



# Verified Carbon Standard

## UPENERGY-SOCIAL AND CLIMATE IMPACT PROGRAMME- NIGERIA-1



Document Prepared by UpEnergy Group

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# CONTENTS

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- 1 PROJECT DETAILS..... 4**
  - 1.1 Summary Description of the Project ..... 4
  - 1.2 Sectoral Scope and Project Type ..... 5
  - 1.3 Project Eligibility ..... 5
  - 1.4 Project Design ..... 6
  - 1.5 Project Proponent ..... 8
  - 1.6 Other Entities Involved in the Project ..... 9
  - 1.7 Ownership..... 9
  - 1.8 Project Start Date ..... 9
  - 1.9 Project Crediting Period ..... 10
  - 1.10 Project Scale and Estimated GHG Emission Reductions or Removals ..... 10
  - 1.11 Description of the Project Activity ..... 11
  - 1.12 Project Location ..... 13
  - 1.13 Conditions Prior to Project Initiation ..... 14
  - 1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks ..... 14
  - 1.15 Participation under Other GHG Programs ..... 14
  - 1.16 Other Forms of Credit..... 14
  - 1.17 Sustainable Development Contributions ..... 15
  - 1.18 Additional Information Relevant to the Project ..... 20
  
- 2 SAFEGUARDS ..... 20**
  - 2.1 No Net Harm ..... 20
  - 2.2 Local Stakeholder Consultation ..... 20
  - 2.3 Environmental Impact ..... 25
  - 2.4 Public Comments ..... 26
  - 2.5 AFOLU-Specific Safeguards ..... 26
  
- 3 APPLICATION OF METHODOLOGY..... 26**
  - 3.1 Title and Reference of Methodology ..... 26
  - 3.2 Applicability of Methodology ..... 26
  - 3.3 Project Boundary ..... 29
  - 3.4 Baseline Scenario ..... 30

3.5	Additionality .....	33
3.6	Methodology Deviations .....	35
<b>4</b>	<b>IMPLEMENTATION STATUS .....</b>	<b>35</b>
4.1	Implementation Status of the Project Activity .....	35
<b>5</b>	<b>ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS.....</b>	<b>35</b>
5.1	Baseline Emissions .....	35
5.2	Project Emissions .....	36
5.3	Leakage.....	36
5.4	Estimated Net GHG Emission Reductions and Removals.....	36
<b>6</b>	<b>MONITORING .....</b>	<b>40</b>
6.1	Data and Parameters Available at Validation .....	40
6.2	Data and Parameters Monitored .....	44
6.3	Monitoring Plan .....	47
<b>7</b>	<b>QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS .....</b>	<b>52</b>
7.1	Data and Parameters Monitored.....	52
7.2	Baseline Emissions .....	54
7.3	Project Emissions .....	54
7.4	Leakage.....	54
7.5	Net GHG Emission Reductions and Removals.....	54
	<b>APPENDIX 1: CALIBRATION CERTIFICATES.....</b>	<b>60</b>
	<b>APPENDIX 2: FNRB ASSESSMENT .....</b>	<b>64</b>

# 1 PROJECT DETAILS

## 1.1 Summary Description of the Project

**A summary description of the technologies / measures to be implemented by the project.**

The project activity involves promotion and distribution of Improved Cooking Stoves (ICS) in Nigeria. The purpose of the project is to support clean cooking interventions that moves end-user to reduce greenhouse gas (GHG) emissions from the burning of non-renewable biomass-based charcoal for cooking in Nigeria.

Through this project, the distribution and installation of approximately 500,000 operational ICS will be undertaken for households in Nigeria. The annual average emission reductions per year are estimated to be 1,633,731 tCO<sub>2e</sub> and over a 7-years period of are approximately 11,436,117 tCO<sub>2e</sub>.

The end user will sign or informed about carbon credit waiver with the help of sales receipt cum warranty information in advance that the use of ICS generates carbon finance which in turn is used for subsidizing the price of ICS and for recovering project implementation costs. End users will also be informed at the time of ICS distribution in the warranty card that the subsidized price of the ICS is in lieu of them generating carbon credits as well as the fact that the ownership of these credits lies with the project proponent. The key timelines and distribution information of ICS are as given in the table below,

### Installation Details of ICS

<b>Date of first ICS installed</b>	<b>07-May-2022</b>
<b>No. of ICS Distributed (till 31-October-2022)</b>	<b>1,648</b>

### Project Developers/Proponent: -

<b>Project Developer</b>	UpEnergy Group
<b>Project Representatives</b>	Climate Catalyst, Nigeria Ltd

### Location of the project

The project activity is being implemented in Nigeria. The details of the project location are provided in Section 1.12.

### An explanation of how the project is expected to generate GHG emission reductions or removals

The project activity will distribute improved cookstoves in the project area to support low-income households. The ICS will substitute the currently common cooking on open fire. The ICS burns charcoal more efficiently thereby improving thermal transfer to pots, hence saving fuel and lowering greenhouse gas emissions.

**Scenario existing prior to the implementation of project activity**

Prior to the implementation of the project activity the existing scenario recorded as the use of traditional cook stoves and the use of non-renewable biomass by the target population to meet similar thermal energy needs and which also cause high GHG emissions in absence of project activity.

**A brief description of the project activity instances implemented at the time of validation.**

The first project activity instance was implemented on 07-May-2022 under this grouped project activity. 1,648 project activity instances i.e., ICS have been implemented till 31-October-2022.

<u>Audit Type</u>	<u>Period</u>	<u>Program</u>	<u>VVB Name</u>	<u>Number of years</u>
Validation cum Verification	(07-May-2022 – 31-October-2022)	UPENERGY-SOCIAL AND CLIMATE IMPACT PROGRAMME-NIGERIA-1	Earthood Services Private Limited	First Year

**Total emission reductions achieved in this monitoring period:**

During the Current Monitoring Period from 07-May-2022 to 31-October-2022 (First and last date included) the project activity has contributed 1,459 tCO<sub>2e</sub> GHG reductions.

## 1.2 Sectoral Scope and Project Type

The project is categorized under type/category as below:

**Sectoral Scope:** 03 Energy Demand.

**Project Type:** Type II Energy Efficiency Improved Projects

The project is a grouped project.

## 1.3 Project Eligibility

The project involves energy efficient cookstove distribution which falls under the category of efficiency improvements in thermal applications, therefore it is eligible under the scope of VCS Program. As per VCS Standard Version 4.4, efficiency improvements in thermal applications (e.g., cook stoves) are not excluded, hence project is eligible under VCS.

Also as mentioned in the VCS standard Version 4.4 section 3.6.16 & 17 this project satisfies all the criteria's mentioned. The justification for all the criterions has been given in the section 1.4 project design "eligibility".

## 1.4 Project Design

The project is a grouped project.

### Eligibility Criteria

The below table enumerates the eligibility criteria for this grouped project in line with section 3.6.16 of VCS standard Version 4.4

No.	Eligibility Criterion	How the project activity instances to comply
1	Meet the applicability conditions set out in the methodology applied to the project	The project activity instances (ICS) added to this grouped project will meet the applicability conditions set out in Section 3.2 of this document, where the target end-users are households and the thermal efficiency of the stoves deployed is at least 25%.
2	Use the technologies or measures specified in the project description.	The project activity instances added to this grouped project are efficient improved cookstoves (ICS) being distributed within the project's pre-defined geographical boundary.
3	Apply the technologies or measures in the same manner as specified in the project description.	The project activity instances added to this grouped project are Improved Cookstove being distributed in the project scenario to replace traditional cookstoves in households. All the project technologies distributed under the project will have a unique identification serial number in order to curb double counting of the stoves under the project.
4	Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.	The project activity instances added to this grouped project will take place within Nigeria only and subject to the same baseline scenario determined in Section 3.4.
5	Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area	This project activity instances added to this grouped project will be distributed at subsidized value and more details on additionality and NPV have been added in the section 3.5 below.

### Inclusion Criteria for New Project Activity Instance

The below table enumerates the inclusion criteria for the new project activity instances in accordance to the section 3.6.17 of VCS standard Version 4.4

No.	Criterion to include new project instances	How the new project activity instances to comply
1	Occur within one of the designated geographic areas specified in the project description	The new project instances to be added to this grouped project will be only within Nigeria
2	Conform with at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial conformance with multiple sets of eligibility criteria is insufficient.	The new project activity instances (ICS) added to this grouped project will comply with all the eligibility criteria as outlined in the previous table
3	Be included in the monitoring report with sufficient technical, financial, geographic, and other relevant information to demonstrate conformance with the applicable set of eligibility criteria and enable evidence gathering by the validation/verification body.	The monitoring report for this grouped project activity includes details of the new project activity instances added i.e., new ICS added to this grouped project. This includes Name of ICS user, Address/Village/ Geographical coordinates of ICS household, Contact Details, Stove model Distributed, Date of distribution/installation, Unique ICS serial, technical specification etc. Further the monitoring report demonstrates conformance of the new project instances to the applicable set eligibility criteria such as applied technology, ICS minimum efficiency level, geography of implementation, baseline scenario and additionality criteria, thus providing requisite evidences to VVB
4	Be included in an updated project description, with updated project location information (as set out in Section 3.11), which shall be validated at the time of verification against the applicable set of eligibility criteria.	The new project instances to be added to this grouped project will be only within Nigeria as highlighted in section 1.12. Further the geographical coordinates of new project instances will be furnished in the project distribution database.
5	Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions).	The distribution receipts for the new project activity instances will be made available for verification wherein the project ownership (carbon waiver) and start date of crediting period (ICS distribution / installation date) are recorded
6	Have a start date that is the same as or later than the grouped project start date	The new project activity instances will either start on the start date of this grouped project i.e., 07-05-2022 or later.

