MICROENERGY CREDITS – MICROFINANCE FOR CLEAN ENERGY PRODUCT LINES – AFRICA – SOLAR LAMPS AND EFFICIENT COOKSTOVES – 10341 – CPA -0001

Document Prepared by Microenergy Credits

Project Title	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA - 0001
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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Implementation Plan

In the urban areas in Kenya, the predominant means of cooking are traditional cook stoves that use charcoal as fuel. The smoke and fumes from these inefficient stoves contribute heavily to indoor air pollution, and affects human health.

In rural areas of Kenya there is either no grid connection or frequent power outages and low voltage so rural households must use kerosene for indoor lighting, which also contributes to indoor air pollution.

The improved cookstove distribution is focused on urban areas of Kenya and solar lamps distribution is focused in rural areas of Kenya.

The products provide clean energy for cooking and renewable energy for lighting. The cookstoves distributed under the project activity replace traditional cookstoves thereby reducing the amount of charcoal used for cooking in the baseline by households and thus reducing GHG emissions corresponding to the charcoal or fuelwood saving by the project activity. The solar lighting systems replace kerosene-based lamps in households, which would have resulted in GHG emissions due to burning of fossil fuel i.e. kerosene.

For solar lighting systems, in the baseline scenario, the households receiving these solar lighting systems are either not connected to the grid or have intermittent electricity supply from the grid resulting in use of kerosene for lighting in the baseline scenario.

For cookstoves, the households receiving these efficient cook stoves, are using inefficient cooking devices in the baseline, thus resulting into higher wood or charcoal consumption in the baseline. The targeted end user group for this project includes, individual households, community organisations and small/medium enterprises in Kenya.

The first solar lamps and improved cookstove was installed on 01-March-2016. Till end of current monitoring period total of 1,069,917 solar lamps and 4,733 improved cookstoves have been distributed. However, total solar lamps credited under the VPA is 650,000 in order to meet the type III threshold requirement. Furthermore, during the current monitoring, no credits are claimed for ICS as majority of them have reached end of life.

Relevant Implementation Dates

Date of first SLS/ICS installed	01-March-2016
Date of Last SLS installed	10-November-2019
Date of last ICS installed	31-December-2020

All solar lighting system under the VPA are falling under Option 2: Project lamps are assumed to

operate up to seven years after distribution to end users, and thus emission reductions are being claimed for up to seven years per project lamp.

Monitoring Period	Maximum count of solar Lamps in Operation at any point of a crediting year	Maximum count of solar Lamps Credited at any point of a crediting year
01-01-2022 to 31-12-2022	1,069,917	650,000

The solar lighting systems are implemented from 01/03/2016 to 10/11/2019. No new sales have been added in the current monitoring period. The total emission reductions achieved in this monitoring period for the VPA is **54,387 tCO2e.**

Audit Type	Period	Program	VVB Name	Number of years
Validation (under CDM)	25-December-2016	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – CPA 01	Earthood	NA
Gap validation (under VEERA)	27-February-2023	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0001	Earthood	NA
Verification (under CDM)	21-February-2017 to 31-December-2020	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0001	Earthood	~4
Verification (Under VERRA)	01-March-2016 to 20-February-2017 and 01-January-2021 to 31-December-2021	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0001	Earthood	~2

Verification[1] (Under VERRA)	01-January-2022 to 31-December-2022	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0001	Ecolance	1
Total	01-March-2016 to 31-December-2022)	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0001	Earthood/ Ecolance	7

1.2 Sectoral Scope and Project Type

The project includes the following sectoral scopes and project type –

- Improved cookstoves – 3 (Energy demand); Type II - Energy efficiency improvement project.
- Solar lighting devices – 1 (Energy industries (renewable - / non-renewable sources); Type III - Other projects reducing annually up to 60 ktCO2e.

The project is not a grouped project.

1.3 Project Proponent

Organization name	MicroEnergy Credits Corporation
Contact person	Sriskandh Subramanian
Title	Technical Director
Address	1201 Alaskan Way Ste 200 WA 98109 Seattle United States of America
Telephone	+91-9999997592
Email	sriskandh@microenergycredits.com

[1] As per para 4.1.23 (2) of VCS Standard, a validation/verification body shall not verify more than six consecutive years of a project's GHG emission reductions or removals. Considering Earthood has already done ~6 consecutive verifications for this VPA hence, PP contracted another VVB (Ecolance) for the current MP.

1.4 Other Entities Involved in the Project

Organization name	N/A
Role in the Project	N/A
Contact person	N/A
Title	N/A
Address	N/A
Telephone	N/A
Email	N/A

1.5 Project Start Date

01-March-2016 i.e., date of sale of first clean energy product under the project activity

1.6 Project Crediting Period

Crediting Period: 7 years (twice renewable)

Start and End Date of the crediting period: 01-March-2016 to 28-February-2023

1.7 Project Location

The products sold were restricted to the boundary of the Republic of Kenya with coordinates 0°1' 24.8" S latitude and 37°54.372' E longitude[2]. The activity involved households in the urban areas for improved cookstoves and rural areas for solar lamps across the host country. Provinces covered under the VPA are North Rift, South Rift, Western, Mount Kenya Region, Nairobi Region, Nyanza and Coast Region. The location of each clean energy installation as per the household address or the address of the nearest bank branch that has distributed product of provided loan was recorded in MicroEnergy Credit's Credit Tracker Platform.

[2] https://www.geodatos.net/en/coordinates/kenya

Figure 1: Map of Kenya

1.8 Title and Reference of Methodology

The Project applies both of the following two approved methodologies under CDM:

- AMS-II.G: Energy efficiency measures in thermal applications of non- renewable biomass (Version 8)[3]
- AMS-III.AR.: Substituting fossil fuel based lighting with LED/CFL lighting systems --- Version 5.0[4]

The associated tools and guideline documents in the project activity include:

- CDM TOOL21 "Demonstration of additionality of small-scale project activities" Version 10.1;[5]
- CDM TOOL30 "Calculation of the fraction of non-renewable biomass" Version 03; [6]
- CDM Guideline "Sampling and surveys of CDM project activities and programmes of activities" version 04;[7]

[3] https://cdm.unfccc.int/methodologies/DB/GNFWB3Y6GM4WPXFRR2SXKS9XR908IO
[4] https://cdm.unfccc.int/methodologies/DB/S3RZMK6KR289WKK0VB1ETT6K73Y3DR
[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v1.pdf/history_view
[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-30-v1.pdf/history_view
[7] https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20151023152925068/Meth_GC48_%28ver04.0%29.pdf

- CDM Standard "Sampling and surveys for CDM project activities and programmes of activities" version 09. [8]
- VCS Standard version 4.3[9]

1.9 Participation under other GHG Programs

This project activity is registered as CPA 1 of the CDM PoA 10341. The link to this activity on the CDM website is provided

- https://cdm.unfccc.int/CPAPostRegChanges/DB/prcp237635536/view

The project has issued CERs under CDM for period between 21-Feburary-2017 to 31-December-2020. The total credits issued is 181,037 (ICS-1,384 and SLS-179,653). The project has also issued VCUs under VERRA for period between 01-March-2016 to 20-February-2017 and 01-January-2021 to 31-December-2021.

Details of credits issued for the project in the previous monitoring period (both CDM and VERRA) have been tabulated below:

Standard	Monitoring Periods	Credits Issued
CDM	21-February-2017 to 31-December-2020	181,037
VERRA	01-March-2016 to 20-February-2017	3,574
VERRA	01-January-2021 to 31-December-2021	51,822

1.10 Other Forms of Credit and Supply Chain (Scope 3) Emissions

1.10.1 Emissions Trading Programs and Other Binding Limits

The project does not reduce GHG emissions from activities that are included in any emissions trading program.

[8] https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20210531160756223/Meth_Stan05.pdf
[9] https://verra.org/wp-content/uploads/2022/09/VCS-Standard_v4.3.pdf

1.10.2 Other Forms of Environmental Credit

Project has not applied for any other form of environmental credit during the current monitoring period.

1.10.3 Scope 3 emissions

Not applicable. As per the latest standard released by Verra (Version 4.4), this section (Scope 3 emissions inventories) is effective 1st January 2024 onwards hence this section is not applicable for the current monitoring period i.e., 01-January-2022 to 31-December-2022

1.11 Sustainable Development Contributions

The project contributes to social, environmental, economic and technological benefits which contribute to sustainable development of the local environment and the country as follows:

- Economic benefits:
    - The project provides access to affordable and clean source of lighting. Households spends more time on income-generating activities due to better lighting in the evenings
    - The expansion of the clean energy supply chain to low-income households generated jobs
- Environmental benefits: The project helped significantly reduce greenhouse gas emissions over the monitoring period.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	1.4	1.4.1 Proportion of population living in households with access to basic services	Increase	In this monitoring period, the project has provided access to basic services of lighting through Solar Lighting Systems to 135,049 households (650,000 solar lamps).	The project has provided 4,733 improved cookstoves[10] to 4,733 households and 650,000 solar lamps to 135,049 low-income households across Kenya.
4)	7.1	7.1.2 Proportion of population with primary reliance on clean fuels and technology	Increase	In this monitoring period, 135,049 low-income households across Kenya have access to affordable solar lamps	The project has provided affordable improved cookstove to 4,733[11] to 4,733 households and 650,000 solar lamps to 135,049 low-income households across Kenya
8)	13.0	13.2.2 Tonnes of greenhouse gas emissions avoided or removed	Increase	The project has generated 54,387 tCO_2e emission reductions in the current monitoring period.	By replacing fossil fuel-based lighting system with solar lighting systems, the project has generated total of 291,494 tCO_2e emission reductions.

[10] PP has removed ICS sales from VPA-1 and reason has been explained in section 1.1

[11] PP has removed ICS sales from VPA-1 and reason has been explained in section 1.1

2 SAFEGUARDS

2.1 No Net Harm

There were no potential negative environmental and socio-economic impacts

2.2 Local Stakeholder Consultation

The procedures or methods used for engaging local stakeholders

Local stakeholder consultation was held at Equity Centre, Upper Hill,9th Floor, Nairobi Kenya on 25-February-2016.

For the project level stakeholder consultation, stakeholders were invited by email and sms to attend the physical stakeholder consultation meetings held at the above address.

Outcome of the local stakeholder consultation

A detailed LSC report is prepared and would be provided to DOE mentioning the detailed account of invitation process, timelines, attendance during the meeting and accounts of comments received.

The invited stakeholders included:

- Existing customers from various locations in the boundary of the project activity
- Technology / CEP providers
- Bank representatives
- Government representatives
- Local NGO

Minutes were recorded for the consultation and a detailed stakeholder consultation report was compiled.

Stakeholder Feedback

Overall, during the meeting and in telephonic communications, the project received significant interest from stakeholders and positive feedback. The stakeholders generally felt that the project offered significant environment, development, and empowerment impacts by making proven clean energy products affordable and accessible to low-income households and microentrepreneurs. Stakeholders agreed that the project will be successful in providing affordable clean energy access to the people of Kenya.

