MICROENERGY CREDITS – MICROFINANCE FOR CLEAN ENERGY PRODUCT LINES – AFRICA – SOLAR LAMPS AND EFFICIENT COOKSTOVES – 10341 – CPA -0003

Document Prepared by MicroEnergy Credits Corporation

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

In urban areas of 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 project activity involves marketing, distributing, and financing approximately 650,000 solar lighting systems (SLS) and 75,000 improved cook stoves (ICS), for low-income households, community organizations and small/medium enterprises across Kenya. These products provide clean, renewable energy for cooking and lighting.

The improved cookstove distribution is focused on urban areas of Kenya and solar lamps distribution is focused in rural areas of Kenya. No implementation of cookstove until the current monitoring period.

The technologies employed by this project activity includes 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.

- Improved cookstoves

No implementation of improved cookstove till the end of the current monitoring period because VPA implementor was unable to establish proper supply chain

- Solar Lighting System

There will be 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[1] –

[1] As per manufacturer's product information sheet

1. Sun King Pro 2
   The technical specifications of this product are –
   Type and Solar panel Wattage: Polycrystalline/3 W
   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
   Lifetime of module – 15 years
   Battery lifetime – 5 years
   Electronics lifetime – 5 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
   Lifetime of module – 15 years
   Battery lifetime – 5 years
   Electronics lifetime – 5 years

3. d.light 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
Lifetime of module – 15 years
Battery lifetime – 5 years
Electronics lifetime – 5 years

4. d.light 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
   Lifetime of module – 15 years
   Battery lifetime – 5 years
   Electronics lifetime – 5 years

5. d.light 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
   Lifetime of module – 15 years
   Battery lifetime – 5 years
   Electronics lifetime – 5 years

6. d.light 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
Lifetime of module – 15 years
Battery lifetime – 5 years
Electronics lifetime – 5 years

7. d.light 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
Lifetime of module – 15 years
Battery lifetime – 5 years
Electronics lifetime – 5 years

8. d.light 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
Lifetime of module – 15 years
Battery lifetime – 5 years
Electronics lifetime – 5 years

9. d.light 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
   Lifetime of module – 15 years
   Battery lifetime – 5 years
   Electronics lifetime – 5 years

10. d.light 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
    Lifetime of module – 15 years
    Battery lifetime – 5 years
    Electronics lifetime – 5 years

11. d.light 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

12. d.light 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

13. d.light 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): 7 hours
    Warranty – 2 years

14. d.light X850 Plus
    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 – 10 Ah (lithium ferro phosphate battery)
Type of charge controller: Active
Solar Run time(SRT): 7 hours
Warranty – 2 years

15. Sunking Home 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): 4 hours
    Warranty – 2 years

16. 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

17. 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

18. 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

19. 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

20. 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

21. 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

22. Solectric 600
    The technical specifications of this product are –
    Type and Solar panel Wattage – Polycrystalline/5 W
    Lighting Wattage: 200 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

23. 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

24. Sunking Home 250

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. Orb Energy Sol-300

The technical specifications of this product are –
Type and Solar panel Wattage – Polycrystalline/100W
Lighting Wattage: 6W
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) – 4
Battery Type/capacity – 1.8 Ah (lithium ferro phosphate battery)
Type of charge controller: Active
Solar Run time(SRT): 5-6 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

All the lamps under this project activity would fall under Option 2: Project lamps are assumed to operate up to seven years after the distribution to end users. Therefore, under this option, emission reductions may only be claimed up to seven years.

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	648,367	650,000

The solar lighting systems are implemented from 11/11/2019 to 31/12/2020. No new sales have been added in the current monitoring period. The total emission reductions achieved in this monitoring period for the VPA is **59,275 tCO2e.**

Audit Type	Period	Program	VVB Name	Number of years
Validation under CDM	27-October-2020	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0003	Earthood	NA
Gap validation under VERRA	23-February-2023	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0003	Earthood	NA
Verification (under CDM)	05-November-2020 to 31-December-2020	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0003	Earthood	0.16
Verification[2] (Under VERRA)	11-November-2019 to 04-November-2020 and 01-January-2021 to 31-December-2021	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0003	Earthood	2

[2] As per para 4.1.23 (1) for VCS standard 4.4, for a gap validation project which is the case of this VPA, same VVB can be used for subsequent verifications. Additionally, as per para 4.1.23 (2), A validation/verification body shall not verify more than six consecutive years of a project's GHG emission reductions or removals. This is the 5th verification by the same VVB.