No.	Criterion to include new project instances	How the new project activity instances to comply
7	Be eligible for crediting from the start date of the project activity instance through to the end of the project crediting period (only).	The crediting period for the new project activity instances will only be eligible to start on 07-05-2022 and end till 06-05-2029 in the first crediting cycle. (Crediting period will be renewed maximum for 2 times) – Please refer section 1.9 for further details
8	Only eligible for crediting from the start of the verification period in which they were added to the grouped project.	The VER crediting for the added new project instances will be only on or after the start date of verification period depending on the date of distribution
9	Not be or have been enrolled in another VCS project.	The new project instances added to this grouped project will have unique identification serial number and shall not be enrolled in any VCS or other Carbon Standards, thus avoiding double counting of credits generated. No double counting declaration has been duly provided by the project proponent
10	Where a capacity limit applies to a project activity included in the project, no project activity instance shall exceed such limit. Further, no single cluster of project activity instances shall exceed the capacity limit, determined as follows: 1) Each project activity instance that exceeds one percent of the capacity limit shall be identified. 2) Such instances shall be divided into clusters, whereby each cluster is comprised of any system of instances such that each instance is within one kilometer of at least one other instance in the cluster. Instances that are not within one kilometer of any other instance shall not be assigned to clusters. 3) None of the clusters shall exceed the capacity limit and no further project activity instances shall be added to the project that would cause any of the clusters to exceed the capacity limit.	Not applicable, since it is a large-scale project.

## 1.5 Project Proponent

<b>Organization name</b>	UpEnergy Group
<b>Contact person</b>	Anantha Karthik Rajagopalan
<b>Title</b>	Director of Carbon Programme
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## 1.6 Other Entities Involved in the Project

<b>Organization name</b>	Climate Catalyst, Nigeria Ltd.,
<b>Role in the project</b>	Project Representative
<b>Contact person</b>	Mitch Sauers
<b>Title</b>	Director
<b>Address</b>	Climate Catalyst, Nigeria Ltd., Close 48, H167, VGC, Lagos, Nigeria.
<b>Telephone</b>	+234 706 512 8533
<b>Email</b>	<a href="mailto:mitch@upenergygroup.com">mitch@upenergygroup.com</a>

## 1.7 Ownership

The project ownership is with UpEnergy Group.

A voluntary and irrevocable agreement in the form of warranty card signed by the end user (cookstove user) conferring project ownership to the project proponent shall be the evidence of project ownership.

Each ICS shall have a unique serial number linking it to the project activity and shall be necessary to establish the fact that the ICS belongs to this VCS programme. End users will be informed at the time of ICS installation/distribution that the ICS will be discounted on account of them generating carbon credits and also the fact that these credits belong to project proponent. The end user will be required to sign the carbon waiver form cum warranty card as required by the project proponent to surrender their rights to carbon credits generated by the project.

## 1.8 Project Start Date

07-May-2022 (The earliest date of commissioning date of a batch distributed for first project activity instance).

### 1.9 Project Crediting Period

Project crediting period type: **Renewable**

Start date of first crediting period: **07-May-2022**

End date of first crediting period: **06-May-2029**

Total number of years: **7 years, 00 months.**

The project activity adopts renewable crediting period of 7 years which can be renewed for maximum 2 times.

Being renewable crediting period, total crediting period of grouped project activity is 21 years.

### 1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

- <20,000 tCO<sub>2</sub>e/year
- 20,000 – 100,000 tCO<sub>2</sub>e/year
- 100,001 – 1,000,000 tCO<sub>2</sub>e/year
- >1,000,000 tCO<sub>2</sub>e/year

Project Scale	
Project	
Large project	<input checked="" type="checkbox"/>

Year	Estimated GHG emission reductions or removals (tCO <sub>2</sub> e)
2022-23	346,553
2023-24	1,114,977
2024-25	2,150,419
2025-26	2,071,765
2026-27	1,994,007

Year	Estimated GHG emission reductions or removals (tCO <sub>2</sub> e)
2027-28	1,917,159
2028-29	1,841,236
<b>Total estimated ERs</b>	<b>11,436,117</b>
<b>Total number of crediting years</b>	<b>7</b>
<b>Average annual ERs</b>	<b>1,633,731</b>

## 1.11 Description of the Project Activity

The purpose of the project is to support clean cooking interventions that moves end-user and reduce greenhouse gas (GHG) emissions from the burning of non-renewable biomass-based charcoal for cooking in Nigeria.

The project is implemented by UpEnergy Group (UpEnergy/UpE). UpEnergy will implement the programme in partnership with local partners and would ensure the last-mile distribution/installation of the Improved Cookstoves to the beneficiaries.

Through this project, the distribution and installation of approximately 500,000 operational ICS will be undertaken for households in Nigeria. It is intended that under this project residential users with improved cooking technologies such as energy- efficient biomass Improved Cookstoves (ICS) will be distributed with the aim to reduce greenhouse gas (GHG) emissions from the burning of non-renewable biomass-based charcoal for cooking. The end user will be informed in advance that the use of ICS generates carbon finance which in turn is used for subsidizing the price of ICS and for recovering project implementation costs.

The ICS will burn fuel more efficiently thereby improving thermal transfer to pots, hence saving fuel and equivalent greenhouse gas emissions. Not only this will reduce the rapidly progressing rate of deforestation (From 2001 to 2021, Nigeria lost 1.14 Mha of tree cover, equivalent to a 11% decrease in tree cover since 2000, and 587 Mt of CO<sub>2</sub>e emissions<sup>1</sup>) in Nigeria but will also reduce health hazards from indoor smoke pollution and women and children will have to spend less time on cooking and fuel purchase.

The baseline study conducted by Project Proponent at Nigeria recently in January 2022 has revealed the major dependency on solid biomass for cooking applications at both urban and rural households. Around 93% of the Nigerian population rely on the non-renewable biomass for their cooking needs in which charcoal appears to be the dominant primary fuel (52%) and followed by firewood (41%). The study also

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<sup>1</sup> <https://gfw.global/42mhFpm> (last accessed on 05/05/2023)

highlights around 32% of the Nigerian household carryout cooking at indoor (within house), which makes the users especially women’s vulnerable to respiratory ailments.

On the other hand, Fuel gathering consumes 1.7 hours<sup>2</sup> per household daily for women and children, limiting other productive activities (e.g., income generation) and taking children away from school. In less secure environments, women and children are at risk of injury and violence during fuel gathering. Reliance on non-renewable biomass fuels for cooking has implications for human health, climate change, conservation of forest resources, general well-being of people, gender specific challenges etc. Hence the current Project Activity is intended to address the aforementioned environmental, health and socio-economic issues.

This project will replace conventional inefficient traditional stoves, with higher efficiency ICS to residential users by leveraging resources provided by the PoA. Therefore, in the absence of the project activity, the baseline scenario would be the traditional cooking technologies with use of non-renewable biomass-based charcoal for meeting similar thermal energy needs share.

Technical Specifications of Smart Home Pro Cook Stoves distributed during the first monitoring period are as follows:

<b>Model</b>	<b>Smart Home Pro a k a SHS Pro</b>
Type of Stove	<b>Domestic</b>
Dimension	<b>(ø 28 * 26 H) cms</b>
Average Unit Weight, Kg	<b>12</b>
Thermal Efficiency, %	<b>37.90</b>
Pot Type pot	<b>Flat Bottom</b>
Fuel Type	<b>Charcoal</b>
Estimated Life Span	<b>7 Years</b>
Average time to boil 5 liters of water	<b>33.8 minutes</b>

The manufacturer / model of stove may change for future project activity instances and same will be transparently reflect during verification.

