide by the above conservative principle in data recording, i.e., use zero values for all the missing or damaged data. 2. If this is due to the working error of the monitoring personnel, further train the person until he or she can perform the job properly. And in the mean time, use zero value for the missing or damaged data; 3. If this is due to the inability or attitude of a particular worker in monitoring team, dismiss such worker and re-hire those with proper ability and attitude. And in the mean time, use zero value for the missing or damaged data; 4. If the monitoring team as a whole does not meet the job requirement of monitoring process, a new monitoring team that

	meets the requirement was created; 5. If the data reported by the user significantly higher than the normal range by common sense, the monitoring personnel asked for the reason If the reason belongs to one of the following: 1) holidays celebration, 2) wedding or funeral, or 3) family/friends party, the reason is considered to be valid. Then the reason is recorded along with the data. Otherwise, zero value is used for that day's data.
Purpose of the data	Calculation of baseline emissions
Calculation method	(1) For each of the 79 sample users, measure and record their daily usage time, then sum up all the daily usage time in a month to get the monthly usage time of each user; (2) Sum up the monthly usage time of all the 79 users to get the total monthly usage time of the 79 users. (3) Divide the number obtained in (2) by 79 to get the average monthly operating time of each solar cooker.
Comments	Records were kept in electronic form and paper form.

Data / Parameter	3. R_i
Data unit	W/m^2
Description	Monthly solar irradiance rate in project region
Source of data	Gansu Meteorological Service Centre (latest available data released on 25 Nov. 2013, which is suitable to be applied.)
Description of measurement methods and procedures to be applied	Inquired Gansu Meteorological Service Centre and obtained the latest available data.
Frequency of monitoring/recording	At least once a year with the latest available complete set of data obtained from relevant authoritative resources.
Value monitored	Month Value 1 408.7 2 503.4 3 635.1 4 738.5 5 799.7 6 814.4 7 829.2 8 767.8 9 696.3 10 537.1 11 410.8 12 363.0

Monitoring equipment	N/A
QA/QC procedures to be applied	The data is from an official source. No additional QA/QC procedure is necessary.
Purpose of the data	Calculation of baseline emissions
Calculation method	N/A
Comments	

Data / Parameter	4. $EF_{FF,CO2}$
Data unit	tCO_2/TJ
Description	Baseline emission factor of Coal
Source of data	IPCC2006, page 2.22, Table2.5
Description of measurement methods and procedures to be applied	Obtained from IPCC
Frequency of monitoring/recording	N/A
Value monitored	94.6
Monitoring equipment	N/A
QA/QC procedures to be applied	The data is from an official source (latest information from IPCC); there is no updated data available. No additional QA/QC procedure is necessary.
Purpose of the data	Calculation of baseline emissions
Calculation method	N/A
Comments	Future revision of the IPCC Guidelines should be taken into account

3.3 Monitoring Plan

There are 4 parameters listed in section 7.1 of the registered PDD. According to methodology AMS-I.C. (Version 18, EB56) and the registered PDD section 7.2 (sub-section 2. “Data Monitored”), parameter #1 and #2 in section 7.1 of the registered PDD (i.e., parameter A and B below) were monitored:

(a) Number of solar cookers in operation in the proposed project (parameter A), and

(b) The monthly operating time of each solar cooker (parameter B).