Verification (Under VERRA)	01-January-2022 – 31-December-2022	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0003	Earthhood	1
Total	11-November-2019-- 31-December-2022	MicroEnergy Credits – Microfinance for Clean Energy Product Lines – Africa – Solar Lamps & Efficient cook stoves – 10341 –CPA – 0003	Earthood	~3

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 $ktCO_2e$.

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 sriskandh@microenergycredits.com
Telephone	+91-9999997592
Email	sriskandh@microenergycredits.com

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

11 November 2019 i.e. the date of sale of first clean energy product under the project activity.

1.6 Project Crediting Period

Crediting Period: Renewable, 7 years

Start and End Date: 11-November-2019 – 10-November-2026

1.7 Project Location

The products sold is restricted to the boundary of the Republic of Kenya with coordinates 0°1' 24.8" S latitude and 37°54.372' E longitude[3]. The activity involves 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 will be recorded in MicroEnergy Credit's Credit Tracker Platform.

[3] 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) [4]
- AMS-III.AR.: Substituting fossil fuel-based lighting with LED/CFL lighting systems --- Version 5.0[5]

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

- CDM TOOL21 "Demonstration of additionality of small-scale project activities" Version 10.0[6];
- CDM TOOL30 "Calculation of the fraction of non-renewable biomass" Version 03[7];

[4] https://cdm.unfccc.int/methodologies/DB/GNFWB3Y6GM4WPXFRR2SXKS9XR908IO
[5] https://cdm.unfccc.int/methodologies/DB/S3RZMK6KR289WKK0VB1ETT6K73Y3DR
[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v1.pdf/history_view
[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-30-v1.pdf/history_view

- CDM Guideline "Sampling and surveys of CDM project activities and programmes of activities" version 04;
- 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 3 of the CDM PoA 10341. The link to this activity on the CDM website is provided-

https://cdm.unfccc.int/ProgrammeOfActivities/cpa_db/view

The project has issued credits under CDM for period between 05-November-2020 to 31-December-2020. The total CERs issued was 8,778. The project transitioned to VERRA and completed the first issuance for period 01-October-2018 to 04-November-2020 and 01-January-2021 to 31-December-2021. Total VCUs issued were 88,893.

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.

1.10.2 Other Forms of Environmental Credit

The project has not sought or received any other form of GHG – related environmental credits during 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 July 2023 onwards hence this section is not applicable for the current monitoring period i.e., 01-January-2022 to 31-December-2022.

[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

1.11 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 spend 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	No further changes during the current monitoring period	The project has provided 648,367 solar lamps to 135,419 low-income households across Kenya
2)	7.1	7.1.2 Proportion of population with primary reliance on clean fuels and technology	Increase	No further changes during the current monitoring period.	The project has provided affordable and clean energy to approx. 135,419 low-income households (648,367 solar lamps)
3)	13.0	13.2.2 Tonnes of greenhouse gas emissions avoided or removed	Increase	The project has generated 59,275 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 157,036 tCO_2e emission reductions.

2 SAFEGUARDS

2.1 No Net Harm

There are 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 25th Feb 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 during the physical meeting:

MicroEnergy Credit Corp

West End Towers, Waiyaki Way

Nairobi 10719, Kenya

Email ID: contact@microenergycredits.com

During the current monitoring period no comments or grievance have been received. There is grievance book at the local office and email ID provided to stakeholders in order for recording the grievance.

2.3 AFOLU-Specific Safeguards

Since this is a non AFOLU project, this section is not filled.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

PP started the implementation the project on 11/11/2019. Various models of solar lighting system have been distributed across the rural areas of Kenya. Implementation of improved cookstoves

hasn't started until the end of the current monitoring period. 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

After the installation, 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

3.2 Deviations

3.2.1 Methodology Deviations

The project does not apply any methodology deviations.

3.2.2 Project Description Deviations

The project does not apply any project deviations.