Majority of the stakeholder felt that the project would benefit the local environment and would have positive impact on health and society at large. The specific comments received during the meeting are as follows:

Category of the Stakeholder	Comments received
End-user	Clean energy project will improve the lives of the society. It is also money saving venture.
Agent	Ensure proper logistics and distribution of products to agents
End-user	The project will go a long way in poverty eradication in Kenya
Agent	Add more variety of products

On-going communication

The stakeholders were informed that the project has designed a continuous input and grievance mechanism to ensure all grievances are recorded and responded. The contact details and Location for maintaining a log book to record the query/complaints of the stakeholders was also shared:

MicroEnergy Credit Corp

Ushuru Pension Plaza, Waiyaki Way

Nairobi 10719, Kenya

Email ID : contact@microenergycredits.com

During the current monitoring period no comments or grievance have been received. A grievance book has been maintained at the local office and email IDs have been provided to stakeholders in order to maintain communication and record the grievances.

2.3 AFOLU-Specific Safeguards

Not Applicable (Since this is a non-AFOLU project)

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

PP started the implementation the project on 01-March-2016. Various models of solar lighting system have been distributed across the rural areas of Kenya. Implementation of improved cookstoves has happened across urban area of Kenya. No new sales have been added to the VPA during the current monitoring period.

MEC's Credit Tracker Platform is used to maintain records for the project activity. The MEC Credit Tracker Platform has been designed specifically for accelerating microfinance access to clean and efficient energy. The Credit Tracker Platform is used to collect and store the information related to the unique identification number, location, installation date, and usage status of each clean energy product (CEP) in project activity, making it easy to identify, locate and verify any or all of the installations that pertain to the project activity. The MEC Credit Tracker Platform is a hosted internet service, limiting the risk of loss of data.

The Credit Tracker Platform enables Micro Energy Credits to maintain consistent data on project activity and product installations. The process for entering data into the Credit Tracker Platform is consistent across all CEPs in the project activity. At the time of installation, a Booking Record (in paper or electronic format) is created that captures detailed data on the installation:

- Household name
- Location of household (address)
- Product type installed
- Product model installed
- Date of installation
- Unique identifier number (s) for CEPs

For the current MP the project has been implemented in the following batches:

Batches	Province	Number of households	Number of lamps	Model wise distribution of lamps
Year 1 Installation	Coast Region= 14,502 Mount Kenya Region= 18,580 Nairobi Region= 13,423 North Rift= 28,410 Nyanza= 31,671 South Rift= 20,985	50,344	149,893	**d.Light 20:** 2 **d.Light 30:** 145,158 **Greenlight Planet Sunking HLS:** 1,545 **Greenlight Planet Sunking Pro-2:** 462 **Orb Energy Sol-10:** 202 **Orb Energy Sol-120:** 112 **Orb Energy Sol-15:** 196 **Orb Energy Sol-30**: 2,216

	Western= 22,322			
Year 2 Installation	Coast Region= 63,489 Mount Kenya Region= 37,554 Nairobi region= 30,120 North Rift= 47,932 Nyanza=1,12,544 South Rift= 59,207 Western= 46,278	100,770	397,124	**d.light D30:** 1,55,397 **d.light S300**: 2 **d.light X850**: 2,38,055 **Greenlight Planet Sunking HLS:** 1,614 **Greenlight Planet Sunking Pro-2**=236 **Orb Energy Sol-10**= 57 **Orb Energy Sol-120**= 88 **Orb Energy Sol-15**= 115 **Orb Energy Sol-30=** 1560
Year 3 Installation	Coast Region= 51,765 Mount Kenya region= 27,888 Nairobi= 20 Nairobi Region= 21,077 North Rift= 21,077 Nyanza= 54,270 South Rift= 39,603 Western = 23,964	51,722	251,016	**d.light D100R**: 21 **d.light D30:** 2,031 **d.light D31**: 2,025 **d.light D330**: 3 **d.light X1100**: 55 **d.light X740=** 472 **d.light X740=** 24,1,480 **Greenlight Planet Sunking Boom**= 293 **Greenlight Planet Sunking HLS**= 3,165 **Greenlight Planet Sunking HLS 120=** 597 **Greenlight Planet Sunking Pico=** 6 **Greenlight Planet Sunking Pro-2=** 34 **Msolar 55 Plus Aerial**= 4 **Msolar 6=** 96 **Orb Energy Sol-10**= 41 **Orb Energy Sol-120=** 20 **Orb Energy Sol-15**= 137 **Orb Energy Sol-30**=532 **Orb Energy Solectric600**= 4

Year 4 Installation	Coast Region= 51,712 Mount Kenya Region= 31,647 Nairobi= 25 Nairobi Region= 23,843 North Rift= 37 Nyanza= 60,021	56,676	271,884	**d.light 100**= 2,592 **d.light D150**= 2,190 **d.light D30=** 150 **d.light D31=** 5,193 **d.light X1000**= 6,315 **d.light X2000**= 585 **d.light X740=** 588 **d.light X850=** 2,48,510 **Greenlight Planet Sunking Boom**= 244 **Greenlight Planet Sunking HLS=** 1,275 **Greenlight Planet Sunking HLS 120=**1,065 **Greenlight Planet Sunking HLS 120 Plus=** 108 **Greenlight Planet Sunking Home 250**=2 **Greenlight Planet Sunking Pico**= 11 **Greenlight Planet Sunking Pro-2**= 3 **Msolar 55 Plus Aerial**= 104 **Msolar 6**= 1,884 **Orb Energy Sol 10**= 46 **Orb Energy Sol 120=** 52 **Orb Energy Sol 15**= 55 **Orb Energy Sol 30**= 900 **Orb Energy Solectric 600=** 12
Total solar lamps= 1,069,917 lamps				
Total number of households with 1,069,917 lamps = 259,512[12]				
Maximum count of solar lamps in operation at any point of CP = 650,000				

[12] Each solar lighting system has multiple lamps. Hence, one household may have more than 1 lamp present. Therefore, the number of households are less than the number of lamps.

Total number of households with 650,000 lamps= 135,049[13]

As evident from the table the total number of lamps distributed is over 1 million (1,069,917) however the PP is claiming credits only for 650,000 lamps in order to meet the small-scale threshold limit of 60,000 ERs. The PP will therefore forego the credits generated from 419,917 solar lamps installed in 2016 and early 2017 as they are already in their end of life.

The products which were non-operational during last monitoring period mainly on account of minor repairs have all been repaired by the local service team. Repairs requested by end users ranged from lose switch to wiring issue to issue in the battery etc. The service team of the PO visited the house of the beneficiary and conducted on-site repair (when minor issues were found) and in cases of major issues the device was taken to the nearest workshop for repair. Therefore, all the non-operational products in the last MP were found operational in the current MP, hence all those lamps have been credited. Sample service request form and photos have been provided.

The technologies employed under project activity include low-cost clean energy products that meet the basic needs of Kenya's low-income demographic. All of the technologies employed by the project activity provide development benefits as well as environmental benefits. The technologies are as follows:

- Improved cookstoves

There are various different models of improved cookstoves that have been disseminated under this project activity. Technical specification of the models currently being distributed are provided below:

1) The Zoom Jet cook stove

The technology has the following description:

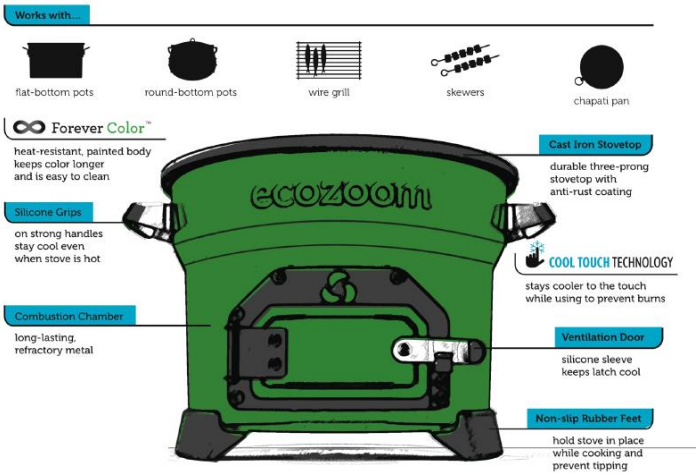
The Zoom Jet cook stove by ecozoom is a single burner, high efficiency cookstove that delivers fuel savings up to 76% and minimizes harmful emissions of CO, CO2 and Particulate Matter. The rated thermal efficiency is 45%[14][15]. In the absence of the project activity, the households with improved cookstoves would have continued to use inefficient traditional cookstoves, including three-stone fired and conventional stoves built of mud/clay lacking a chimney and grate to provide energy for cooking. These stoves use charcoal as the fuel. The efficiencies of these conventional stoves are low and are of the order of 10%. The technical specifications[16] of the clean energy products are as follows:

[13] Each solar lighting system has multiple lamps. Hence, one household may have more than 1 lamp present. Therefore, the number of households are less than the number of lamps.

[14] Ecozoom efficiency test results_WBT

[15] As per stove testing results (water boiling test carried out by University of Nairobi)

[16] Manufacturer's certificate on specifications



Physical dimension of the stove is provided below:

Height: 21cm

Weight: 7kg

Stove top diameter: 28cm

The average lifetime of the cook stove as per manufacturer's specifications is five years and the fuel used in these stoves in Charcoal.

2) Burn Jikokoa G3 efficient cookstove

The technology has the following description:

The Jikokoa cook stove by burnstoves is a single burner, high efficiency cookstove that delivers fuel savings up to 50% and minimizes harmful emissions of CO, CO2 and Particulate Matter. The rated thermal efficiency is 45%. In the absence of the project activity, the households with improved cookstoves would have continued to use inefficient traditional cookstoves, including three-stone fired and conventional stoves built of mud/clay lacking a chimney and grate to provide energy for cooking. These stoves use charcoal as the fuel. The efficiencies of these conventional stoves are low and are of the order of 10%. The technical specifications[17] of the clean energy products are as follows -

[17] Manufacturer's certificate on specifications

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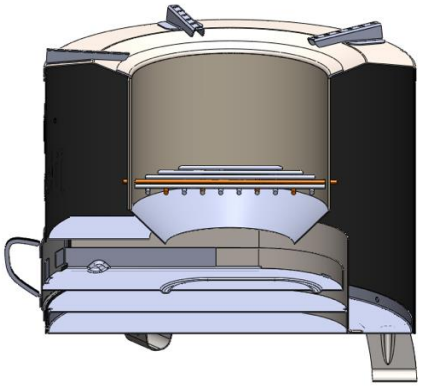


Physical dimension of the stove is provided below:

Height: 25.4cm

Diameter: 26.2cm

The average lifetime of the cookstove as per manufacturer's specification is 5 years[18]. In case of the product becomes non-operational, replacement stoves will be provided to the end user.