**Project Developers/Representatives: -**

<b>Project Developer</b>	UpEnergy Group
<b>Project Representatives</b>	Climate Catalyst Nigeria Ltd.,

**Data collection of ICS end-user: -**

<sup>2</sup> <https://documents1.worldbank.org/curated/en/164241468178757464/pdf/98664-REVISED-WP-P146621-PUBLIC-Box393185B.pdf> (last accessed on 05/05/2023)

Project proponent must gather the necessary information to identify households using its ICS during the course of the project. To facilitate this process, each ICS will be assigned a unique serial number. The respective stove serial numbers will be recorded during the distribution process, together with the following information (as appropriate and as available in the dedicated project database):

- Name of ICS user or head of the household
- Address/ Village name of ICS household
- Geographical coordinates of the household
- Contact Details of the household
- Baseline cooking technology & fuel
- Stove model Distributed
- Date of distribution/installation
- ICS serial number (Unique identification alpha/numeric ID for each device that is distributed)

The information collected will be stored in the electronic database excel sheet which will serve as project database for project monitoring and sampling purposes. The traditional cook stoves were operational and this was the scenario prior to the implementation of project.

### 1.12 Project Location

The project will be located within the boundary of Nigeria having the geographical coordinates 9° 55.2 latitude and 8° 40.517 longitude. It is part of Africa and the northern hemisphere.<sup>3</sup>



Figure 1 Nigeria Map

<sup>3</sup> <https://www.geodatos.net/en/coordinates/nigeria> (last accessed on 05/05/2023)

### 1.13 Conditions Prior to Project Initiation

Prior to the implementation of the project activity the existing scenario recorded as the use of traditional cookstoves and the use of non-renewable biomass by the target population to meet similar thermal energy needs and which also cause indoor air pollution (IAP) in absence of project activity.

From 2001 to 2021, Nigeria has lost 1.14 Mha of tree cover, equivalent to a 11% decrease in tree cover since 2000 and this translates to 587 Mt of CO<sub>2</sub>e emissions<sup>4</sup>. This can be attributed towards the dependency of solid biomass for cooking application by majority of the Nigerian population and also the use of traditional cookstove or inefficient cookstove, which inherently increases the demand of fuel input.

### 1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

There are no mandatory laws or regulations in the host country for the use of improved cookstoves in Nigeria households. The project is a voluntary effort by the project proponent. A review is made on Nigeria environmental laws and regulations as below<sup>5</sup>

- 1) National Environmental Standards and Regulation Enforcement Agency (NESREA) Act 2007
- 2) Environmental Impact Assessment (EIA) Act. Cap E12, LFN2004
- 3) The Nigerian Urban and Regional Planning Act Cap N138, LFN 2004

### 1.15 Participation under Other GHG Programs

#### 1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

The project has not been registered, nor is it seeking registration under any other GHG program to avail carbon benefits during the crediting period.

#### 1.15.2 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG program

### 1.16 Other Forms of Credit

#### 1.16.1 Emissions Trading Programs and Other Binding Limits

This project is not part of any emissions trading program or any other mechanism that includes GHG allowance trading.

#### 1.16.2 Other Forms of Environmental Credit

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<sup>4</sup> <https://gfw.global/42mhFpm> (last accessed on 05/05/2023)

<sup>5</sup> <https://esrmaq.worldbank.org/program-countries/overview-environmental-legislation> (last accessed on 05/05/2023)

The project has not sought or will receive another form of GHG-related environmental credit.

### 1.16.3 Supply Chain (Scope 3) Emissions

Not applicable.

## 1.17 Sustainable Development Contributions

### 1.17.1 Sustainable Development Contributions Activity Description

**Project's contribution to Sustainable Development:** The contributions of proposed project activity towards sustainable development are explained with indicators viz. social, economic, environmental, technological well-being and legislative as follows:

**Environmental well-being:** The project activity will result in the reduction of firewood consumption and emission of greenhouse gases and thus conserve forest and biodiversity.

**Social well-being:** The project activity will pave the way for development and increases the social status and living conditions and the prevailing living standard in the vicinity of the project activity and thus results in empowering the nearby. Also, it will contribute to a small increase in the local employment by employing skilled and un-skilled personnel for operation and maintenance of the equipment. The project will reduce the drudgery of women, time saving and the use of saved time for other productive activities.

**Economic well-being:** The project has created a business opportunity during construction phase for local stakeholders such as suppliers, contractors etc. contributing to economic well-being aspects. Further, the project also influences creation of employment opportunities for local people, which would enhance their social status. Sufficiently enhance indoor air quality thereby improving health of women and children and reducing incidences of smoke and fire related injuries and therefore result in saving of health-related expenses.

**Technological well-being:** The proposed project activity will promote improved cook stoves that result in reduced fuel consumption and emissions due to cooking and heating water in homes.

**Legislative:** The Project Proponent has obtained all the relevant approvals required for the establishment and operation of the project activity.

## 1.17.2 Sustainable Development Contributions Activity Monitoring

Table 1 Sustainable Development Contributions

Row Number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	1.1	Average household savings i.e., decrease in expenditure on basic service such as cooking	Implemented activities to increase	The distribution of energy efficient stoves helped save \$0.23 per day per household during this monitoring period	The distribution of energy efficient stoves helped 1,566 households to save \$0.23 per day per household
2)	1.4	Number of households having access to improved cooking technology due to project activity	Implemented activities to increase	The distribution of 1,566 energy efficient stoves under this project activity helped Nigerian households by providing access to basic services	The project activity benefits 1,566 Nigerian households by providing access to basic services

Row Number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
3)	5.1	% of Female employees	Implemented activities to increase	This project activity promotes employment to women, thus helps eradicating gender-based discrimination and provides socio-economic parity. Around 28% of the total employees working as a part of the project activity are females. This proportion is expected to increase in the upcoming monitoring period	Around 28% of the total employees working as a part of the project activity are females
4)	5.4	Average time saving associated with cooking time	Implemented activities to decrease	The project ICS help reduce cooking time by 0.82 hours or 49 mins/household/day, thus providing women in project households with more time to invest in other productive economic development activities	This project activity led to time saving of 49 mins/household/day
5)	5.5	proportion of women serving in managerial/ leadership /ownership role	Implemented activities to increase	This project activity encourages participation of women in leadership / managerial role. 3 out of 5 i.e., 60% individuals operating at managerial positions for the given project activity are women	This leadership of the project activity to an extent 60% is held by women employees

Row Number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
6)	7.1	Number of households having access to improved cooking technology due to project activity	Implemented activities to increase	The distribution of 1,566 energy efficient stoves under this project activity helped Nigerian households by providing access to basic services	The project activity benefits 1,566 Nigerian households by providing access to basic services
7)	8.b.1	Number of Trainings conducted in a year	Implemented activities to increase	The project activity provides training and skill development program for youth population, thus increasing their employability. A total of 3 trainings were held for the employees as a part of this monitoring period. This will increase in the upcoming monitoring period	A total of 3 trainings were held for the employees for this project activity
8)	8.5	Number of jobs created	Implemented activities to increase	This project activity has created 69 jobs for marketing / sales and distribution / technical employees during the current monitoring period.	This project activity has created 69 jobs so far

Row Number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
9)	12.2	Decrease in specific fuel consumption	Implemented activities to decrease	The distribution of ICS has helped to reduce the consumption of Non-renewable biomass in participant households to an extent 2.75 tonnes / year / HH	The distribution of energy efficient stoves helped 1,566 households to save 2.75 tonnes of non-renewable biomass per year per household
10)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to decrease	Distribution of ICS has resulted in 1,459 tCO <sub>2e</sub> of greenhouse gas emissions avoidance during this monitoring period	This project activity has avoided 1,459 tCO <sub>2e</sub> of greenhouse gas emissions into the atmosphere
11)	15.1	Amount of Non-renewable biomass saved	Implemented activities to decrease	The project activity has reduced 792 tonnes of Non-renewable biomass over the course of the monitoring period in participant households which contributed towards reducing the rate of deforestation.	This project has saved 792 tonnes of non-renewable biomass and has contributed in reduction of deforestation activity in Nigeria

## 1.18 Additional Information Relevant to the Project

### Leakage Management

Leakage has been considered as default 0.95 as per the methodology.

### Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

### Further Information

The Project Proponent has obtained all the relevant approvals required for the establishment and operation of the project activity.

# 2 SAFEGUARDS

## 2.1 No Net Harm

No potential negative environmental or socio-economic impacts have been identified for the project.

The project activity aims to distribute improved cookstove in the project area which will result in reduced consumption of natural resources. Also, the project activity will lead to reduced smoke/PM emission in the households, increased employment and overall emission reduction in the project area. The project technology is distributed at subsidized price and also reduces economic pressure from buying of wood fuel. Thus, no negative socio-economic impact is expected out of this.

## 2.2 Local Stakeholder Consultation

The first round Stakeholder Consultation meetings was done on the 23-June-2022 with the participation of different stakeholder categories. A total of 60 stakeholders participated in the LSC meeting.