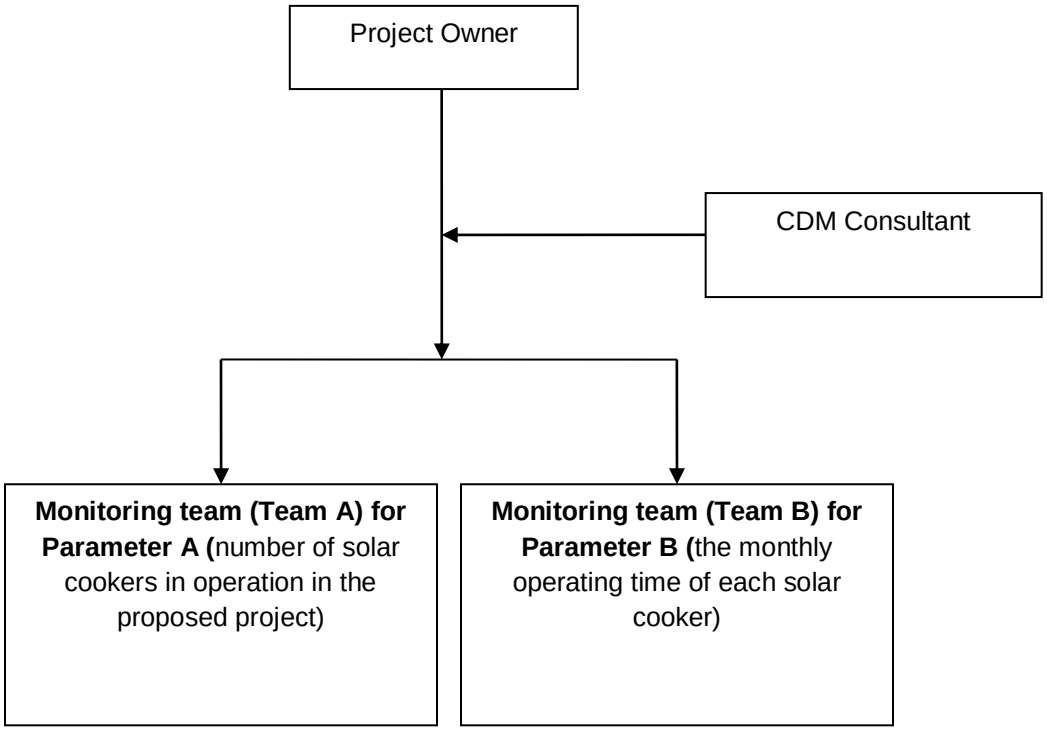
Parameter #3 and #4 in section 7.1 of the registered PDD are the data from reference documents which only need to be updated if there is an update on the latest available data. These two parameters are:

"Monthly solar irradiance rate in project region"(R_i) and

"Baseline emission factor of coal" ($EF_{FF,CO2}$).

For R_i, the latest available data released in November 2013 were used in the monitoring report. For $EF_{FF,CO2}$, the latest available data is still the IPCC default value used in registered PDD. For more details of these two parameters, please refer to parameter#3 and #4 in section 3.2 of this monitoring report.

Since the monitoring of R_i and $EF_{FF,CO2}$ only involves obtaining the latest available data from reference documents, which is handled by project owner, the monitoring system only need to address the monitoring of parameter A and B. Below is the organization structure of the monitoring system for parameter A and B:



Roles and Responsibilities:

The monitoring process was conducted through the coordination between the project owner and local Rural Energy Stations[1] (RES), the governmental organization in charge of the rural energy affairs.

In general, the project owner was responsible for overall management of the entire monitoring process as well as data analyzing, checking, and archiving; RES was responsible for the raw data collection and recording, and all the raw data were confirmed by RES. The project owner worked closely with RES to ensure proper equipment installation, training of the users, monitoring, document preservation, and maintenance.

Specifically, under the project owner, there were monitoring teams for the monitoring of parameter A (number of solar cookers in operation in the proposed project) and parameter B (the monthly operating time of each solar cooker). The monitoring teams consist of personnel from RES and project owner. For the details of the monitoring team, please refer to the table below.

Due to the non-industrial nature of the project, emergency procedures are not applicable to the project. For QA/QC procedures, please refer to QA/QC procedures in section 3.2.