Below is the summary of production process of these cookstoves.

- Punching/forming, which makes parts from raw materials, primarily sheet metal
- Powder coating, which coats the stoves
- Final assembly which is a continuous flow production line that takes parts and assembles them into finished goods

3) Jiko Fresh efficient cookstove

The Jiko Fresh is a single burner, high efficiency cookstove that delivers fuel savings and minimizes harmful emissions of CO, CO2 and Particulate Matter and saves significant quantities of charcoal compared to the baseline technology.

The stove offers the following key characteristics:

Diameter- 26cm diameter

The stove has Refractory metal combustion chamber.

The average lifetime of the cookstove as per manufacturer's specification is 5 years. Also, the efficiency of the cookstove as per the test results is: 36.21%.

4) Jiko Bora efficient cookstove

[18] The lifetime may vary from individual product to product depending on usage handling and other physical factors. Additionally, there is an elaborate complaint registration system to assist in systematically tracking and resolving the customer complaints in timely manner.

The Jiko Bora reduces is a single burner, high efficiency cookstove that delivers fuel savings and minimizes harmful emissions of CO, CO_2 and Particulate Matter and saves significant quantities of charcoal compared to the baseline technology.

The stove offers the following key characteristics:

Diameter- 28cm diameter

The stove has Refractory metal combustion chamber.

The average lifetime of the cookstove as per manufacturer's specification is 5 years. Also, the efficiency of the cookstove as per the test results is: 37.74%

5) Burn xtra Jikokoa

The Burn xtra Jikokoa is a single burner, high efficiency cookstove that delivers fuel savings and minimizes harmful emissions of CO, CO2 and Particulate Matter and saves significant quantities of charcoal compared to the baseline technology.

The stove offers the following key characteristics:

Diameter- 30.2 cm diameter

The stove is a charcoal stove

The average lifetime of the cookstove as per manufacturer's specification 3 years. Also, the efficiency of the cookstove as per the manufacturer's specifications is: 44%

Improved cookstoves were part of the VPA till monitoring period 31-01-2021 however, CME has removed these sales considering thermal efficiency of large portion of the stoves database is less than 20% which means no credits as per the methodology.

- Solar Lighting System

There are various models of solar lighting technologies disseminated under this project activity. Households receiving these solar lighting systems are either not connected to the grid or have intermittent electricity supply from the grid resulting in use of kerosene for lighting in the baseline scenario. In the absence of the project activity, the households would have continued to use kerosene for lighting purposes which would have resulted in GHG emissions due to burning of fossil fuel i.e., kerosene. The models where LED/CFL lighting system has more than one LED/ CFL lamp connected to a single rechargeable battery system, every LED/CFL lamp would be considered as one project lamp. The technology has the following description and technical specifications[19] –

1. Sun King Pro 2
   The technical specifications of this product are –
   Type and Solar panel Wattage: Polycrystalline/3 W

[19] As per manufacturer's product information sheet

Lighting Wattage: 1.1
Luminous flux output (Lumens): 160
Lumen maintenance (for 2,000 hours): 96%
Rated lamp life: greater than 10,000 hours
Lighting point (number of project lamps): 1
Battery type/capacity– lithium ion phosphate battery/2900mAh
Type of charge controller – NA
Solar Run time(SRT): 5.5 hours
Warranty – 2 years

2. Sun King Home 60
   The technical specifications of this product are –
   Type and Solar panel Wattage – Polycrystalline/6.3 W
   Lighting Wattage: 2.64
   Luminous flux output (Lumens) – 305
   Lumen maintenance (for 2,000 hours): 99%
   Rated lamp life: greater than 10,000 hours
   Lighting points (number of project lamps) – 3
   Battery Type/capacity – 5900 mAh (lithium ion phosphate battery)
   Type of charge controller:
   Solar Run time(SRT): 5.6 hours
   Warranty – 2 years

3. Dlight S300
   The technical specifications of this product are –
   Type and Solar panel Wattage – Monocrystalline/1.6 W
   Lighting Wattage: 1.0
   Luminous flux output (Lumens) – 100
   Lumen maintenance (for 2,000 hours): 97.97%
   Rated lamp life: greater than 10,000 hours
   Lighting points (number of project lamps) – 1
   Battery Type/capacity – 1.8 Ah (lithium ferro phosphate battery)
   Type of charge controller: Active
   Solar Run time(SRT): 5 hours
   Warranty – 2 years

4. Dlight D20
   The technical specifications of this product are –
   Type and Solar panel Wattage – Polycrystalline/5.4 W
   Lighting Wattage: 1.7

Luminous flux output (Lumens) – 170
Lumen maintenance (for 2,000 hours): 97.97%
Rated lamp life: greater than 10,000 hours
Lighting points (number of project lamps) – 2
Battery Type/capacity – 3 Ah (lithium ferro phosphate battery)
Type of charge controller: Active
Solar Run time(SRT): 7 hours
Warranty – 2 years

5. Dlight D30
   The technical specifications of this product are –
   Type and Solar panel Wattage – Polycrystalline/10.0 W
   Lighting Wattage: 3.6
   Luminous flux output (Lumens) – 360
   Lumen maintenance (for 2,000 hours): 97.97%
   Rated lamp life: greater than 10,000 hours
   Lighting points (number of project lamps) – 3
   Battery Type/capacity – 3 Ah (lithium ferro phosphate battery)
   Type of charge controller: Active
   Solar Run time(SRT): 5 hours
   Warranty – 2 years

6. Dlight D31
   The technical specifications of this product are –
   Type and Solar panel Wattage – Polycrystalline/10.0 W
   Lighting Wattage: 3.6
   Luminous flux output (Lumens) – 360
   Lumen maintenance (for 2,000 hours): 97.97%
   Rated lamp life: greater than 10,000 hours
   Lighting points (number of project lamps) – 3
   Battery Type/capacity – 3 Ah (lithium ferro phosphate battery)
   Type of charge controller: Active
   Solar Run time(SRT): 5 hours
   Warranty – 2 years

7. Dlight D100R
   The technical specifications of this product are –
   Type and Solar panel Wattage – Polycrystalline/9 W
   Lighting Wattage: 4.8
   Luminous flux output (Lumens) – 480

Lumen maintenance (for 2,000 hours): 97.97%
Rated lamp life: greater than 10,000 hours
Lighting points (number of project lamps) – 3
Battery Type/capacity – 9 Ah (lithium ferro phosphate battery)
Type of charge controller: Passive
Solar Run time(SRT): 6 hours
Warranty – 2 years

8. Dlight D330
   The technical specifications of this product are –
   Type and Solar panel Wattage – Polycrystalline/6.5 W
   Lighting Wattage: 4.4
   Luminous flux output (Lumens) – 440
   Lumen maintenance (for 2,000 hours): 97.97%
   Rated lamp life: greater than 10,000 hours
   Lighting points (number of project lamps) – 3
   Battery Type/capacity – 6 Ah (lithium ferro phosphate battery)
   Type of charge controller: Active
   Solar Run time(SRT): 4 hours
   Warranty – 2 years

9. Dlight X740
   The technical specifications of this product are –
   Type and Solar panel Wattage – Polycrystalline/30 W
   Lighting Wattage: 10 W
   Luminous flux output (Lumens) – 1000
   Lumen maintenance (for 2,000 hours): 97.97%
   Rated lamp life: greater than 10,000 hours
   Lighting points (number of project lamps) – 4
   Battery Type/capacity – 6 Ah (lithium ferro phosphate battery)
   Type of charge controller: Active
   Solar Run time(SRT): 7 hours
   Warranty – 2 years

10. Dlight X850
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/40 W
    Lighting Wattage: 12 W
    Luminous flux output (Lumens) – 1200
    Lumen maintenance (for 2,000 hours): 97.97%

Rated lamp life: greater than 10,000 hours
Lighting points (number of project lamps) – 5
Battery Type/capacity – 6 Ah (lithium ferro phosphate battery)
Type of charge controller: Active
Solar Run time(SRT): 6 hours
Warranty – 2 years

11. Dlight D100
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/9 W
    Lighting Wattage: 4.8 W
    Luminous flux output (Lumens) – 1200
    Lumen maintenance (for 2,000 hours): 97.97%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 3
    Battery Type/capacity – 9 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 6 hours
    Warranty – 2 years

12. Dlight D150
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/10 W
    Lighting Wattage: 4.8 W
    Luminous flux output (Lumens) – 1200
    Lumen maintenance (for 2,000 hours): 97.97%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 3
    Battery Type/capacity – 9 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 6 hours
    Warranty – 2 years

13. Dlight X1000
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/40 W
    Lighting Wattage: 14 W
    Luminous flux output (Lumens) – 1400
    Lumen maintenance (for 2,000 hours): 97.97%
    Rated lamp life: greater than 10,000 hours

Lighting points (number of project lamps) – 5
Battery Type/capacity – 9 Ah (lithium ferro phosphate battery)
Type of charge controller: Active
Solar Run time(SRT): 7 hours
Warranty – 2 years

14. Dlight X1100
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/40 W
    Lighting Wattage: 14 W
    Luminous flux output (Lumens) – 1400
    Lumen maintenance (for 2,000 hours): 97.97%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 5
    Battery Type/capacity – 9.6 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 7 hours
    Warranty – 2 years

15. Dlight X2000
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/80 W
    Lighting Wattage: 14 W
    Luminous flux output (Lumens) – 1400
    Lumen maintenance (for 2,000 hours): 97.97%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 5
    Battery Type/capacity – 12 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 9 hours
    Warranty – 2 years

16. Sunking Home 120
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/12 W
    Lighting Wattage: 1.4 W
    Luminous flux output (Lumens) – 600
    Lumen maintenance (for 2,000 hours): >90%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 3
    Battery Type/capacity – 12 Ah (lithium ferro phosphate battery)

Type of charge controller: Active
Solar Run time(SRT): 5 hours
Warranty – 2 years

17. Msolar 55 plus aerial
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/55 W
    Lighting Wattage: 1 W & 2 W
    Luminous flux output (Lumens) – 700
    Lumen maintenance (for 2,000 hours): >99%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 6
    Battery Type/capacity – 12 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 6 hours
    Warranty – 2 years

18. Msolar 6
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/5.7 W
    Lighting Wattage: 1.6 W & 0.8 W
    Luminous flux output (Lumens) – 400
    Lumen maintenance (for 2,000 hours): >99%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 3
    Battery Type/capacity – 12 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 5.5 hours
    Warranty – 2 years

19. Orb Energy Sol-10
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/3.8 W
    Lighting Wattage: 3 W
    Luminous flux output (Lumens) – 160
    Lumen maintenance (for 2,000 hours): >96%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 1
    Battery Type/capacity – 4.5 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active