The consultation process included invitation to wide range of invitees, to include effective and equal participation of both men and women. PP has sent an open invitation via National Daily Newspaper "PUNCH" on 23-May-2022, which addresses the entire population / region of Nigeria, thus enabling the participation of the common citizen across the project boundary. In addition to this, PP has invited the potential stakeholders viz., micro-entrepreneurs, NGOs, financial institutions, local distribution partners etc. via email, these group of key stakeholders works across Nigeria to address various socio-economic issues, gender equality, climate change mitigation etc. PP has also given the remunerations for the participants of the LSC meeting to cover their travel cost. By adopting the aforementioned strategies, PP has ensured the maximum participation from both the key stakeholders and common public, this makes

the local stakeholder's participation a representation of entire country of Nigeria

Prior to the consultation, UpEnergy had provided with the following documents in the language that allows local stakeholders to understand and engage with the project:

- Relevant information about the project
- Summary of the economic, social and environmental impacts of the project
- Contact details/E-mail ID of the UpEnergy group

During the meeting, the Key Project Information was presented to the local stakeholders. The sustainable development indicators and the monitoring of the indicators were clearly explained, and the Blind Assessment and Consultation Feedback Forms were shared in the second half of the consultation. Additionally, a copy of the presentation was also shared with them in order to help them provide feedback to UpEnergy Group in order to maximize the benefits to end-users.

A live demonstration of Improved Cookstoves (ICS)/SmartHome Stove, SmartHome Electric Pressure Cooker and Domestic & Institutional Safe Drinking Water System were conducted for the participants. It was also explained to the stakeholders that similar technologies may also be implemented by UpEnergy based on beneficiary's' feedback.

The invitation to stakeholders were sent via email and screenshots of the same have been provided. In addition to email, the CME also reached out to stakeholders locally in Nigeria to collect their feedback in person or telephonically.

- Invitation email to stakeholders was sent on 24-May-2022

UpEnergy Carbon Technical Team <technical@upenergygroup.com> Tue, May 24, 2022 at 4:01 PM  
 To: Vickars <vickars2000@gmail.com>

Dear Ms. Victoria Arafiri,

Greetings from The UpEnergy Group, Nigeria

UpEnergy Group is the Co-ordinating/Managing entity of UpEnergy – Social and Climate Impact Programme

The purpose of the programme is to provide end-users with Energy- Efficient cooking technologies and Safe water systems (WPS) with the aim to reduce greenhouse gas (GHG) emissions from the burning of non-renewable woody biomass and/or charcoal for cooking and water treatment to make it safe for consumption. Thus, the PoA supports the intended goals of reducing fuel consumption, improving health, reducing deforestation and reducing GHG emissions in Nigeria.

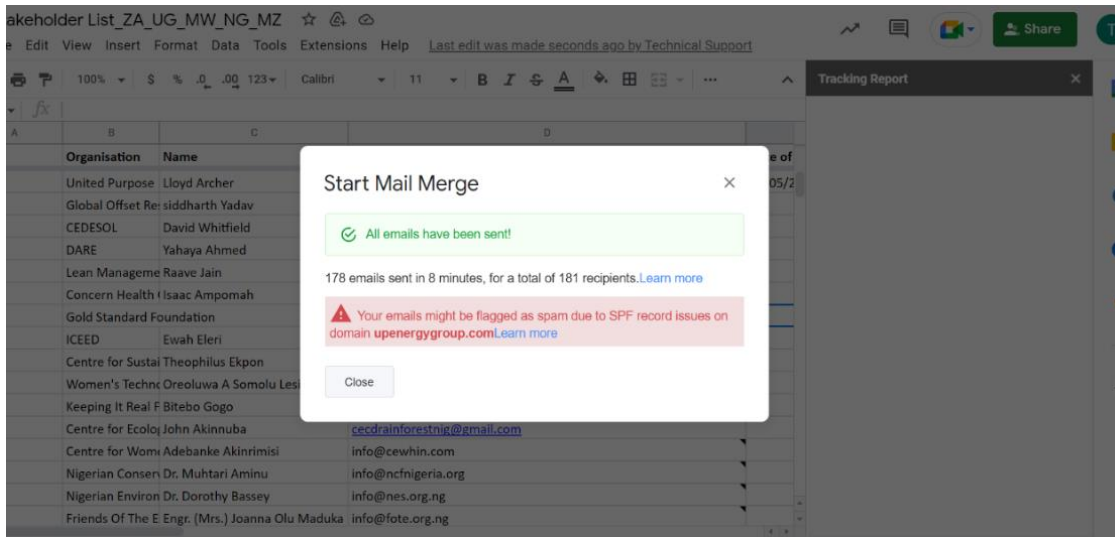
As a valued stakeholder of the PoA, you are requested to participate in the design of an initiative intended to create, register and trade carbon credits in order to fund the expanded dissemination of Improved Cooking Stoves and Water Purification Systems. The stakeholder consultation is an opportunity at the early stage, to present the projects to the relevant parties involved and include their feedback into the design of the projects.

We are currently beginning the initial stakeholder consultation process. You are requested to attend the physical meeting which will be held on **23/06/2022, 10:00 AM, at Denis Hotel, Plot 910 Ndjamena Crescent, Off Amino Kano Crescent, Wuse 2 Abuja, Nigeria.** We welcome your feedback and suggestions and cordially request you to fill the feedback form to share your views on this PoA.

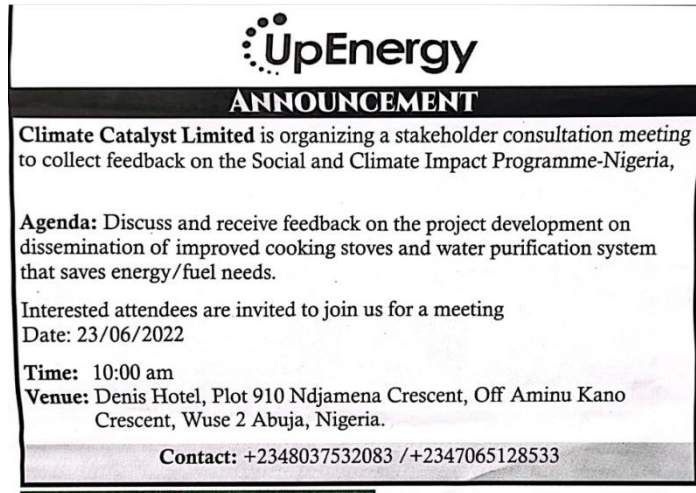
A brief non-technical description of the projects is available upon request by email, and a working draft of the Project Design Document will be also publicly available soon. The written feedback can be sent via email to [technical@upenergygroup.com](mailto:technical@upenergygroup.com) up to 7 days after the consultation day.

Thank you for your consideration of this request. We look forward to receiving your comments and/or having the pleasure of meeting you in person on (date)

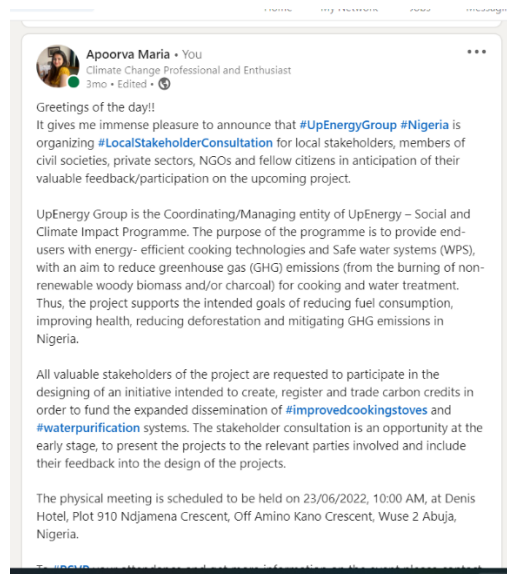
Thanking you,  
 Regards  
 UpEnergy Group  
 Nigeria



- Invitation via newspaper ad. published on 23-May-2022



- Invitation via LinkedIn was published on 24-May-2022



**Minutes of the meeting:**

- The meeting commenced at 10 AM with a round of introduction from the participants, followed by a brief overview of UpEnergy Group.
- The Carbon consultant briefed the participants about UpEnergy Group and the aspirational products that are specially designed for low-income groups. He further discussed global presence of UpEnergy group
- Functioning and usage of Improved Cookstove (ICS), Safe Water System (SWS), Electric Pressure Cooker (EPC) was also demonstrated to the participants.

- The Project Manager discussed about the benefits of Improved Cookstoves (ICS) over the traditional charcoal stoves. She also addressed queries on price, durability and availability of ICS. She further explained the key benefits of clean cooking products being, less poverty, good health, money saving, affordable and clean energy, capacity building of women and overall contributions of the project to sustainable development goals.
- During the feedback round, the stakeholders asked queries about pricing of ICS, technicalities of carbon trading and partnership opportunities offered by UpEnergy Group.
- Mr and Mrs Mathais (Smart Home ICS End-User) shared their experiences of using the cookstove and various benefits of the usage.
- The meeting concluded at 2:30pm with about 60 participants in attendance.