3.3 Grouped Projects

The project 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: arcgis.com
Value applied:	4.0
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: 0.33 tonnes/household per year
Justification of choice of data or description of measurement methods	Using following calculations: 1. $B_{old,p}$ times $N_{P,HH}$

and procedures applied	
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: 0.33 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	According to the methodology, default factor of 0.95 can be used

data or description of measurement methods and procedures applied	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 v3.0
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	Default value
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

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 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. Distribution of ICS has not taken place until the end of the current monitoring period
Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of 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 monitored	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	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 monitored	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 monitored	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 monitored	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

<table>
<tr><td></td><td>commissioning/distribution. Following approach will be applied for the products included in the program:

<table><tr><th>Year</th><th>Stove efficiency</th></tr><tr><td>1 (day 1-day 365)</td><td>42.5</td></tr><tr><td>2 (day 366-day730)</td><td>37.5</td></tr><tr><td>3 (day 731- day 1095)</td><td>32.5</td></tr><tr><td>4 (day 1096- day 1460)</td><td>27.5</td></tr><tr><td>5 (day 1461-day 1825)</td><td>22.5</td></tr></table>
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.</td></tr>
<tr><td>Frequency of monitoring/recording</td><td>(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;</td></tr>
<tr><td>Value monitored</td><td>0.45</td></tr>
</table>

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 monitored	5 years
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 monitored	1.0 (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	$N_{d,HH}$
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 monitored	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 monitored	648,367
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 monitored	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; Option 1
Description of measurement methods and procedures applied	Calculated as either: a) Option 1: default of 1.0 in the absence of relevant information; b) Option 2: value of 1.0+FFg where FFg is the documented

	national growth rate of kerosene fuel use in lighting from the preceding years (use the most recent available data for a three or five years average (fraction))
Frequency of monitoring/recording	Default Option 1
Value monitored	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	$OF_{y\ i,j}$
Data unit	Fraction
Description	The percentage of project lamps distributed to end users that are operating and in service
Source of data	AMS III.AR, version 05.0
Description of measurement methods and procedures applied	See comments below.
Frequency of monitoring/recording	Monitoring survey to be conducted in 3rd year of crediting period.
Value monitored	Installation Year Year-3 / Year-4 Batch-1: 100% / 95% Batch-2: 100% / 100%
Monitoring equipment	N/A

QA/QC procedures applied	N/A
Purpose of data	Calculation of emission reductions.
Calculation method	N/A
Comments	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. 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 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 monitored	100% fossil fuel

Monitoring equipment	N/A
QA/QC procedures applied	N/A
Purpose of data	This is to fulfil the methodology applicability criterion; that each lamp replaced would ensure that baseline fuel is fossil fuel
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 provides a framework for project preparation and monitoring processes that will be undertaken at the project level.

This schedule takes into account 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. These will be updated each monitoring period:

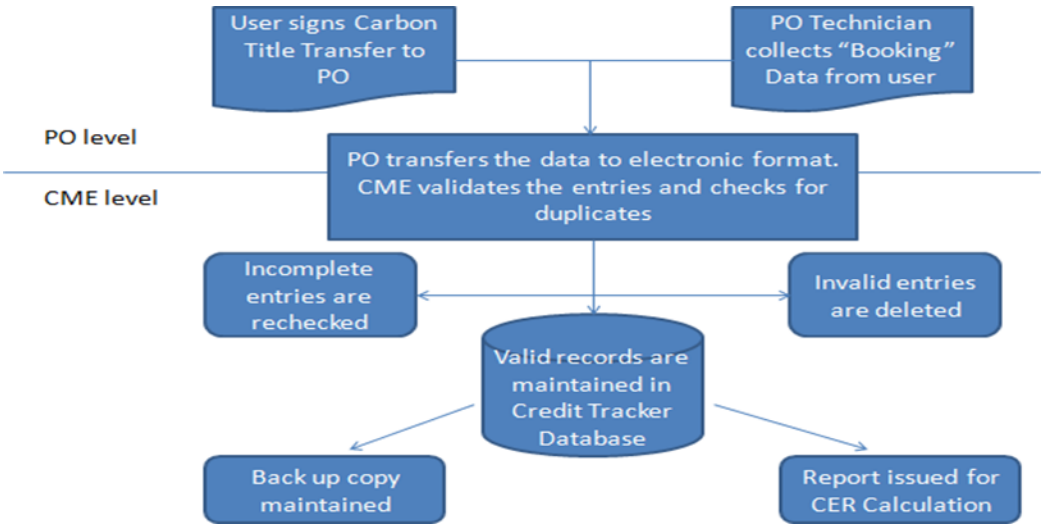
The methods for measuring, recording, storing, aggregating, collating and reporting data and parameters