Solar Run time(SRT): 16 hours
Warranty – 2 years

20. Orb Energy Sol-120
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/49 W
    Lighting Wattage: 40 W
    Luminous flux output (Lumens) – 160
    Lumen maintenance (for 2,000 hours): >96%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 4
    Battery Type/capacity – 15 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 5.5 hours
    Warranty – 2 years

21. Orb Energy Sol-15
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/7.1 W
    Lighting Wattage: 5 W
    Luminous flux output (Lumens) – 160
    Lumen maintenance (for 2,000 hours): >96%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 2
    Battery Type/capacity – 1.6 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 4.6 hours
    Warranty – 2 years

22. Orb Energy Sol-30
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/10.8 W
    Lighting Wattage: 6 W
    Luminous flux output (Lumens) – 160
    Lumen maintenance (for 2,000 hours): >96%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 4
    Battery Type/capacity – 3 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 4.6 hours

Warranty – 2 years

23. Solectric 600
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/200 W
    Lighting Wattage: 50 W
    Luminous flux output (Lumens) – 160
    Lumen maintenance (for 2,000 hours): >96%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 4
    Battery Type/capacity – 20 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 5.5 hours
    Warranty – 2 years

24. Sunking Boom
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/2.7 W
    Lighting Wattage: 1.2 W
    Luminous flux output (Lumens) – 160
    Lumen maintenance (for 2,000 hours): >100%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 1
    Battery Type/capacity – 3 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 6 hours
    Warranty – 2 years

25. Sunking Home 250
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/20 W
    Lighting Wattage: 2.3 W
    Luminous flux output (Lumens) – 400
    Lumen maintenance (for 2,000 hours): >100%
    Rated lamp life: greater than 10,000 hours
    Lighting points (number of project lamps) – 1
    Battery Type/capacity – 5.1 Ah (lithium ferro phosphate battery)
    Type of charge controller: Active
    Solar Run time(SRT): 6 hours
    Warranty – 2 years

26. Sunking HLS 120 plus

The technical specifications of this product are –
Type and Solar panel Wattage – Polycrystalline/12 W
Lighting Wattage: 1.4 W
Luminous flux output (Lumens) – 900
Lumen maintenance (for 2,000 hours): >94%
Rated lamp life: greater than 10,000 hours
Lighting points (number of project lamps) – 5
Battery Type/capacity – 12 Ah (lithium ferro phosphate battery)
Type of charge controller: Active
Solar Run time(SRT): 5.1hours
Warranty – 2 years

27. Sunking PICO

The technical specifications of this product are –
Type and Solar panel Wattage – Polycrystalline/0.35 W
Lighting Wattage: 0.28 W
Luminous flux output (Lumens) – 50
Lumen maintenance (for 2,000 hours): >90%
Rated lamp life: greater than 10,000 hours
Lighting points (number of project lamps) – 1
Battery Type/capacity – 400 mAh (lithium ferro phosphate battery)
Type of charge controller: Active
Solar Run time(SRT): 72 hours
Warranty – 2 years

All the project lamps/devices are physically protected against any environmental factors such as rain, heat, insects and ingress etc. All products have passed the requirement as per IEC TS 62257-9-8 which provides baseline requirements for quality, durability and truth in advertising to protect consumers of off-grid renewable energy products. Few of the criteria have been listed below:

I. **Physical Ingress:** All models have IP2X protection for all products, IP3X project for PV modules and IP5X protection for outdoor products
II. **Water Protection:** All models pass the water protection criteria listed below. Degree of protection required is based on product type:

- Fixed separate (indoor): No protection required
- Portable separate: Occasional exposure to rain
- Portable integrated: Frequent exposure to rain
- Fixed integrated (outdoor): Permanent outdoor exposure

- PV modules: Outdoor rooftop installation

After installation of the technology, the VPA implementer ensures that all the data from the Booking Record created at the time of installation is accurately captured in the electronic Booking Record in the Credit Tracker Platform. The VPA implementer has implemented an internal check to verify the accuracy of data entry and to ensure that the data captured in Credit Tracker is identical to the data recorded at the time of installation.

Each *VPA* has unique identifier number that can be attributed to each household and installation within that VPA to ensure no double counting. This identifier is in the form of unique sales receipt number issued when the Household involved in the VPA makes the purchase of a clean energy product (CEP). This information will match with the information displayed on each VPA Credit Tracker Platform, with a copy retained by the customer, thus identifying that each CEP with its unique sales receipt number. The three unique identifiers for each CEP sold by respective VPA implementor is as follows:

Partner	Unique Identification - 1	Unique Identification – 2	Unique Identification - 3
d.light	Purchaser name (Customer name)	Product unique identifier number (Product serial number)	GPS location of the nearest branch of PO which services the household
Juhudi	Purchaser name (Customer name)	National ID number	Bank ID number
Equity	Purchaser name (Customer name)	GPS location of the nearest branch of PO which services the household	Bank ID number

3.2 Deviations

3.2.1 Methodology Deviations

The project does apply methodology deviation.

As per para 30 section 6 of AMS III AR version 5.0, for project lamp that will claim emission reduction up to 7 years, ex-post monitoring surveys to determine percentage of project lamps distributed to end users that are operating and in service shall be conducted during the third year of the crediting period and the results of ex post monitoring survey undertaken during the third year shall be used in years 4, 5, 6 and 7.

Instead of using third year result for year 4,5,6 and 7, PP has conducted annual monitoring which is more conservative than using year 3 results. PP has provided comparative analysis between 2 approaches for installation done in year-3:

Parameter	Using Approach suggested by Methodology	Using the Approach suggested by PP
No of Lamps	251,016	251,016
OFy,i,j	90%	89%
ERs	20,784	20,553

As per year-3 monitoring, usage rate was 90%. If PP used 90% for the current monitoring period for Year-4 and Year-5, total emission reductions would be 20,784 tCO2e. However, PP has conducted annual monitoring resulting in reduction in usage rate i.e. 89% hence total emission reduction is 20,553 tCO2e.

Considering the annual monitoring approach suggested by PP results in more conservative results, PP would like to apply methodology deviation.

3.2.2 Project Description Deviations

Improved cookstove

During the current monitoring period, PP has removed improved cookstove from the VPA as most of the stoves had reached their end of life. The installation schedule of stoves was as follows:

Year	Model	Number of stoves	Lifespan
2016	Jikokoa	427	5
2017	Jikokoa + Jikobora + Jikofresh	2007	5
2018	Jikokoa+Jikobora	676	5
2019	Jikokoa	1149	5
2020	Jikokoa	435	5
2020	BurnXtra	39	3
Total		4733	

More than 50% of stoves had already reached their end of life during the current MP. Hence PP did not include the ICS. Additionally, not accounting for ICS during the current MP is also leading to less emission reduction thus the approach is conservative.

Solar Lamps

Total lamps included in the project activity are 1,069,917 which is more than the type III threshold number of 650,000. As the project is using AMS III AR, the type III threshold of annual emission reduction of 60k tCO_2e is applicable for the project. Total lamp distribution to end user per batch is as follows:

Period	Total Lamps	Total Households
Batch-4	271,884	56,676
Batch-3	251,016	51,722
Batch-2	397,124	100,770
Batch-1	149,893	50,344
Total	**1,069,917**	**259,512**

As evident from the above table the total number of lamps distributed is over 1 million (1,069,917) however the PP is claiming credits only for 650,000 lamps in order to meet the small-scale threshold limit of annual emission reduction of 60k tCO_2e. PP has therefore foregone the credits generated from 419,917 solar lamps installed in 2016 and early 2017 as they are already in their end of life. Hence revised value of $N_{i,y}$ for each batch is as follows:

Period	Total Lamps	Total Households
Batch-4	271,884	56,676
Batch-3	251,016	51,722
Batch-2	127,100	26,651
Batch-1	0	0
Total	**650,000**	**135,049**

3.3 Grouped Projects

This is not a grouped project.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Improved Cookstove

Data / Parameter	$B_{old,p}$
Data unit	tonnes/person/year
Description	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data	A default value of 0.5 tonnes/capita per year has been applied for the stoves using non-renewable biomass. For the stoves using Charcoal a factor of 1/6 would be applied as provided in AMS II.G. version 08
Value applied:	Charcoal: 0.083 tonnes/capita per year
Justification of choice of data or description of measurement methods and procedures applied	Methodology default
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$N_{p,HH}$
Data unit	Number
Description	Average number of persons served per household prior to project implementation
Source of data	Based on the literature review: https://pdf.usaid.gov/pdf_docs/Pnacy934.pdf
Value applied:	4.4

Justification of choice of data or description of measurement methods and procedures applied	Established ex ante prior to project implementation
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$B_{old,HH}$
Data unit	tonnes/household/year
Description	Annual quantity of woody biomass that would have been used in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices
Source of data	Determined ex ante based on calculations
Value applied:	Charcoal: 0.366667 tonnes/household per year
Justification of choice of data or description of measurement methods and procedures applied	Using following calculations: 1. $B_{old,p}$ times $N_{P,HH}$
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$B_{old,i,j}$
Data unit	tonnes/year
Description	Annual quantity of woody biomass that would have been used in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project device type i and batch j
Source of data	This parameter shall be determined ex ante

Value applied:	Charcoal: 0.366667 tonnes/household per year
Justification of choice of data or description of measurement methods and procedures applied	$B_{old,HH}$ divided by $N_{d,HH}$
Purpose of Data	Calculation of baseline emissions
Comments	$B_{old,i,j}$ equals $B_{old,HH}$ when only one project device per household is distributed. This would only involve households where once device would be distributed hence $B_{old,i,j}$ equals $B_{old,HH}$

Data / Parameter	$NCV_{biomass}$
Data unit	TJ/tonne
Description	Net calorific value of biomass
Source of data	The net calorific value of wood & charcoal is as given in 2006 IPCC Guidelines Reference: 2006 IPCC Guidelines for National Greenhouse Gas Inventories Volume 2: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html
Value applied:	Charcoal: 0.029
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of baseline emissions
Comments	The parameter is fixed for the entire crediting period.