**Assessment of comments from all consultations above:**

Gender of Stakeholder	Stakeholder comment	Was comment taken into account (Yes/ No)?	Explanation (Why? How?)
Male	Need to include health sector and academia in the LSC	Yes	UpEnergy Group has taken the feedback positively and shall include health sector and academia in its upcoming LSC and other key forums
Male	Replacement of traditional stoves by ICS reduces the amount of charcoal used, therefore leading to money saving	Yes	Generic comment; requires no action
Female	Awareness about clean technologies should be upscaled	Yes	UpEnergy Group is committed to disseminate awareness of Improved cooking technology amongst the various socio-economic strata within the project boundary by conducting awareness campaigns & workshops
Female	The project leads to fuel reduction, mitigating gender inequality and money saving.	Yes	Generic comment; requires no action

The mechanism for on-going communication with local stakeholders:

	<b>Method Chosen (include all known details e.g., location of book, phone, number, identity of mediator)</b>	<b>Justification of Choice (best practice)</b>
<b>Continuous Input / Grievance Expression Process Book (mandatory)</b>	Continuous input / Grievance Expression process book is available at the following office: Climate Catalyst, Nigeria Ltd., Close 48, H167, VGC, Lagos, Nigeria. Phone: +234 706 512 8533	Grievance Expression book will be placed at Climate Catalyst office in Lagos, Nigeria Stakeholders are free to voice their concerns via the Grievance Expression Book. By maintaining feedback book at the local office, it is ensured that stakeholders that don't have access to electronic media for expressing concerns / grievances are also able to share their concerns / feedback. Additionally, the end users always have an option to revert to the salesperson (representative of distribution/retail partners etc.) in case of any feedback / complaints with the product post distribution.
<b>Telephone access (optional)</b>	-	-
<b>Internet/email access (optional)</b>	technical@upenergygroup.com	-
<b>Nominated Independent Mediator (optional)</b>	-	-
<b>Other</b>	-	-

### 2.3 Environmental Impact

No negative environmental impacts have been identified from the project and environmental impact assessment (EIA) is not required for this project

## 2.4 Public Comments

This project was open for public comment from 29-March-2023 to 28-April-2023. No comments were received during the 30-day comment period

Link to the project: <https://registry.verra.org/app/projectDetail/VCS/2673>

## 2.5 AFOLU-Specific Safeguards

This section is not applicable as the project is a non-AFOLU project.

# 3 APPLICATION OF METHODOLOGY

## 3.1 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied.

Methodology: **VMR0006- Methodology for Installation of High Efficiency Firewood Cookstoves. Ver: 1.1.**

<https://verra.org/wp-content/uploads/2021/07/VMR0006-Methodology-for-Installation-of-High-Efficiency-Firewood-Cookstoves-v1.1.pdf>

Sectoral Scope: 03

List of CDM tools and standards applied in this grouped project are as follows,

- 1) CDM TOOL 1: Tool for the demonstration and assessment of additionality – Version 7.0.0
- 2) CDM TOOL 30: Calculation of the fraction of non-renewable biomass – Version 4.0
- 3) CDM Standard: Sampling and surveys for CDM project activities and programme of activities – Version 9.0

## 3.2 Applicability of Methodology

S No	Applicability criterion	How the project complies
1.	Project activities shall be implemented in domestic premises or in community-based kitchen	The project activity involves distribution of ICS in residential sector
2.	The project stove shall have specified high power thermal efficiency of at least 25% per the manufacturer’s specifications and shall exclusively use woody biomass and can be single pot or multi-pot; in case of project	Improved Cookstoves planned to be distributed under this project is SmartHome Pro stove that have an efficiency of 37.9% as per the manufacturer’s specifications.

S No	Applicability criterion	How the project complies
	stove replacing fossil fuel baseline stove, it shall exclusively use renewable biomass.	This project does not involve replacement of fossil fuel-based stoves.
3.	Both 'Projects' and 'Large Projects' can use this methodology	The project is a large-scale project.
4.	Non-renewable biomass has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports or statistics;	According to the U.N. FAO, 9.9% or about 9,041,000 ha of Nigeria is forested during 2010 and between 1990 and 2010 Nigeria lost an average of 409,650 ha or 2.38% per year. In total, between 1990 and 2010, Nigeria lost 47.5% of its forest cover, or around 8,193,000 ha <sup>6</sup> . This can be attributed to dependency of non-renewable biomass for cooking needs by a large amount of its population. Hence the use of non-renewable biomass in the region is very much evident
5.	For the specific case of biomass residues processed as a fuel (e.g., briquettes, wood chips), it shall be demonstrated that: (a) It is produced using exclusively renewable biomass (more than one type of biomass may be used). (b) The consumption of the fuel should be monitored during the crediting period and (c) Energy use for renewable biomass processing (e.g., shredding and compacting in the case of briquetting) may be considered as equivalent to the upstream emissions associated with the processing of the displaced fossil fuel and hence disregarded.	Not applicable. The project stove which is improved energy efficient technology is introduced to replace baseline stoves and reduce the use of non-renewable biomass for combustion.
6.	The CDM-PDD or CDM-PoA-DD/CPA-DD shall explain the proposed method for distribution of project devices including the method to avoid double counting of emission reductions such as unique identifications of product and end-user locations (e.g., programme logo).	A unique numbering or identification system for the ICS installed is applied in the project instance. This shall ensure no double counting of stoves within the Project and ensure that stoves can be identified as belonging to this Project and not to a project managed by any other PP. Each ICS distributed under the project instance will have the UpE logo or Brand name (Smart Home Pro or similar) and unique serial

<sup>6</sup> <https://rainforests.mongabay.com/deforestation/2000/Nigeria.htm> (last accessed on 07/05/2023)

S No	Applicability criterion	How the project complies
		number on the product. The unique serial number along with the customer details (name, address, etc) is also stored in the sales database along with the unique serial number assigned to each product.
7.	The CDM-PDD or CDM-PoA-DD/CPA-DD shall also explain how the proposed procedures prevent double counting of emission reductions, for example to avoid that project stove manufacturers, wholesale providers or others claim credit for emission reductions from the project devices.	To prevent the double accounting of emission reductions by the key stakeholders involved in this grouped project viz., ICS manufacturer and end users, the carbon waiver agreements have been signed. This will prevent the other involved parties to claim the carbon credits generated by this project activity. The carbon waiver agreements will be shared with VVB during validation & verification.
8	CDM TOOL 30: This tool provides guidance and a step-wise procedure/method to calculate values of fNRB. The tool may be applied when calculating baseline emissions in applicable methodologies (e.g. AMS-I.E., AMS-II.G., AMS-III.Z., AMS-III.AV., AMS-III.BG.) for a project activity or a programme of activities (PoA) that displaces the use of non-renewable biomass.	The project activity applies the methodology VMR0006, which is based on CDM small-scale methodology AMS-II.G, "Energy efficiency measures in thermal applications of non-renewable biomass". Hence PP has used this TOOL for the fNRB calculations.
9.	CDM TOOL 30 (a) DNAs to submit region- or country-specific default fNRB values, following the procedures for development, revision, clarification and update of standardized baselines (SB procedures); or (b) project participants to calculate project- or PoA-specific fNRB values.	PP has conducted a region-specific study and calculated the fNRB value for the project boundary i.e., Nigeria by adopting CDM TOOL 30
10.	CDM TOOL 1: The use of the "Tool for the demonstration and assessment of additionality" is not mandatory for project participants when proposing new methodologies. Project participants may propose alternative methods to demonstrate additionality for consideration by the Executive Board. They	PP has adopted this CDM Tool for demonstrating project's additionality.

S No	Applicability criterion	How the project complies
	may also submit revisions to approved methodologies using the additionality tool.  Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory	

### 3.3 Project Boundary

The project will be located within the boundary of Nigeria having the geographical coordinates 9° '55.2 latitude and 8° 40.517 longitude. It is part of Africa and the northern hemisphere.<sup>7</sup>

Source	Gas	Included?	Justification/Explanation	
Baseline	Emission of non-renewable biomass	CO <sub>2</sub>	Yes	Major Source
		CH <sub>4</sub>	Yes	Major Source
		N <sub>2</sub> O	Yes	Major Source
		Other	No	No other source identified
Project	Emission of non-renewable biomass	CO <sub>2</sub>	Yes	Major Source
		CH <sub>4</sub>	Yes	Major Source
		N <sub>2</sub> O	Yes	Major Source
		Other	No	No other source identified

A representation of the baseline Scenario and project scenario are given as below Figure 3:

<sup>7</sup> <https://www.geodatos.net/en/coordinates/nigeria> (last accessed on 05/05/2023)