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



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 8.0***"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 two batches –

Batch 1: Installation falling between 11-November-2019 to 10-November-2020

Batch 2: Installation falling between 11-November-2020 to 10-November-2021

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 3rd and 4th year of operation whereas Batch-2 i.e. all the solar lamps distributed in year-2 of crediting period, falls within 1-3 years of operation. 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	120,783	11-November-2019 to 10-November-2020	01-January-2022 to 31-December-2022 The current MP falls within CP-3 and CP-4 of the VPA. CP-3: 11-November-2021 to 10-November-2022 CP4: 11-November-2022 to 10-November-2023 .	Operation Year-3: 01-January-2022 to 10-November-2022 Operation Year-4: 11-November-2022 to 31-December-2022
Batch-2	14,636	11-November-2020 to 10-November-2021		Operation Year-2: 01-January-2022 to 10-November-2022 Operation Year-3: 11-November-2022 to 31-December-2022

The methodology allows the PP to assume a value of 100% only in the operating year 1, 2 and 3, therefore no monitoring is required for Batch-2, whereas ex-post monitoring is required for Batch-1 because solar lamps fall under both year-3 and year-4 of operation. 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 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 to arrive at the required sample size was as follows:

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

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	Number of households selected for the monitoring survey	Province wise number of households
Batch-1	120,783	581,615	100[10]	Nyanza= 16 Coast Region= 6 Mount Kenya Region= 15 Nairobi Region= 9 North Rift= 13 South Rift= 24 Western= 17
Batch-2	14,636	66,752	No monitoring is required to be conducted as per paragraph 37 of AMS.III.AR (version 8) which allows use of default value of 100% for Year 1, 2 and 3.	
Total number of households= 135,419				
Total number of households sampled for monitoring = 120,783				

[10] Paragraph 39 of the methodology AMS.III.AR (version 8.0) specifies a minimum sample size of 100 for the survey.

Total households monitored = 100

Sampling Objective – The sampling objective for the parameter ($OF_{y,i,j}$) 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 has been carried out in line with the methodology requirement. The reliability calculations for the operating and in-service level (for Batch-1) have been summarized in the table below:

Generalities:

The Project proponent has 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. The actual field measurements to be conducted during monitoring (e.g. testing of ICS selected during sampling) was performed by the PP. The Project Proponent (PP) has provided local insight into questionnaire design, interview technique and for gaining physical access to project beneficiaries to obtain accurate results during monitoring therefore during the current monitoring period, no local partner was hired. Monitoring has been carried out by the operating entity of the project activity according to the procedures and monitoring framework established below and has been submitted to the managing entity. The PP has stored the data in an electronic database.

Primary data has been stored by the implementing entities/operators: The MEC Credit Tracker Platform has been used to keep detailed records of all installations under the project. Each installation is monitored annually to check usage status. The Project has monitored a representative sample of households that have received the solar lighting technology. All monitoring records have been maintained in the Credit Tracker Platform.

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

2. The emissions parameters required for ex-post management have been 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 have been backed up on the Internet, reducing risk of any loss of data.

5. All monitored data required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs 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 undertook the following strategies, tailoring the specific approach to the local circumstances:

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

2) Questionnaire design. The design of the questionnaire had ensured that the questions were non-intrusive and easy to understand for both the interviewee and interviewer.

3) Drawing on local knowledge: The PP in each region has played an important role in tailoring the approach to suit local circumstances..

4) Quality of contractors. No local contractor or their party was hired during the current monitoring period.

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 is an 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, repair services were 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 CDM Tool 30 v3.0 is 0.97.