Data / Parameter	$EF_{projected\_fossilfuel}$
Data unit	tCO2/TJ
Description	Emission factor: substitution of non-renewable biomass by similar consumers

Source of data	AMS IIG ver 8.0
Value applied:	81.6 tCO2/TJ
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of Data	Calculation of emission reductions
Comments	N/A

Data / Parameter	L_{NRB}
Data unit	Fraction
Description	Fraction to account for leakage related to the non-renewable woody biomass saved by the project activity
Source of data	Default as per AMS II G version 8.0
Value applied:	0.95
Justification of choice of data or description of measurement methods and procedures applied	According to the methodology, default factor of 0.95 can be used to account for leakage related to the non-renewable woody biomass saved by the proposed project
Purpose of Data	Calculation of emission reductions
Comments	N/A

Data / Parameter	$f_{NRB,y}$
Data unit	Fraction
Description	Fraction of woody biomass saved by the project activity during year y that can be established as non-renewable biomass

Source of data	CDM Tool 30 version 3.0
Value applied:	The $f_{NRB,y}$ value for Kenya is 0.97
Justification of choice of data or description of measurement methods and procedures applied	Calculated using CDM Tool 30, v3.0
Purpose of Data	Calculation of baseline emissions
Comments	N/A

Data / Parameter	$n_{old,i,j}$
Data unit	Fraction
Description	Efficiency of pre - project device, which are the conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney.
Source of data	A default value of 0.20 has been used for charcoal based cook stoves (value cited in AMS-II.G version 8)
Value applied:	0.2
Justification of choice of data or description of measurement methods and procedures applied:	Based on the parameter $Stove_{baseline}$
Purpose of data	Calculation of baseline emissions
Comments	Once determined, $n_{old,i,j}$ will remain fixed for the entire crediting period.

Solar Lighting System

Data / Parameter	DV
Data unit	tCO_2/project lamp
Description	Annual emission factor for the baseline lamp

Source of data	Internal records
Value applied	0.092 (for ex-ante estimation only)
Justification of choice of data or description of measurement methods and procedures applied	Default Value
Purpose of Data	Calculation of baseline emissions
Comments	This is based on calculation provided in the methodology based on fuel use rate (0.03 litres/hour), Utilization Rate (3.5 hours/day), Annual Utilization (365 days/year), Fuel Emission Factor (2.4 kgCO2/litre), Leakage Factor (1), Number of lamps replaced per project lamp (1.0 or more) & Net to gross adjustment factor of 1.0.

4.2 Data and Parameters Monitored

Improved Cookstove

Data / Parameter	$N_{y,i,j}$
Data unit	Number
Description	Number of project devices of type i and batch j operating during year y
Source of data	Monitoring surveys
Description of measurement methods and procedures to be applied	Measured directly or based on a representative sample. Sampling standard shall be used for determining the sample size to achieve 90/10 confidence precision. A discount shall be applied based on the percentage of devices operational as determined by the sample survey e.g. if survey shows that 10% of the devices is non-operating, an adjustment factor of 0.9 shall be applied to number of project devices commissioned in a particular batch. Separate samples shall be taken for each batch.
Frequency of monitoring/recording	Atleast once every two years
Value monitored	N/A[20]
Monitoring equipment	N/A

[20] PP has removed ICS sales from the VPA in the current MP

QA/QC procedures to be applied	N/A
Purpose of the data	Calculation of emission reductions
Calculation method	N/A
Comments	Proportion of operational stoves obtained from the survey is multiplied by the total commissioned stoves to arrive at this value.

Data / Parameter	Date of commissioning of batch j
Data unit	Date
Description	To establish the date of commissioning, the devices will be grouped in “batches” and the latest date of commissioning of a device within the batch shall be used as the date of commissioning for the entire batch.
Source of data	Internal records
Description of measurement methods and procedures applied	As per the dates captured in tracker database
Frequency of monitoring/recording	Recorded once at the time of commissioning/distribution of the last project device in the batch
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions.
Calculation method	N/A
Comments	To be reported in Monitoring Report

Data / Parameter	Date of commissioning of project stove i
Data unit	Date
Description	Actual date of commissioning of the project device.
Source of data	Internal records
Description of measurement methods and procedures applied	As per the dates captured in tracker database
Frequency of monitoring/recording	Recorded once at the time of commissioning/distribution.
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions.
Calculation method	N/A
Comments	N/A

Data / Parameter	$Stove_{baseline}$
Data unit	-
Description	This parameter would capture the type of each baseline stove that is being replaced with the project stoves, and would ensure that only inefficient cookstoves are being replaced.
Source of data	Monitoring
Description of measurement methods and procedures applied	Tracked directly at the time on new and efficient stove distribution based on the response by the users/customers of the new stoves

Frequency of monitoring/recording	N/A
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of Baseline emissions
Calculation method	N/A
Comments	This is to ensure that methodological requirement of replacement of only old and inefficient stoves is being met.

Data / Parameter	$n_{old,i,j}$
Data unit	Fraction
Description	Efficiency of pre - project device, which are the conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney.
Source of data	Based on monitoring of devices replaced
Description of measurement methods and procedures applied	Based on the parameter $Stove_{baseline}$ as defined above
Frequency of monitoring/recording	Once for each household when included in the project activity database
Value applied:	0.2
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline emissions

Calculation method	N/A
Comments	Once determined, $n_{old,i,j}$ will remain fixed for the entire crediting period.

Data / Parameter	$n_{new,i,j}$
Data unit	Fraction
Description	Efficiency of the device of each type i and batch j implemented as part of the project activity
Source of data	This will be determined each year as per para 25 (a) of the methodology AMS IIG ver 8.0
Description of measurement methods and procedures applied	A linear efficiency degradation approach has been used as per para 25(a) of the methodology. As per clarification SSC_789, the ICS efficiency is assumed to start degrading from the day of commissioning/distribution. Following approach will be applied for the products included in the program:

Year	Stove efficiency
1 (day 1-day 365)	42.5
2 (day 366-day730)	37.5
3 (day 731- day 1095)	32.5
4 (day 1096- day 1460)	27.5
5 (day 1461-day 1825)	22.5

Any other devices included would follow the same efficiency degradation approach which assumes that efficiency degradation starts from day 1. This is in line with the approach suggested by SSC_789 and is accurate and conservative.

It is more accurate and conservative to consider a drop in efficiency throughout any given year of the crediting period:

- The average efficiency of a given year is applied for the entire year, calculated as the mid-value between the efficiency values at the start and end of that year.

	- Efficiency at any other point in the year can be linearly interpolated. - The decay of efficiency starts on day 1 of the operation, thus the average efficiency of year 1 does not equal the initial efficiency; rather, it is equivalent to the average efficiency for year 1. This means, for example, applicable value for stoves that operated throughout year 1 (i.e. day 1 to day 365 from the start date of the crediting period) will be the average of 45 per cent on day 1 and 40 per cent on day 365 i.e. 42.5 per cent.
Frequency of monitoring/recording	(i) Recorded at the time of commissioning/distribution (ii) Adjusted for the loss of efficiency as per option (a) in para 25 of the methodology: A default schedule of linear decrease in efficiency up to the terminal efficiency assumed as 20 per cent shall be applied through the life span of the project device. For example, if the life span of project device is five years and project device has an efficiency of 30 per cent at commissioning then a 2 per cent decrease in efficiency every year shall be applied;
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	As per para 25 (a) of the methodology AMS IIG ver 8.0
Comments	If the efficiency of the project devices falls below 20%, it is no longer eligible to be considered a project device and it will be restricted from further crediting.

Data / Parameter	Life Span
Data unit	Years
Description	State the operating lifetime of project device for projects opting Equation 6 (above) for updating project stove efficiency during project crediting period.
Source of data	Manufacturer's specifications

Description of measurement methods and procedures applied	Based on the manufacturer's specifications
Frequency of monitoring/recording	Once for each type of project cook stove recorded before distribution
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of Data	Calculation of baseline emissions
Calculation method	N/A
Comments	The lifespan of the improved cookstove is average 5 years.

Data / Parameter	μ_y
Data unit	Fraction
Description	Adjustment to account for any continued use of pre-project devices during the year y
Source of data	MEC Tracker database
Description of measurement methods and procedures applied	This parameter would be monitored using following methods: 1. If the pre-project devices are decommissioned and no longer used, as determined by the monitoring survey its value is 1.0. If both the project devices and pre-project devices are used together, measurement campaigns shall be undertaken using data loggers such as stove utilization monitors (SUMs) which can log the operation of all devices (recording the situation of the device being used or not during any day 'd' of the measurement campaign) in order to determine the average device utilization intensity (to establish the relative share of the usage of the devices). The measurement campaign shall be conducted in at

	least 10 randomly selected participant households of the project activity for at least 90 days during the year y. If seasonal variation is observed, the average value determined through the campaign shall be annualised taking into account seasonal variation of device utilization. 2. Alternatively, surveys may be conducted if the use of data loggers to record the continued operation of baseline devices is demonstrated to be not practical, for example when the baseline device is the three stone fire. The surveys should be designed to capture the cooking habits and stove usage of households in the region, including quantification of use of baseline devices, by formulating questions and/or collecting evidences to determine the frequency of usage of both the project devices and baseline devices. For example if there were 3 pre-project devices per household and it was determined during the survey that use of one of them continues during the crediting period then a conservative adjustment factor of 0.66 is applied for the relevant monitoring period. Another example would be the case where there was only one pre-project device per household and its use during the project period continues along with the project stove to meet 25% of the cooking needs of the household in which case the adjustment factor will be 0.75. Where a more precise data is available i.e. the thermal capacity of the project and pre-project devices and respective utilisation hours, a weighted average adjustment factor may be used
Frequency of monitoring/recording	Atleast once every two years
Value applied:	N/A
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	$N_{d,HH}$
Data unit	Number
Description	Number of project devices distributed per household
Source of data	MEC Tracker platform
Description of measurement methods and procedures applied	N/A
Frequency of monitoring/recording	Recorded at the time of commissioning/distribution of project devices
Value applied:	1
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	-
Calculation method	N/A
Comments	N/A

Solar Lighting System

Data / Parameter	$N_{i,j}$
Data unit	Number of lights
Description	Number of lights distributed to end users, i, type, j
Source of data	MEC tracker platform
Description of measurement methods and procedures applied	The data is recorded in a web-based tracker platform. The data consists of unique number, number of units sold, to whom and where.

Frequency of monitoring/recording	Annual
Value applied:	650,000
Monitoring equipment	N/A
QA/QC procedures applied	Each solar lighting system, and number of solar lamps in each system, has been recorded in the MEC Tracker System. Associated data resides in the MEC Tracker Database, allowing each installation to be monitored.
Purpose of data	Calculation of baseline emissions
Calculation method	N/A
Comments	N/A

Data / Parameter	GF_y
Data unit	Fraction
Description	Grid factor in year y
Source of data	AMS III.AR, version 05.0
Description of measurement methods and procedures applied	In line with para 27 of the methodology, this parameter has been considered equal to 1.0 as charging option deployed is the Solar Charging.
Frequency of monitoring/recording	Default value
Value applied:	1
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline emissions.