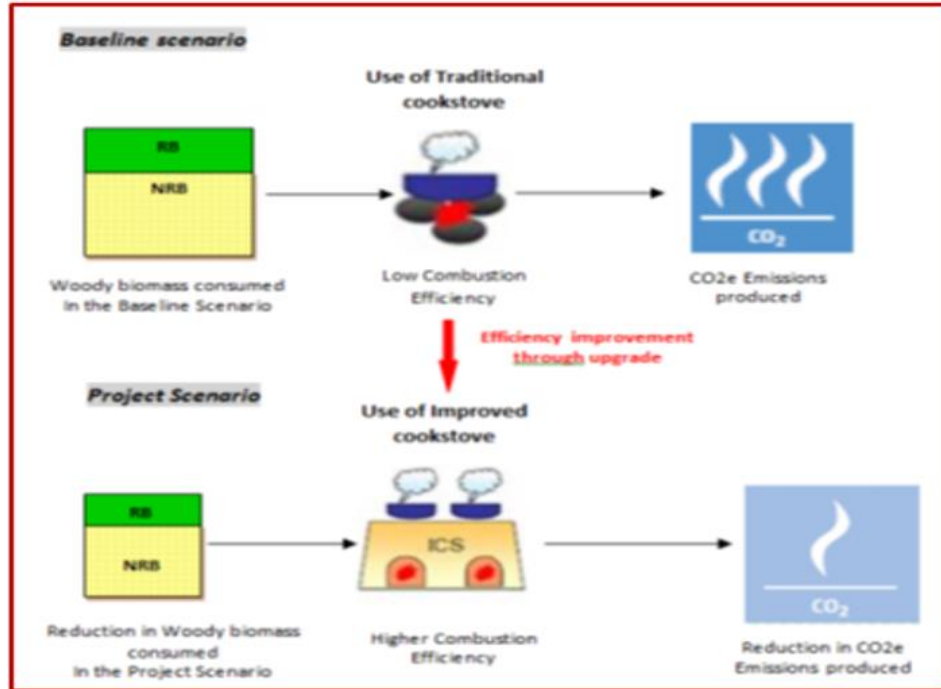


Figure 2 Baseline & Project scenario

### 3.4 Baseline Scenario

In line with the applied methodology, the baseline scenario is the continued use of non-renewable biomass fuel (charcoal) by the target population to meet similar thermal energy needs as provided by project cookstoves in absence of project activity.

The baseline study conducted by Project Proponent to determine the baseline scenario at Nigeria are of three folds,

- 1) Baseline Assessment of Cookstove and Fuel Usage
- 2) Baseline KPT Survey (Charcoal)
- 3) Baseline WBT Survey (Charcoal Stoves)

#### 1) Baseline Assessment of Cookstove and Fuel Usage

A comprehensive survey has been conducted by the PP to determine the baseline stove usage at Nigeria in collaboration with International Centre for Energy, Environment and Development (ICEED) recently in January 2022. The study focuses in capturing the as-is scenario of cooking technology deployed, cooking fuels, stove usage pattern, cooking practices, quantitative and qualitative assessment on the challenges faced with the existing cooking technology etc.

The baseline survey has been conducted on 165 households spread across rural, semi-urban and urban areas in Nigeria and targeting all the key geographical areas of Nigeria, i.e, Northern Region, Southwest

Region and Southeast Region. To fully understand the household cooking patterns with a view to ascertaining possible improved cookstoves interventions that can be introduced, UpEnergy has conducted the baseline assessment of households in Kano, Lagos and Ebonyi states belonging to the above-mentioned regions. The choice of region for baseline study is strategic and reflects the meeting points of the various regions across Nigeria. Kano is the converging point for all regions in Northern Nigeria, Lagos is the converging point for all of Southwest and parts of South South region, while Ebonyi is the converging point for all of South East and most parts of South South Nigeria. The sample selection of households from the identified key localities was done through a combination of stratified and random sampling. In line with the urban / rural demographic breakup of Nigeria<sup>8</sup>, the considered 165 samples were split into 2 strata i.e., 47% sampled from urban areas, and rest 53% sampled from rural areas.

The baseline study has revealed the major dependency on solid biomass for cooking applications at both urban and rural households along with the use of inefficient cooking technologies viz., traditional charcoal stoves and three stone firewood stoves. Around 93% of the Nigerian population rely on the non-renewable biomass for their cooking needs in which charcoal appears to be the dominant primary fuel (52%) and followed by firewood (41%). As an outcome of the study PP envisages a high potential for saving the non-renewable biomass and the associated CO<sub>2</sub> emissions through distribution of fuel-efficient charcoal/firewood stoves in the project boundary.

## 2) Baseline KPT Survey (Charcoal)

PP has conducted Kitchen Performance Tests (KPTs) to determine the baseline fuel consumption ( $B_{old}$ ) values for charcoal using households., since the project activity intent to displace inefficient / traditional charcoal stoves with improved charcoal. The sample size for baseline KPT has been determined using the “Sampling and surveys for CDM project activities and programmes of activities, Version 09.0” which adopts the Student’s t-distribution method done since the parameter of interest is a numeric mean value. The sample size requirement for baseline KPTs was calculated to be 27 for the charcoal households. Hence PP has conducted KPTs for 45 households for charcoal households households in-line with the CDM sampling requirement. The sample households for KPTs were picked within the 165 households those underwent baseline survey by adopting a combination of spatial distribution and random sampling approach. The results obtained from the baseline KPT study have met the reliability criteria of 95/10 for large scale project activities and the resulted  $B_{old}$  values for charcoal households and reliability calculations are given the below tables,

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<sup>8</sup> <https://population.un.org/wup/Publications/Files/WUP2014-Highlights.pdf> last accessed on 04-10-2023

Baseline Fuel	Fuel Consumption (tonnes/y/captia)	National Average HH Size	B <sub>old</sub> (tonnes/y/HH)	B <sub>old</sub> in Eq. fuel wood (tonnes/y/HH)
Charcoal	0.203	4.5 <sup>9</sup>	0.91	5.46*

\*Default wood to charcoal conversion factor of 6 kg of firewood per kg of charcoal is used in line with the applied methodology

Reliability Analysis for B <sub>old</sub> Value	Value	Unit
<b>RELIABILITY CALCULATIONS</b>		
Sample Mean	0.203	(tonnes/y/captia)
Sample Size (valid count)	45	-
Standard Deviation	0.056	-
Standard error	0.008	-
Confidence (%) (90 or 95)	95%	
Margin of Error (%)	10%	
Z Value for 95/10 rule	1.95	
What is the precision attained?	8.10%	-
Does the result satisfy the 95/10 rule?	YES	-
Fuel consumption	Use Mean Value	-
Mean value	0.203	(tonnes/y/captia)
Higher bound	-	(tonnes/y/captia)

### 3) Baseline WBT Survey (Charcoal Stoves)

PP has carried out Water Boiling Tests (WBTs) to understand the thermal efficiency of charcoal stoves in Nigerian market. The tests were conducted using the Laboratory Emissions Monitoring System at the ICEED-owned Clean Cookstoves Development and Testing Laboratory in Ebonyi State, Nigeria. The sample size required for baseline WBT for charcoal stoves is determined to be 12 by adopting Student's t-distribution method in line with the "Sampling and surveys for CDM project activities and programmes of activities, Version 09.0", hence PP has conducted WBTs for 14 baseline stoves (3 tests / stove) following the requirement of WBT protocol and obtained results have met the reliability criteria of 95/10. The average thermal efficiency of the baseline charcoal stoves works out to 16.5%.

The ex-ante  $\eta_{old}$  value and reliability calculations are given in the subsequent tables below,

Baseline Stove	$\eta_{old}$	Source
Charcoal	16.5%	Baseline WBT survey

<sup>9</sup> <https://hub.arcgis.com/maps/esri::average-household-size-in-nigeria/about>

Reliability Analysis for  $\eta_{old}$  Value

<b>RELIABILITY CALCULATIONS</b>	<b>Value</b>	<b>Unit</b>
Sample Mean	16.5%	%
Sample Size (valid count)	14	-
Standard Deviation	0.031	-
Standard error	0.008	-
Confidence (%) (90 or 95)	95%	
Margin of Error (%)	10%	
Z Value for 95/10 rule	1.95	
What is the precision attained?	9.75%	-
Does the result satisfy the 95/10 rule?	YES	-
Fuel consumption	Use Mean Value	-
Mean value	16.5%	%
Higher bound	-	%

### 3.5 Additionality

The ICS in the project instances have been distributed at a subsidized price therefore the project proponent has adopted “Project method” to demonstrate additionality of the project. In line with the methodology requirement, the project proponent has applied investment analysis method set out in the CDM Tool for the Demonstration and Assessment of Additionality (“Tool for demonstration and assessment of additionality” Version-7.0.0) to determine that the proposed project activity is either: 1) not the most economically or financially attractive, or 2) not economically or financially feasible.

The below tables summaries the key financial parameters and indicators followed by a detailed NPV analysis for evaluation of project feasibility

Project Revenue and Costs: Over 7-year period.