Monitoring Plan in PDD	Monitoring Process Implemented
For number of solar cookers in operation in the proposed project (Parameter A): **B.7.1 of PDD**: The initial value of this parameter will be determined by the sales contract of the solar cookers and then this parameter will be monitored, recorded, and archived at each monitoring period. **B.7.2 of PDD**: ● Sampling survey method will be used for the monitoring of parameter A. 79 sample users will be randomly selected from the 49,000 users within the project boundary. Before the beginning of each monitoring period, a set of 79 samples will be drawn for the monitoring of parameter A. Before the beginning of the next monitoring period, a new round of random sampling will be conducted among the 49,000 users to generate a new set of 79 samples which will be	**For number of solar cookers in operation in the proposed project (Parameter A):** The sales contracts have been presented to the verification team during the first verification. 49,000 solar cookers were ordered and installed initially. The logo of the project and the user name was put on each of the cookers during the distribution process. Sampling survey method was used in the monitoring of parameter A and 79 samples were randomly selected from 49,000 solar cook users using MS Excel software. The monitoring of this parameter was conducted by monitoring team A. 2 groups in Team A were responsible for on-site monitoring and each group consisted of 2 people (one from local Rural Energy Station ("RES") and the other from project owner). All the team members were properly trained beforehand so that they were fully aware of the monitoring procedures and the conservative principle. The

[1] Refer to Linze Rural Energy Station and Gaotai Energy and Zoning Office (The former name of the latter is Gaotai Rural Energy Station) .

monitored during the forthcoming monitoring period.[2] ● A monitoring team (Team A) will be set up to conduct the monitoring of the number of operating cookers of the sample users. The monitoring personnel will be trained before the starting of the project operation to ensure that each team member is fully aware of and able to strictly follow this conservative principle. ● The monitoring will be conducted during the last 3 months of each monitoring period. A table will be used for monitoring and recording this parameter. ● To track the solar cookers, the logo of the project will be put on each of the solar cookers involved in the project. Moreover, the name of the user will be put on the cooker that the user is going to receive. ● For the transfer of solar cookers, the monitoring team will ensure that the transferee is also located within the project boundary of the proposed project, and will record the transferor, transferee, and the time of transfer.	monitoring of this parameter involved visiting each of the abovementioned sample users by team A. From 17 June 2018 to 24 June 2018, the monitoring team A checked if the cooker is in operation, and if the logo of the project and the user name is on the cooker through visual observation and short conversation. After the visit to households, the monitoring results were recorded in the monitoring table substantially in the form shown in PDD section B.7.2.Clause 3. Then all the operational cookers were summed up to generate the total number of cookers in operation. There was no transfer of cookers during this monitoring period. All the monitoring data were collected, recorded and confirmed by the monitoring team and the personnel of RES, and then provided the records to the project owner.
<u>For the monthly operating time of each solar cooker (Parameter B):</u> **B.7.2 of PDD:** ● Sampling survey method will be used for the monitoring of parameter B. 79 sample users will be randomly selected from the 49,000 users within the project boundary. Before the beginning of each monitoring period, a set of 79 samples will be drawn for the monitoring of parameter B. Before the beginning of the next monitoring period, a new round of random sampling will be conducted among the 49,000 users to generate a new set of 79 samples which will be	**<u>For the monthly operating time of each solar cooker (Parameter B):</u>** ● Sampling survey method was used for the monitoring of parameter B and 79 samples were randomly selected from 49,000 solar cooker users using MS Excel software. ● To monitor this parameter, monitoring Team B was set up. Team B consisted of 2 persons from RES and they recorded the operating hours of the sample users in monitoring forms. The monitoring personnel used phone call, SMS message, or visited the user face-to-face to get and record the data reported by the sampled

[2] The original text in the registered PDD is: "*Before the beginning of each monitoring period, two sets of 79 samples will be drawn, one set for the monitoring of parameter A and the other set is for the monitoring of parameter B. Before the beginning of the next monitoring period, a new round of random sampling will be conducted among the 49,000 users to generate two new sets of 79 samples which will be monitored during the forthcoming monitoring period.*" In the above text of PDD, the sampling for parameters A and B are described together as two sets of 79 samples (one set for parameter A and the other set for parameter B). For more clarity, the description in this monitoring report splits the original description in PDD and describes the sampling for each parameter separately. The description in this monitoring report has the exactly same meaning as the original text in PDD.