Calculation method	N/A
Comments	N/A

Data / Parameter	DB_y
Data unit	Fraction
Description	Dynamic baseline factor in year y
Source of data	AMS III.AR, version 05.0
Description of measurement methods and procedures applied	Option 1: default of 1.0 in the absence of relevant information
Frequency of monitoring/recording	Default value chosen as per Option 1 provided in the methodology
Value applied:	1 (ex-ante)
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline emissions.
Calculation method	N/A
Comments	N/A

Data / Parameter	$OF_{y\ i,j}$
Data unit	Fraction
Description	The percentage of project lamps distributed to end users that are operating and in service

<table>
<tr><td>Source of data</td><td>AMS III.AR, version 05.0</td></tr>
<tr><td>Description of measurement methods and procedures applied</td><td>Monitoring survey has been conducted to arrive at the value of operating fraction. The non-operational lamps (during the monitoring survey) were not accounted during parameter estimation.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>Annual.</td></tr>
<tr><td>Value applied:</td><td>
<table>
<tr><td></td><td colspan="2">Crediting Period</td></tr>
<tr><td>Installation Year</td><td>Year-6</td><td>Year-7</td></tr>
<tr><td>Batch-1</td><td>82.69%</td><td>82.69%</td></tr>
<tr><td>Batch-2</td><td>84.40%</td><td>84.40%</td></tr>
<tr><td>Batch-3</td><td>89.00%</td><td>89.00%</td></tr>
<tr><td>Batch-4</td><td>100.00%</td><td>95.00%</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied</td><td>N/A</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emission reduction.</td></tr>
<tr><td>Calculation method</td><td>The percentage of project lamps that are operating and in service has been considered equal 100 per cent in year 1, 2, and 3. For the project lamps operating in Year 4, 5 and 6, monitoring survey was undertaken during the third year to determine the value.</td></tr>
<tr><td>Comments</td><td>The percentage of project lamps that are operating and in service has been considered equal 100 per cent in year 1, 2, and 3. For the project lamps operating in Year 4, 5 and 6, monitoring survey to be undertaken during the third year to determine the value. PP conducted monitoring in 3rd year and the result was used for the last monitoring period i.e 01/01/2021 to 31/12/2021). However, PP is conducting annual monitoring instead of using Year 3 results for Year 4-6. This is a more conservative approach than using Year-3 results for Years 4-6. Hence for the current monitoring period, fresh monitoring was conducted at the beginning of Year-4. PP has applied methodology deviation and the same is updated in section 3.2.1. During the registration of the CPA under CDM, the technical specification of the products included in the CPA were not available in the format (indicating operational life as 10,000</td></tr>
</table>

	hours) that was needed to opt for Option 2. Hence, PD had to use the available specs and opted for Option 1 (indicating operational life as 5,000 hours). Later, PD was able to acquire the same from the manufacturer. All the products including in the VPA has an operational life of >10,000 hours based on technical specification and third-party test report. Considering the above, PD has changed from Option 1 to Option 2.

Data / Parameter	$Lamps_{baseline}$
Data unit	Fuel type consumed in the baseline lamps
Description	This parameter would capture the fuel type used in baseline lamps that are getting replaced with the project lamps. Project lamps will only be distributed to the households that are using fossil fuel for lighting in the baseline lamps
Source of data	MEC Tracker platform
Description of measurement methods and procedures applied	The lamp used in baseline lamp would be recorded in the database on the basis of information provided by the user
Frequency of monitoring/recording	Once at time of distribution of project devices
Value applied:	100% fossil fuel
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	Calculation of baseline emissions.
Calculation method	N/A
Comments	This is to ensure that methodological requirement of replacement of only fossil fuel fired lamps is being met. This is not used directly in emission reduction equation. A particular project lamp would be counted only if fossil fuel consuming baseline lamp is getting replaced as monitored by this parameter.

4.3 Monitoring Plan

Monitoring for project activity is described below. The monitoring period for which issuance request is submitted is 01-January-2022 to 31-December-2022.The monitoring activity has provided a framework for project preparation and monitoring processes that have been undertaken at the project level.

This schedule has considered the key parameters that are needed during the crediting periods of the project. All required monitoring and documentation have been implemented, reported, consolidated, and managed by the PP or a qualified expert partner to meet verification requirements. Monitored data has been stored in a suite of monitoring databases. This would be updated for each monitoring period:

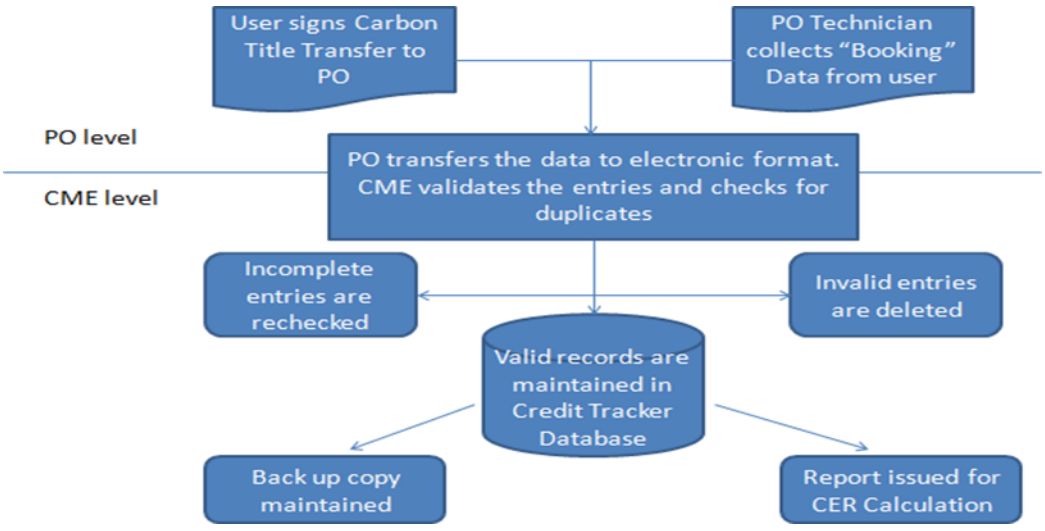
The methods for measuring, recording, storing, aggregating, collating, and reporting data and parameters

1. PP keeps a record of all the CEPs it installs in the MEC Credit Tracker Platform. The record includes the name, date of installation, model of CEP and ID number of the user and mobile number of the user. All records are screened by the PP and crosschecked with the on-ground records to confirm the installation record is authentic and no double counting occurs.

2. The values of the parameter required for ex-post ER calculation number of CEPs still operating are found from sampling of CEP installations

3. The records kept in the MEC Credit Tracker Platform relate to paper copies of title transfer agreements received from individual households.

The organizational structure, responsibilities and competencies of the personnel that will be carrying out monitoring activities



Schematic: Organizational structure diagram for distribution of responsibilities

PP establishes a marketing and lending program for CEPs. This program engages its own staff, as well as local distributors, technicians, and other service providers to effectively market the Clean Energy Products (CEPs) to clients (households). PP followed the monitoring plan and procedures to identify each CEP sold during the project so that the appropriate amount of emissions reductions can be claimed.

Within MEC, the person responsible for carrying out the carbon tasks is the Carbon Operations Manager. This individual is trained using the MEC user manual, which specifies how to complete the inclusion process. This individual has sufficient experience with CDM projects and terminology to successfully carry out the duties. The PP has ensured that Carbon Operations Manager received relevant training and has all necessary competencies to accurately assess and oversee the inclusion process, including the following:

- Knowledgeable on issues relating to Additionality
- Adept at ensuring protocol is followed to prevent double counting

Sampling Approach

As per paragraph 37 of the CDM methodology, AMS III.AR version 5.0***"Percentage of project lamps that are operating and in service can be assumed to be equal to 100 percent in year 1,2 and 3, the result of ex-post monitoring survey undertaken during the third year shall be used in years 4,5,6 and 7"***

Total installations that are part of this VPA has been split into four batches –

Batch 1: Installation falling between 01-March-2016 to 28-February-2017

Batch 2: Installation falling between 01-March-2017 to 28-February-2018

Batch-3: Installation falling between 01-March-2018 to 28-February-2019

Batch-4: Installation falling between 01-March-2019 to 10-November-2019

This segregation has been done because footnote 8 of the applied methodology has distinct monitoring requirements for solar installations in different years of their lifetime. During the current monitoring period, Batch-1 i.e. all the solar lamps distributed in year-1 of crediting period of the project, falls in their 6th and 7th year of operation, Batch-2 i.e. all the solar lamps distributed in year-2 of crediting period, falls in their 5th and 6th year of operations, Batch-3 i.e. all the solar lamps distributed in year-3 of crediting period falls in their 4th and 5th year of operations and Batch-4 i.e. all solar lamps distributed in year-4 of crediting period falls in their 3rd and 4th year of operations. The table below has been added to provide more details:

Batch Wise Installation	Total number of households	Period of installation	Current MP	Operation Year

Batch-1	50,344	01-March-2016 to 28-February-2017	01-January-2022 to 31-December-2022 The current MP falls within CP-6 and CP-7 of the VPA. CP-6: 01-March-2021 to 28-February-2022 CP-7: 01-March-2022 to 28-February-2023 .	Operation Year-6: 01-January-2022 to 28-February-2022 Operation Year-7: 01-March-2022 to 31-December-2022
Batch-2	100,770	01-March-2017 to 28-February-2018		Operation Year-5: 01-January-2022 to 28-February-2022 Operation Year-6: 01-March-2022 to 31-December-2022
Batch-3	51,722	01-March-2018 to 28-February-2019		Operation Year-4: 01-January-2022 to 28-February-2022 Operation Year-5: 01-March-2022 to 31-December-2022
Batch-4	56,676	01-March-2019 to 10-November-2019		Operation Year-3: 01-January-2022 to 28-February-2022 Operation Year-4: 01-March-2022 to 31-December-2022

The methodology allows the PP to assume a value of 100% in the operating years 1, 2 and 3. However during the current monitoring period, ex-post monitoring is required for Batch-1, Batch-2, Batch-3 and Batch-4 as all solar lamps fall beyond 4th year of operations. As per applied methodology, year-4 onwards ex-post monitoring survey shall be undertaken to arrive at $OF_{y,i,j}$ value.

Parameter value ($OF_{y,i,j}$) for batch-1, batch-2, batch-3 and batch-4 was estimated by sampling in accordance with the requirements in the applied methodology separately and independently for this VPA. 90/10 confidence/precision was used as the criteria for reliability of sampling efforts for small-scale project activities (in accordance with CDM Guideline for Sampling and Survey)

.

The equation used for arriving at the required sample was z

$$n \geq \frac{1.645^2 N \times p(1-p)}{(N-1)\times 0.1^2 \times p^2 + 1.645^2 p(1-p)}$$ Equation (1)

Where:

n	=	Sample size
N	=	Total number of households (640,000)
p	=	Our expected proportion (0.50)
1.645	=	Represents the 90% confidence required
0.1	=	Represents the 10% relative precision ($0.1 \times 0.5 = 0.05$ = 5% points either side of p)

A pilot study was conducted to arrive at the value of expected proportion. In order to arrive at the expected proportion 15-20 samples were picked for each batch. Samples were randomly selected from each batch.