Date of Investment Decision: 15<sup>th</sup> April 2022

<b>Project Costs</b>	<b>USD \$</b>
Stove manufacturing cost	8,582,436
Implementation cost	4,018,154
Cost on account of defective stove/breakdown	742,603
Costs involving software/database maintenance	13,947,906
Overhead costs	16,502,287
Project Management	3,800,000
<b>Total costs</b>	<b>47,593,386</b>
<b>Project Revenue</b>	
ICS Distribution Revenue	2,690,000

<b>Total Revenue</b>	<b>2,690,000</b>
<b>Discounted cash flow</b>	
Discounted Project Cost	(22,904,397)
Discounted annual revenue	1,801,852
<b>Net Present value excluding VCUs Revenue (USD)</b>	<b>( - ) 21,102,545<sup>10</sup></b>

### Key considerations

- 1) Project ICS are planned to be distributed at a subsidized price up to \$5 to promote clean cooking technology at Nigerian Households; the initial pilot distribution (about 5% of the projected ICS volume) has been planned to be distributed at \$12.6
- 2) Discount rate is considered as 20% adopted as per the company level benchmark
- 3) Inflation rate (18.8%) is sourced from the data provided by International Monetary Funds
- 4) Other operational costs / overheads are considered based on project's financial feasibility report & relevant management assumptions and are in-line with the actual company financial reports and also vetted by independent financial auditor.

A sensitivity analysis has also been carried out to understand and analyze the variations in the NPV with respect to the select key financial parameters viz., Cost of Manufacturing, ICS Distribution Cost and Inflation rate. These key financial parameters are selected for the sensitivity analysis considering the dynamics involved in market situation and economic conditions at the project location.

The key outcome of the sensitivity analysis is tabulated below,

Parameter / Variation	Project NPV in \$		
	10%	0%	-10%
Manufacturing Cost	(21,688,127)	(21,102,545)	(20,516,963)
Inflation Rate	(21,997,188)	(21,102,545)	(20,248,749)
ICS Distribution Cost <sup>11</sup>	(21,817,003)	(21,102,545)	(22,177,373)

<sup>10</sup> PP has made a corollary approach (Additionality Model-Naira v1.0) for evaluating the additionality in the local currency Naira in order to avoid the uncertainties due to FOREX rates and also hypothetically removing the global cost components (project management, software development and data management costs), since these costs are denominated in USD. The additionality model in local currency also resulted in negative NPV, thus demonstrating project's additionality in both USD & Local Currency.

<sup>11</sup> ICS distribution cost in the sensitivity analysis has been considered as weighted average of pilot and full-scale distribution i.e., \$5 & \$12.6

As can be seen in the above table, the Project NPV is found to be negative in all iterations with respect to +/- 10% variations in the key financial parameters. This proves the project is additional in all scenarios and strongly indicates that the carbon revenue is vital for sustenance of the project

For the present project instances, additionality is demonstrated through the investment barrier. As described the assessment of additionality of project instance implemented under the project activity is deemed to be additional if it can establish that it is financially unviable. This shall be done by providing an analysis that the Net Present Value (NPV) of investments made by the project instance implementer is negative. As evidenced by the accompanying cashflow analysis, The NPV for this project is projected to be (-) \$21,102,545 without VCU revenue. This is because the cost of manufacturing, shipping and distribution of the product exceeds the cost of sale, so the gross margin for the product is negative without carbon finance. Hence, the project faces investment barrier and is considered to be additional.

### 3.6 Methodology Deviations

The project activity has not taken any deviation in the applied methodology VMR0006- Methodology for Installation of High Efficiency Firewood Cookstoves. Ver: 1.1.

## 4 IMPLEMENTATION STATUS

### 4.1 Implementation Status of the Project Activity

During the project instance 1,648 charcoal ICS were distributed in the project area, which includes 1<sup>st</sup> date of project technology sale from 07-May-2022 to end of 1<sup>st</sup> monitoring period date of 31-October-2022. The model of stoves sold during this monitoring period were SHS Pro with a technical specified efficiency of 37.9%. As a part of stove maintenance and after sales services, UpEnergy group has a dedicated toll-free customer care numbers (09099999227/0706879780) mentioned in the distribution receipts and flyers, which can be used for any complaints or maintenance if needed.

## 5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

### 5.1 Baseline Emissions

The methodology does not account for baseline emissions separately, but instead quantifies net emission reductions achieved by the project. Please refer to Section 5.4.

## 5.2 Project Emissions

The methodology does not account for baseline emissions separately, but instead quantifies net emission reductions achieved by the project. Please refer to Section 5.4.

## 5.3 Leakage

Leakage shall be considered as default 0.95 in accordance with methodology.

## 5.4 Estimated Net GHG Emission Reductions and Removals

Net GHG emission reductions are calculated by applying Equations 1 and 2 for project activities replacing baseline stoves using non-renewable biomass (charcoal).

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

Where:

$ER_y$  = Emission reductions during year y in tCO<sub>2</sub>e

$i$  = Indices for the situation where more than one type/model of improved cook stove is introduced to replace the baseline inefficient stoves

$j$  = Indices for the situation where there is more than one batch of improved cookstove of type i

$ER_{y,i,j}$  = Emission reductions by improved cook stove of type i and batch j during year y in tCO<sub>2</sub>e

Where:

$$ER_{y,,} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times (EF_{wf,CO2} + EF_{wf,non\ CO2}) \times N_{y,j} \times 0.95 \quad \text{Equation (2)}$$

$B_{y,savings,i,j}$  = Quantity of woody biomass that is saved in tonnes per cookstove device of type i and batch j during year y

$f_{NRB,y}$  = Fraction of woody biomass that can be established as non-renewable biomass ( $f_{NRB}$ ) (Calculation for  $f_{NRB}$  done by using CDM tool 30)

$NCV_{wood\ fuel}$  = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne)<sup>12</sup>

<sup>12</sup> AMS II.G. Version 12

$EF_{wf, CO_2}$  = CO<sub>2</sub> emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO<sub>2</sub>/TJ)<sup>13</sup>

$EF_{wf, non\ CO_2}$  = Non-CO<sub>2</sub> emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 26.23 tCO<sub>2</sub>/TJ)<sup>14</sup>

$N_{y, i, j}$  = Number of project devices of type *i* and batch *j* operating during year *y*

**0.95** = Discount factor to account for leakage

The quantify of woody biomass saved  $B_{y, savings, i, j}$  due to implementation of improved cook stoves can be estimated by Equations 3.

$$B_{y, savings, i, j} = B_{old} \times \left( 1 - \frac{\eta_{old}}{\eta_{new, i, j}} \right) \quad \text{Equation (3)}$$

Where:

$B_{old}$  = Annual quantity of woody biomass that would have been used in the absence of the project activity (in tonnes per device) to generate useful thermal energy equivalent to that provided by the improved cook stove. The value of  $B_{old}$  can be sourced from historical data or baseline surveys. A default wood to charcoal conversion factor of 6 kg of firewood per kg of charcoal may be used in line with paragraph 35 of AMS II.G, version 11.

$\eta_{old}$  = Efficiency of baseline cookstove

$\eta_{new, i, j}$  = Efficiency of the improved cook stove type *i* and batch *j* determined through water boiling test (WBT) in the project scenario.

When the project households continue to use baseline cookstoves along with improved cookstoves,  $B_{old}$  shall be adjusted ex-post based on the percentage of project households found to continue such practice according to Equation 4. For such cases, the quantity of woody biomass saved  $B_{y, savings, i, j}$ , due to implementation of improved cook stoves shall be calculated using an adjusted value to account for ex-post use of baseline stoves in addition to improved cookstove

$$B_{old, adjusted} = B_{old} \times (1 - \mu_y) \quad \text{Equation (4)}$$

$B_{old, adjusted}$  = Adjusted  $B_{old}$  to account the ex-post usage of firewood in baseline cookstove(s) by project households in addition to improved cookstove (in tonnes per device).

<sup>13</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Chapter 2 Stationary Combustion

<sup>14</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Chapter 2 Stationary Combustion

$\mu_y$  = Baseline stove usage factor to account for use of baseline cookstoves along with improved cookstoves.

The quantity of firewood consumed in absence of project activity ( $B_{old}$ ) shall be determined using an estimation of average annual consumption of firewood per household which may be derived using any of the following options:

- a. **Historical Data:** Project proponent shall ensure that the relevance of data is appropriately justified for the target population and is the latest available data from credible source(s).
- b. **Baseline Survey of Local Usage:** Project proponent shall carry out a survey of usage prior to implementation of the project activity following the sampling approach described in the latest version of CDM document Sampling and surveys for CDM project activities and programme of activities. Alternatively, the project participant may follow the simple random sampling approach and the minimum sample size should be determined as per the following guidelines:
  - Project target population < 300: Minimum sample size 30
  - Project target population 300 – 1000: Minimum sample size 10% of group size
  - Project target population > 1000: Minimum sample size 100

This simplified approach may also be used for determining minimum sample size for parameters listed under Sections 6.1 and 6.2 in which case it is not requisite for the sample size to meet confidence/precision requirements

In order to address the potential source of leakage which can be attributed to diversion of non-renewable biomass saved by project devices to non-project households which previously used renewable biomass; a net to gross adjustment factor of 0.95 is applied to  $ER_{y,i,j}$ .