monitored during the forthcoming monitoring period. [3] ● Method of measurement: respondent self-reports, and operational logs. ● A monitoring team (Team B) will be set up to conduct the daily monitoring of the operating hours of the sample users. ● The monitoring forms will be filled out daily by Team B members to record the daily usage data of these sample users. At least once a month Team B leader will collect monitoring forms from Team B members and the quality of data will be checked.	users. At the end of each month during the monitoring period, the monitoring forms were collected and the paper documents were converted into electronic form and archived. The quality of data was checked by the "RES" and project owner separately. Specifically, RES collected data from sampled users every day to guarantee data completeness and recorded data in accordance with the monitoring plan of PDD; RES also ensured the data records (numbers and dates, etc.) were legible and correct, and double-checked with sampled users for the data out of normal range. The project owner reviewed RES's data records and conducted reliability checking to ensure the precision of these data meet the requirement of PDD (For details on reliability checking, please refer to next section).

Implementation of sampling plan

According to the registered PDD, simple random sampling (with sample size of 79) was used for number of solar cookers in operation in the proposed project (Parameter A) and the monthly operational time of each solar cooker (Parameter B). For each parameter, 79 sample users were randomly selected from users within the project boundary.

Checking reliability

Parameter A (Number of solar cookers in operation in the proposed project)

The monitoring result of this parameter is that all the cookers are operational for 79 sample users, this means that the proportion of operational cooker is 1, i.e., p = 1. According to "Best Practices Examples Focusing on Sample Size and Reliability Calculations"(EB67, Annex 6), paragraph 189, when p is very large (as in this case), a 90% confidence interval should be calculated as follows:

$$\frac{A-B}{C} \text{ to } \frac{A+B}{C}$$

Where:

$A=2np\hat{}+1.645^2$

$B=1.645\sqrt{1.645^2+4np\hat{}(1-p\hat{})}$

$C=2(n+1.645^2)$

[3] Same as footnote 2

n is the sample size

p^ is the sample proportion calculated

In our case, n=79, p^=1

Putting the information together gives:

$\frac{A-B}{C}$=0.9669 $\frac{A+B}{C}$=1

Therefore, for the proportion of solar cookers in operation, the confidence interval is 0.9669 to 1, i.e., *p* = 0.98345 ± 0.01655 (Note: 0.98345 = (1 + 0.9669)/2, and 0.01655 = (1 - 0.9669)/2)

Relative precision is 0.01655/0.98345 = 1.68%

Therefore, the relative precision of the data is 1.68%, meeting the required precision of 10%.

Parameter B (The monthly operating time of each solar cooker)

According to "Guidelines for Sampling and Surveys for CDM Project Activities and Programme of Activities" (EB67, Annex 6) appendix 4, paragraph 11-17, confidence/precision should be checked following the steps below:

(i) Standard error of the mean = $\sqrt{(1-f)\frac{s^2}{n}}$

f is the sampling fraction – the proportion of the population that is sampled.

s^2 is the sample variance (*s* is the sample standard deviation) of the monthly usage hours per user.

n is the sample size.

In our case, n = 79, and the population =49000.

Using Excel, we can calculate

s = 7.1545

Mean value of monthly usage hours per user = 136.0854

Putting all these pieces of information together gives:

Standard error of the mean = $\sqrt{(1-\frac{79}{49000})*\frac{s^2}{79}}$ = 0.8043

(ii) t-value

This value depends on the level of confidence and the size of the sample. The exact figure can be acquired from statistical tables for the t-distribution, or using standard statistical software. The value can also be derived in Microsoft Excel using the TINV function.