The field survey for the monitoring were conducted between 01-September-2022 and 15-October-2022

The table given below summarizes the number of samples calculated and the number of samples considered for the survey:

Batch Wise Installation	Total number of households	Total number of SLS installed in the households	Minimum number of samples as per para 31 of AMS III AR	Number of samples considered for the survey	Province wise number of HHs

Batch-1	50,344	149,893[21]	100	104 households (313 solar lamps)	Coast Region: 5 Mount Kenya Region: 15 Nairobi Region: 14 North Rift: 22 Nyanza: 21 South Rift: 14 Western: 13
Batch-2	100,770	397,124[22]	100	109 households (470 solar lamps	Coast Region: 17 Mount Kenya Region: 10 Nairobi Region: 7 North Rift: 16 Nyanza: 21 South Rift: 27 Western: 11
Batch-3	51,722	251,016	100	100 households (485 solar lamps)	Coast Region: 18 Mount Kenya Region: 7 Nairobi Region: 11 North Rift: 27 Nyanza: 17 South Rift: 15 Western: 5
Batch-4	56,676	271,884	100	100 households (477 solar lamps)	Coast Region: 23 Mount Kenya Region: 15

[21] The total lamps (Batch-1+Batch-2+Batch-3+Batch-4) exceed 650,000 lamps which is the maximum number of lamps that can be included during a crediting period to adhere to SSC threshold type III. Hence, even though PP has conducted monitoring for Batch-1 as per the applied methodology, yet, PP has not accounted for the emission reductions from Batch-1 (149,893 lamps) .

[22] The total lamps (Batch-1+Batch-2+Batch-3+Batch-4) exceed 650,000 lamps which is the maximum number of lamps that can be included during a crediting period to adhere to SSC threshold type III. Even though PP has conducted monitoring for batch-2 as per the applied methodology however PP has not accounted for the emission reductions from 270,024 lamps from batch-2. It has only accounted for emission reduction from only 127,100 solar lamps.

					Nairobi Region: 8 North Rift: 13 Nyanza: 22 South Rift: 11 Western: 8
Total number of solar lamps = 650,000					
Total number of households sampled for monitoring = 259,512[23]					
Total households monitored per batch = atleast 100					

Sampling Objective – The sampling objective for each parameter was to determine via survey with statistically significant value for the emission reduction calculations. This parameter is defined in the tables presented in section 6.1.

During the current monitoring period, sampling was carried out in line with the methodology requirement. Oversampling had been conducted during the current monitoring period in order to in order to compensate for any attrition, outliers or non-response associated with the sample, but also to prevent a situation at the analysis stage where the required reliability is not achieved (10% precision).

The achieved precision value for each installation batch has been summarized in the table below:

Installation Batch	Precision %
Year 1 Installation	7.37%
Year 2 Installation	6.77%
Year 3 Installation	5.78%
Year 4 Installation	3.77%

For year 1, 2, 3 default values for Solar Lighting Systems was applied. For year 4, 5 and 6, monitoring survey was conducted during the third year to arrive at the value as per Option 2, para 5.1.3 of AMS III AR. Version 5.

For ICS parameters as per AMS II.G. version 8, sampling was carried out in line with the methodology requirements. **However. ICS sales have been removed from the VPA during the current monitoring period.**

[23] Total households sampled for monitoring is 259,512. However, total households for which emission reductions are claimed is 135,049 which has already explained in the MR.

Sample method – Simple random sampling was used. Single stage simple random sampling was applied per CDM EB Guidelines for sampling and surveys for CDM project activities and programme of activities, Version 4. To ensure a random sample selection, random number generators was applied. Each CEP in the target population was uniquely identifiable by its number assigned in the credit tracker platform. Each CEP within a sampling frame was allocated a Sample Selection Number in each monitoring period, starting at 1 and increasing up to the total number of CEPs in the Credit Tracker Platform for that pre-defined sampling frame. Applying the random number generators, the CEP was randomly chosen from the defined population up to the required sample size as calculated by the PP.

Implementation - The sampling for surveyed data was implemented consistent with the approach described above.

The monitoring activity provides a framework for project preparation and monitoring processes that was undertaken at the VPA level for this VPA, as required by the CDM rules. This schedule takes into account the key parameters that were needed during the crediting periods of the project. All required monitoring and documentation were implemented, reported, consolidated and managed by the PP to meet verification requirements. Monitored data has been stored in MEC tracker platform.

Summary:

1. Each PO keeps a record of all the CEPs it installs in the MEC Credit Tracker Platform. The record includes the name, date of installation, model of CEP and ID number of the user and mobile number of the user. All records are screened by the PP and crosschecked with the PO records to confirm the installation record is authentic and no double counting occurs.

2. The values of the emission reduction parameters required for ex-post ER calculation, number of CEPs still operating are found from sampling of CEP installations

3. The records kept in the MEC Credit Tracker Platform relate to paper copies of title transfer agreements received from individual households.

Generalities:

The Project proponent coordinated all ex-post monitoring activities in the project activity. The PP was ultimately responsible for implementing the monitoring plan, ensuring the quality of data obtained and the use of this data for emissions reduction calculations. However, the actual field measurements will most likely be performed by third parties contracted to the PP. In the case of using contractors, however, the PP will still be responsible for setting the procedures and providing oversight and training to the contractors. The choice between conducting the actual monitoring activities itself or employing another organization (for example, local marketing firm, university etc) will depend on locational, operational factors and financial factors. For the current monitoring period, surveys were done in-house without hiring any third party.. Monitoring was carried out by enumerators trained by PP according to the procedures and monitoring framework

established below. The survey method that used by PP includes: (a) Face to face interview (b) Survey questionniare.

Primary data was stored by the implementing entities/operators: The MEC Credit Tracker Platform is used to keep detailed records of all installations under the project. Each installation is monitored annually to check usage status. The Project monitors households as per the sample requirement of the methodology. All monitoring records are maintained in the Credit Tracker Platform. PP has also prepared a survey report in line with section 9.4.2 para 64 of the Guideline: Sampling and Survey for CDM project activities and PoA version 4.0. The report contains detail of the statistical design and sampling used along with justification. It also entails statistical methods employed for analyzing the data.

1. The PP maintains in the Credit Tracker Platform a record of all clean energy products that are installed

2. The emissions parameters required for ex-post management are also maintained in the Credit Tracker Platform. These include the number of solar lighting systems still in operation, and then performance of the solar lighting systems. These parameters are determined through a sampling study as described above.

3. The PP uses the Credit Tracker Platform to cross-check the new records with the existing Platform in order to confirm that the installation record is authentic and that no double-counting occurs.

4. The electronic files holding installation records are backed up on the Internet, reducing risk of any loss of data.

5. All monitored data required for verification and issuance has been kept for two years after the end of the crediting period or the last issuance of credits for the project activity, whichever occurs later. The unique system ID number which is linked to a gps location and/or verified address eliminates any risk of double-counting between project activities.

Quality Assurance/Quality control

PP undertakes the following strategies, tailoring the specific approach to the local circumstances:

1) Ensuring end user awareness. At the time of sale, the CEP customer is made aware that they are required to participate in monitoring activities. This will be via training sales personnel to explain the importance of monitoring to each customer, and during regularly scheduled microfinance group meetings for end-users.

2) Questionnaire design. The design of the questionnaire will ensure that the questions are non-intrusive and easy to understand for both the interviewee and interviewer.

3) Drawing on local knowledge. The local contractors to be hired by the PP in each region will play an important role in tailoring the approach to suit local circumstances. For example, in

some instances, it may be essential for a local person to conduct the interview in order to obtain accurate results.

4) Quality of contractors. Any third parties hired by the PP to carry out sampling will be required to demonstrate a high level of cultural awareness, local language skills and appropriate experience with data entry and data management. PP will ensure that contractors are adequately trained for the tasks they are contracted for (eg. carrying out of WBTs in line with a methodology supported by an appropriate international body such as PCIA). Training will also be provided on how to deal with non-responses, refusals and other problems should these occur.

5) End of life product: Lifetime of a product may vary from individual product to product depending on usage handling and other physical factors. Additionally, there are elaborate complaint registration system to assist in systematically tracking and resolving the customer complaints in timely manner. Furthermore, in case of the product becomes non-operational, replacement products will be provided to the end user.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Equation for Improved Cookstove as per CDM small scale methodology – AMS II.G, version 8.0

The applied methodology AMS IIG version 8.0 provides for the default baseline fuelwood consumption of 0.5 tons per person per annum. The f_{NRB} values applied are also based on the CDM Tool 30 v3.0 is 0.97.

According to the methodology

$$ER_y = \sum_i \sum_j ER_{y,i,j} - LE_y$$ Equation

Where:

i	=	Indices for the situation where more than one type of project device is introduced to replace the pre-project devices[24]
J	=	Indices for the situation where there is more than one batch of project device
ER_y	=	Emission reductions during year *y* (tCO_2e)
$ER_{y,i,j}$	=	Emission reductions by project device of type *i* and batch *j* during year *y* (tCO_2e)

[24] For example, in some instances, full replacement of the pre-project device would require the implementation of more than one project device (e.g. one stove suitable for cooking and the other stove suitable for cooking/boiling water).

LE_y = Leakage emissions in the year *y* (tCO_2e)

$$ER_{y,i,j} = B_{y,savings,i,j} \times N_{o,i,j} \times n_{y,i,j} \times \mu_y \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossil\ fuel}$$ Equation (2)

Where:

$B_{y,savings,i,j}$ would be calculated using the equation 6, as per para 20 of AMS II.G. Version 8

$$B_{y,savings,i,j} = B_{old,i,j} \times (1 - \frac{\eta_{old,i,j}}{\eta_{new,i,j}})$$ Equation 6

Value of $Bold_{i,j}$:

As per para 44 of methodology AMS II.G., quantity of woody biomass $B_{old,,}$ has been determined by following approach:

Option 1: A default value of 0.5 tonnes/capita per year to be applied for the stoves using non-renewable biomass.

As per AMS II.G. Version 8, para 25(a) the following approach would be used to arrive at the loss of efficiency and the annual value of $\eta_{new,i,j}$

(a) A default schedule of linear decrease in efficiency up to the terminal efficiency assumed as 20 per cent shall be applied through the life span of the project device. For example, if the life span of project device is five years and project device has an efficiency of 30 per cent at commissioning then a 2 per cent decrease in efficiency every year shall be applied;

A linear efficiency degradation approach would be used as per para 25(a) of the methodology. As per clarification SSC_789, the ICS efficiency is assumed to start degrading from the day of commissioning/distribution. Following approach will be applied for the products included in the project activity:

Year	Stove efficiency
1 (day 1-365)	42.5
2 (day 366-730)	37.5
3 (day 731-1095)	32.5
4 (day 1096- 1460)	27.5
5 (day 1461-1825)	22.5

The decay of efficiency starts on day 1 of the operation, thus the average efficiency of year 1 does not equal the initial efficiency; rather, it is equivalent to the average efficiency for year 1. This means, for example, applicable value for stoves that operated throughout year 1 (i.e. day 1 to day 365 from the start date of the crediting period) will be the average of 45 per cent on day 1 and 40 per cent on day 365 i.e. 42.5 per cent. For any stoves, if initial or manufacturer efficiency is different from 45%, the above table will be modified accordingly.