According to the methodology

$$ER_y = \sum_i \sum_j ER_{y,i,j} - LE_y \qquad \text{Equation (1)}$$

Where:

i	=	Indices for the situation where more than one type of project device is introduced to replace the pre-project devices[11]
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)
LE_y	=	Leakage emissions in the year *y* (tCO_2e)

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

Where:

$B_{y,savings,i,j}$	=	Quantity of woody biomass that is saved per cookstove device of type *i* and batch *j* during year *y* (tonnes)
$f_{NRB,y}$	=	Fraction of woody biomass that can be established as non-renewable biomass[12] (fraction or %)
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne, based on the gross weight of the wood that is 'air-dried')
$EF_{projected\_fossilfuel}$	=	Emission factor of fossil fuels projected to be used to substitute non-renewable woody biomass by similar consumers (tCO_2e/TJ).
$N_{0,i,j}$	=	Number[13] of project devices of type *i* and batch *j* commissioned (number)
$n_{y,i,j}$	=	Proportion of commissioned project devices of type *i* and batch *j* ($N_{y,i,j}$) that remain operating in year *y* (fraction)
μ_y	=	Adjustment to account for any continued use of pre-project devices during the year *y*

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

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

Considering, only one ICS will be provided per households, therefore,

[11] 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).

[12] Default values endorsed by designated national authorities and approved by the Board are available at <http://cdm.unfccc.int/methodologies/standard_base/index.html>.

[13] Project devices may be commissioned in batches. See paragraph **Error! Reference source not found.**.

$B_{old,i,j} = B_{old,HH} = B_{old,p} * N_{p,HH}$

Value of $Bold_{i,j}$:

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

Option 1: A default value of 0.5 tonnes/capita per year for $B_{old,p}$ 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;

No improved cookstove distributed till the end of the current monitoring period.

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:

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

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:

$$BEy=DV\times GFy\times DBy \qquad \text{Equation (2)}$$

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 of the current monitoring period is mentioned below. The detailed calculation is provided in the emission reduction sheet.

ER calculation for installation done in Year-1

Parameter	Description	Unit	Year-3	Year-4	Reference
DV	Default annual baseline emission factor for the project lamp	tCO2	0.092	0.092	Default value AMS-III.AR. Version 5/ CPA-DD
Ni,j	Number of lights distributed to end users, i, type, j	number of lamps	581,615	581,615	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	100%	95%	Default value of 100% as per Option-2 of Metholodogy AMS-III.AR v5 doesn't require monitoring for this parameter for first three years (all lamps part of the CPA are within three years from the date of

					installation at the end of monitoring period)
Lampsbaseline	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	46,032.04	7,476.54	Calculated
ERy	Emission reduction achieved for this monitoring period	tCO2	46,032.04	7,102.71	Calculated

ER calculation for installation done in Year-2

Parameter	Description	Unit	Year-3	Year-4	Reference

DV	Default annual baseline emission factor for the project lamp	tCO2	0.092	0.092	Default value AMS-III.AR. Version 5/ CPA-DD
Ni,j	Number of lights distributed to end users, i, type, j	number of lamps	66,752	66,752	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	100%	100%	Default value of 100% as per Option-2 of Metholodogy AMS-III.AR v5 doesn't require monitoring for this parameter for first three years (all lamps part of the CPA are within three years from the date of installation at the end of monitoring period)

Lampsbaseline	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	5,283.10	858.08	Calculated
ERy	Emission reduction achieved for this monitoring period	tCO2	5,283.10	858.08	Calculated

Crediting Period	Period	Emission Reduction (round off)
Year-3*	01-01-2022 to 10-11-2022	46,032.04+5,283.10 = 51,315
Year-4	11-11-2022 to 31-12-2022	7,102.71+858.08 = 7,961
Total		51,315 + 7,961 = 59,275 (rounded down)

*Crediting Period Year-3 requesting issuance under VCS is spanning from 11-11-2021 to 10-11-2022. Period between 11-11-2021 to 31-12-2021 has already issued 8,335 VCUs under VERRA. Hence, total emission reduction for Crediting Period Year-3 becomes 51,315 + 8,335 = 59,650 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-2022 – 31-December-2022)	59,275	0	0	59,275
Total	**59,275**	**0**	**0**	**59,275**

Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference
59,800	59,275	~1%	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.