For a sample size of 79 and 90% confidence, using the TINV function in Microsoft Excel, the t-value is 1.6646.

(iii) Precision

The precision associated with an estimate is: t-value × standard error of the mean.

The precision of the monthly usage (in hours) per user, assuming 90% confidence, is therefore:

± (1.6646 ×0.8043) = ± 1.3388,

The ratio of this relative to the mean monthly usage per user is:

1.3388/136.0854 = 0.98%,

Therefore, the relative precision of the data over the monitoring period is 0.98%, meeting the required precision of 10%.

The relative precision of data was also calculated on monthly basis using the above method. All the precision values calculated on monthly basis are smaller than the 10% precision value required, which gives additional assurance that the precision is within the required range. For details of these calculations, please refer to the attached Excel calculation sheet.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

According to the registered PDD, the emission reduction can be calculated in the following table using the parameters below:

$$BE_y = n^* \sum [910.0^*(R_i /700)^* t_i * 3.6 \times 10^{-9}] * EF_{FF,CO2} / \eta_{BL,\ thermal} \qquad (i = 1, 2. \ldots, 12)$$

Where:

R_i	R_i is the actual solar irradiance rate in month i in W/ m^2. The values adopted are parameter #3 in the data table 3.2
t_i	t_i is the usage time of the solar cooker in month i in hours. The values adopted are parameter #2 in table 3.2
n	The total number of solar cookers installed by the proposed project. The value adopted is 49,000 (refer to parameter #1 in table 3.2 for details).
$EF_{FF,CO2}$	The CO_2 emission factor of coal (tCO_2e/ TJ). IPCC default emission factor of 94.6tCO_2e/TJ was adopted in the proposed project (refer to parameter #4 in table 3.2).

$\eta_{BL,\ thermal}$ The efficiency of the coal-fired stove that would have been used in the absence of project activity. The value adopted is 14.6% (refer to parameter #3 in table 3.1).

The result is summarized in the tables below:

Month	Time Interval	Solar irradiance rate	Actual Power of Solar Cooker	Monthly Usage Time	Net Heat Supplied Monthly	CER Generated Monthly
		R_i	P_i = 910*(R_i/700) Equation (8) in PDD	t_i	HG_i = n*[P_i*t_i*(3.6 ×10^{-9})] Equation (6) in PDD	BE_i = HG_i*$EF_{FF,CO2}$ /$\eta_{BL,\ thermal}$ Equation (5) in PDD
		(W/m^2)	(W)	(hour)	(TJ)	(tCO$_2$e)
2017-12	01/12/2017 – 31/12/2017	363.0	471.9	145.47	12.10923	7846
2018-01	01/01/2018 – 31/01/2018	408.7	531.3	134.41	12.59757	8163
2018-02	01/02/2018 – 28/02/2018	503.4	654.4	131.25	15.15134	9817
2018-03	01/03/2018 – 31/03/2018	635.1	825.6	138.84	20.22132	13102
2018-04	01/04/2018 – 30/04/2018	738.5	960.1	136.77	23.16268	15008
2018-05	01/05/2018 – 31/05/2018	799.7	1039.6	136.77	25.08122	16251
2018-06	01/06/2018 – 30/06/2018	814.4	1058.7	136.88	25.56298	16563
2018-07	01/07/2018 – 31/07/2018	829.2	1078.0	128.29	24.39548	15807

Using Equation (4) in PDD, total Baseline Emissions in the monitoring period = $\sum BE_i$ = **102,557 tCO$_2$e.**

Therefore, the total Baseline Emissions generated in the monitoring period is **102,557 tCO$_2$e**.

4.2 Project Emissions

According to the registered PDD and the applied methodology, there is no project emission.

4.3 Leakage

According to the registered PDD and the applied methodology, there is no project leakage.

4.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 2017	7,846	0	0	7,846
Year 2018	94,711	0	0	94,711
Total	102,557	0	0	102,557