The project activity involves the household predominantly using Charcoal as fuel. Hence a conversion factor of 6 kg of firewood (wet basis) per kg of charcoal (dry basis) has been used.

Total emission reduction from improved cookstoves in the current monitoring period is 0 tCO_2e.

Equation for Solar Lamps as per CDM small scale methodology – AMS III.AR, version 5.0

The methodology AMS III.AR provides for a default annual baseline emissions factor for the project lamps. The following assumptions are made about the equivalent baseline lighting system:

$$DV = FUR \times O \times U \times EF \div 1000 \times LF \times n \times NTG \quad \text{Equation (1)}$$

Where:

DV = Lamp Emission Factor (0.092 t CO2e per project lamp, assumed for ex-ante estimate)

FUR = Fuel use rate (0.03 liters/hour)

O= Utilization rate (3.5 hours/day)

U= Annual utilization (365 days/year)

EF= Fuel emissions factor (2.4 kgCO2/liter)

LF = Leakage factor (1.0)

n= Number of fuel-based lamps replaced per project lamp (1.0, assumed for ex-ante estimate)

NTG = Net-to-gross adjustment factor (1.0)

Baseline emissions are calculated as per below equation:

$$BE_y = DV \times GF_y \times DB_y \quad \text{Equation (2)}$$

Where:

BE_y = Baseline emissions per project lamp in year y (t CO2e)

GF_y = Grid Factor in year y chosen equal to 1.0 since solar energy is used to charge the solar lamps

DB_y = Dynamic Baseline Factor chosen as equal to 1.0 as per Option 1 given in equation (3) of the methodology (default of 1.0 is considered).

Snapshot of the ex-post calculation under current monitoring period is given below.

Detailed calculation for solar lamps has been provided below:

ER calculation_Year1 installation

Parameter	Description	Unit	Crediting Period Year-6	Crediting Period Year-7	Reference
			Operation Year-6	Operation Year-6	
DV	Default annual baseline emission factor for the project lamp	tCO2	0.092	0.092	Default value AMS-III.AR. Version 5/ VPA-DD
Ni,j	Number of lights distributed to end users, i, type, j	number of lamps	0	0	Monitored. All lamps under this batch is falling beyond the 650,000 cap for the project hence not accounted for ER calculation
GFy	Grid Factor in year y	Fraction	1	1	GFy value has been used as 1 as per para 21 of methodology AMS III.AR. Version 5
DBy	Dynamic baseline factor in year y	Fraction	1	1	Default value chosen as option -1. Baseline fuel information is captured at the time of loan application collected before

					product disbursement which is the baseline scenario.
OFy,i,j	The percentage of project lamps distributed to end users that are operating and in service	Percentage	83%	83%	Monitoring survey has been conducted to arrive at the value of operating fraction. The non-operational lamps (during the monitoring survey) were not accounted during parameter estimation.
$Lamps_{baseline}$	This parameter would capture the fuel type for each baseline lamp that is getting replaced with the project lamps, and would ensure that project lamps are only distributed to the households which are using fossil fuel. Kerosene for lighting in the baseline lamps	-	100%	100%	Baseline fuel information is captured at the time of loan application collected before product disbursement which is the baseline scenario.
BEy	Baseline emissions per	tCO2	0.092	0.092	Calculated

	project lamp in a year y				
BEy	Baseline emissions per project lamp for a day	tCO2	0.000252055	0.000252055	Calculated
BE	Baseline emissions for this monitoring period	tCO2	0	0	Calculated
ERy	Emission reduction achieved for this monitoring period	tCO2	0	0	Calculated

ER calculation_Year2 installation

Parameter	Description	Unit	Crediting Period Year-6	Crediting Period Year-7	Reference
			Operation Year-6	Operation Year-6	
DV	Default annual baseline emission factor for the project lamp	tCO2	0.092	0.092	Default value AMS-III.AR. Version 5/ VPA-DD
Ni,j	Number of lights distributed to end users, i, type, j	number of lamps	127,100	127,100	Monitored. 270,024 Lamps under this batch is falling beyond the 650,000 cap for the project hence only 127,100 lamps have been accounted for ER calculation

GFy	Grid Factor in year y	Fraction	1	1	GFy value has been used as 1 as per para 21 of methodology AMS III.AR. Version 5
DBy	Dynamic baseline factor in year y	Fraction	1	1	Default value chosen as option - 1. Baseline fuel information is captured at the time of loan application collected before product disbursement which is the baseline scenario.
OFy,i,j	The percentage of project lamps distributed to end users that are operating and in service	Percentage	84%	84%	Monitoring survey has been conducted to arrive at the value of operating fraction. The non-operational lamps (during the monitoring survey) were not accounted during parameter estimation.)
$Lamps_{baseline}$	This parameter would capture the fuel type for each baseline lamp that is getting replaced with the project lamps, and would ensure	-	100%	100%	Baseline fuel information is captured at the time of loan application collected before product disbursement

	that project lamps are only distributed to the households which are using fossil fuel. Kerosene for lighting in the baseline lamps				which is the baseline scenario.
BEy	Baseline emissions per project lamp in a year y	tCO2	0.092	0.092	Calculated
BEy	Baseline emissions per project lamp for a day	tCO2	0.000252055	0.000252055	Calculated
BE	Baseline emissions for this monitoring period	tCO2	1,890.13	9,803.07	Calculated
ERy	Emission reduction achieved for this monitoring period	tCO2	1,595.34	8,274.15	Calculated

ER calculation_Year3 installation

Parameter	Description	Unit	Crediting Period Year-6	Crediting Period Year-7	Reference
			Operation Year-6	Operation Year-6	
DV	Default annual baseline emission factor	tCO2	0.092	0.092	Default value AMS-III.AR. Version 5/ VPA-DD

	for the project lamp				
Ni,j	Number of lights distributed to end users, i, type, j	number of lamps	251,016	251,016	Monitored
GFy	Grid Factor in year y	Fraction	1	1	GFy value has been used as 1 as per para 21 of methodology AMS III.AR. Version 5
DBy	Dynamic baseline factor in year y	Fraction	1	1	Default value chosen as option - 1. Baseline fuel information is captured at the time of loan application collected before product disbursement which is the baseline scenario.
OFy,i,j	The percentage of project lamps distributed to end users that are operating and in service	Percentage	89%	89%	Monitoring survey has been conducted to arrive at the value of operating fraction. The non-operational lamps (during the monitoring survey) were not accounted during parameter estimation.

$Lamps_{baseline}$	This parameter would capture the fuel type for each baseline lamp that is getting replaced with the project lamps, and would ensure that project lamps are only distributed to the households which are using fossil fuel. Kerosene for lighting in the baseline lamps	-	100%	100%	Baseline fuel information is captured at the time of loan application collected before product disbursement which is the baseline scenario.
BEy	Baseline emissions per project lamp in a year y	tCO2	0.092	0.092	Calculated
BEy	Baseline emissions per project lamp for a day	tCO2	0.000252055	0.000252055	Calculated
BE	Baseline emissions for this monitoring period	tCO2	3,732.92	19,360.55	Calculated
ERy	Emission reduction achieved for this monitoring period	tCO2	3,322.30	17,230.89	Calculated

ER calculation_Year4 installation

Parameter	Description	Unit	Crediting Period Year-6	Crediting Period Year-7	Reference
			Operation Year-6	Operation Year-6	
DV	Default annual baseline emission factor for the project lamp	tCO2	0.092	0.092	Default value AMS-III.AR. Version 5/ VPA-DD
Ni,j	Number of lights distributed to end users, i, type, j	number of lamps	271,884	271,884	Monitored
GFy	Grid Factor in year y	Fraction	1	1	GFy value has been used as 1 as per para 21 of methodology AMS III.AR. Version 5
DBy	Dynamic baseline factor in year y	Fraction	1	1	Default value chosen as option - 1. Baseline fuel information is captured at the time of loan application collected before product disbursement which is the baseline scenario.
OFy,i,j	The percentage of project lamps distributed to end users that	Percentage	100%	95%	Monitoring survey has been conducted for 7th year to arrive at the value of operating fraction. The non-

	are operating and in service				operational lamps (during the monitoring survey) were not accounted during parameter estimation
$Lamps_{baseline}$	This parameter would capture the fuel type for each baseline lamp that is getting replaced with the project lamps, and would ensure that project lamps are only distributed to the households which are using fossil fuel. Kerosene for lighting in the baseline lamps	-	100%	100%	Baseline fuel information is captured at the time of loan application collected before product disbursement which is the baseline scenario.
BEy	Baseline emissions per project lamp in a year y	tCO2	0.092	0.092	Calculated
BEy	Baseline emissions per project lamp for a day	tCO2	0.000252055	0.000252055	Calculated
BE	Baseline emissions for this monitoring period	tCO2	4,043.25	20,970.08	Calculated

ERy	Emission reduction achieved for this monitoring period	tCO2	4,043.25	19,921.57	Calculated

Solar Lighting System

Crediting Period	Period	Emission Reduction (round off)
Year-6*	01-01-2022 to 28-02-2022	0+1,595.34+3,322.30+4.043.25=8.960
Year-7	01-03-2022 to 31-12-2022	0+8,274.15+17,230.89+19,921.57 =45,427
Total		**Year 6+ Year 7 = 8,960 + 45,427 = 54,387 tCO_2e**

*Crediting Period Year-6 requesting issuance under VCS is spanning from 01-03-2021 to 28-02-2022. Period between 01-03-2021 to 31-12-2021 has already issued 43,317 VCUs under VERRA. Hence, total emission reduction for Crediting Period Year-6 becomes 43,317 + 8,960 = 52,277 tCO_2e which is below the Type III SSC threshold as per AMS III AR methodology

5.2 Project Emissions

Equation for Improved Cookstove as per CDM methodology – AMS II.G, version 8.0

The equation for calculating emission reductions already accounts for project emissions.

Equation for Solar Lamps as per CDM methodology – AMS III.AR, version 5.0

Project emissions, PEy = 0 since project lamps have photovoltaic system that are charged using solar energy.

5.3 Leakage

Equation for Improved Cookstove as per CDM methodology – AMS II.G, version 8.0

Leakage is considered as default 0.95 as per methodology

Equation for Solar Lamps as per CDM methodology – AMS III.AR, version 5.0

Leakage factor is assumed equal to 1.0 as per the methodology

5.4 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)
2022 (01-January-	54,387	0	0	54,387

022 to 31-December-022)				
Total	**54,387**	0	0	**54,387**

Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference
59,800	54,387	~9%	The ex-ante emissions reductions is calculated on 100% usage rate however, products may get damaged during the course of the crediting period. Hence, there is a difference.