The above equations assume that a single baseline stove is replaced by a single project stove. However, in some cases more than one project stove may be required to achieve service levels equal to baseline stove. For such cases, the displaced biomass shall be apportioned between the project stoves while calculating  $B_{old}$ .

The Equation 5 below shall be used for calculating biomass consumed in absence of project activity in case more than one project stove is used in household

$$\left. \begin{aligned}
 B_{old, i, j} &= B_{old, HH} \div N_{d, HH} \\
 B_{old, HH} &= B_{old, p} \times N_{p, HH}
 \end{aligned} \right\} \text{Equation (5)}$$

Where:

**Bold, HH** = 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 (tonnes/household/year)

**Nd, HH** = Number of project devices per household

**Bold, p** = Annual quantity of woody biomass that would have been used per person in the household in the absence of the project activity to generate useful thermal energy equivalent to that provided by the project devices (tonnes/person/year)

**Np, HH** = Average number of households

Calculation for the parameters:

**Estimated Emission removal calculation for the parameters shown for Project Year 1:**

$$B_{old,adjusted} = B_{old} \times (1 - \mu_y)$$

$$B_{old,adjusted} = 5.46 \times (1 - 0.1) = 4.91 \text{ tonnes of eq firewood/ year/HH}$$

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

$$B_{y,Savings} = [ (4.91) \times (1 - (16.5\% / 35.6\%)) ]$$

$$= 2.638 \text{ tonnes of eq firewood/ year/HH}$$

$$ER_{y,i,j} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times (EF_{wf,CO2} + EF_{wf,non\ CO2}) \times N_{y,i,j} \times 0.95$$

Year	Estimated baseline emissions or removals (tCO <sub>2e</sub> )	Estimated project emissions or removals (tCO <sub>2e</sub> )	Estimated leakage emissions (tCO <sub>2e</sub> )	Estimated net GHG emission reductions or removals (tCO <sub>2e</sub> )
07-05-2022 to 06-05-2023	346,553	0	0	346,553
07-05-2023 to 06-05-2024	1,114,977	0	0	1,114,977
07-05-2024 to 06-05-2025	2,150,419	0	0	2,150,419
	2,071,765	0	0	2,071,765

Year	Estimated baseline emissions or removals (tCO <sub>2</sub> e)	Estimated project emissions or removals (tCO <sub>2</sub> e)	Estimated leakage emissions (tCO <sub>2</sub> e)	Estimated net GHG emission reductions or removals (tCO <sub>2</sub> e)
07-05-2025 to 06-05-2026				
07-05-2026 to 06-05-2027	1,994,007	0	0	1,994,007
07-05-2027 to 06-05-2028	1,917,159	0	0	1,917,159
07-05-2028 to 06-05-2029	1,841,236	0	0	1,841,236
<b>Total</b>	<b>11,436,117</b>	<b>0</b>	<b>0</b>	<b>11,436,117</b>

The annual average of 7 years' period for project activity is **11,436,117 tCO<sub>2</sub>e**.

## 6 MONITORING

### 6.1 Data and Parameters Available at Validation

<b>Data / Parameter</b>	<i>Bold</i>
<b>Data unit</b>	Tonnes/year/HH
<b>Description</b>	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.
<b>Source of data</b>	Calculated through Baseline survey assessment & KPT
<b>Value applied</b>	Charcoal households – 5.46
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	This parameter shall be determined ex-ante

<b>Purpose of Data</b>	Calculation of emission reduction
<b>Comments</b>	<p>Parameter <math>B_{old}</math> once determined shall remain fixed for the entire crediting period.</p> <p>Where charcoal is used by baseline devices, a default wood to charcoal conversion factor of 6 Kg of firewood per kg of charcoal may be used in line with paragraph 35 of AMS II.G, version 11</p>

<b>Data / Parameter</b>	$f_{NRB,y}$
<b>Data unit</b>	Fraction
<b>Description</b>	Fraction of woody biomass saved by the project activity during year $y$ that can be established as non-renewable biomass
<b>Source of data</b>	Value determined from survey methods using the CDM tool 30
<b>Value applied</b>	0.90
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	This parameter shall be determined ex-ante.
<b>Purpose of Data</b>	Calculation of emission reductions
<b>Comments</b>	The report of $f_{NRB}$ has been to VVB during the validation. Summary of the $f_{NRB}$ is given in the Appendix 2

<b>Data / Parameter</b>	$EF_{wf,CO_2}$
<b>Data unit</b>	tCO <sub>2</sub> /TJ
<b>Description</b>	CO <sub>2</sub> emission factor for the use of wood fuel in baseline scenario
<b>Source of data</b>	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion
<b>Value applied</b>	112
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	IPCC default value
<b>Purpose of Data</b>	Calculation of emission reductions

Comments	N/A
Data / Parameter	<b><math>EF_{wf, non CO_2}</math></b>
Data unit	tCO <sub>2</sub> /TJ
Description	Non-CO <sub>2</sub> emission factor for the use of wood fuel in baseline scenario
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 2 Stationary Combustion
Value applied	26.23
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of emission reductions
Comments	-

Data / Parameter	<b><math>NCV_{wood fuel}</math></b>
Data unit	TJ/tonne
Description	Net calorific value of the non-renewable woody biomass that is substituted or reduced
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 2 Energy, Chapter 1 Introduction
Value applied	0.0156
Justification of choice of data or description of measurement methods and procedures applied	IPCC default value
Purpose of Data	Calculation of emission reductions
Comments	-

Data / Parameter	η <sub>p</sub>
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<b>Data unit</b>	%
<b>Description</b>	Efficiency of project stove at the start of project activity.
<b>Source of data</b>	Manufacturer's specification
<b>Value applied</b>	Smart Home Pro stove – 37.9% <sup>15</sup>
<b>Justification of choice of data or description of measurement methods and procedures applied</b>	This parameter shall be determined ex-ante
<b>Purpose of Data</b>	Calculation of $\eta_{new, i,j}$
<b>Comments</b>	N/A

<b>Data / Parameter</b>	$\eta_{old}$
<b>Data unit</b>	Fraction
<b>Description</b>	Efficiency of baseline stove
<b>Source of data</b>	Surveyed prior to implementation of project activity
<b>Description of measurement methods and procedures to be applied</b>	In line with the methodology WBT has been conducted for the baseline devices during the pre-project scenario
<b>Frequency of monitoring/recording</b>	Fixed for each individual household at the time of project implementation.
<b>Value applied</b>	Traditional Charcoal Stove – 16.5%
<b>QA/QC procedures to be applied</b>	-
<b>Purpose of data</b>	Calculation of emission reduction
<b>Calculation method</b>	Water Boiling Test Protocol
<b>Comments</b>	PP has conducted WBTs to determine the thermal efficiency of the baseline charcoal stoves as elaborated in section 3.4

<sup>15</sup> More similar cookstove models may be included during the project implementation period

<b>Data / Parameter</b>	Life span
<b>Data unit</b>	Years
<b>Description</b>	This parameter is determined at the start of project activity through the technical specification from ICS manufacturers and based on this the parameter the project stoves will be discontinued from the database on expiration of their useful service life
<b>Source of data</b>	ICS Manufacturer's specification
<b>Description of measurement methods and procedures to be applied</b>	-
<b>Frequency of monitoring/recording</b>	Once at the time of Project stove installation
<b>Value applied</b>	7 Years
<b>QA/QC procedures to be applied</b>	-
<b>Purpose of data</b>	Calculation of $N_{y,i,j}$
<b>Calculation method</b>	-
<b>Comments</b>	This parameter is used to only determine the life span of the ICS and however WBT shall be conducted to determine the actual thermal efficiency of the project stoves during the verification period as this project activity does not opt for Eq 5 of VMR0006 Methodology

## 6.2 Data and Parameters Monitored

<b>Data / Parameter</b>	$N_{y,i,j}$
<b>Data unit</b>	Number
<b>Description</b>	Number of project devices of type i and batch j operating during year y

<b>Source of data</b>	Monitoring														
<b>Description of measurement methods and procedures to be applied</b>	Measured directly or based on a representative sample. Sampling standard will be used for determining the sample size to achieve 95/10 confidence precision according to the latest version of Standard for sampling and surveys for project activities and programme of activities. Alternately, simplified approach proposed in option (b) under Section 8.4 in the methodology may be used for determining the minimum sample size in which case compliance with 95/10 confidence precision is not obligatory.														
<b>Frequency of monitoring/recording</b>	At least once every two years														
<b>Value applied</b>	<p>For ex-ante emission reduction calculation, it is assumed that the project will have operational ICS in the following scale:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;"><b>Year 1</b></td> <td style="text-align: center;">71,250</td> </tr> <tr> <td style="text-align: center;"><b>Year 2</b></td> <td style="text-align: center;">231,250</td> </tr> <tr> <td style="text-align: center;"><b>Year 3</b></td> <td style="text-align: center;">450,000</td> </tr> <tr> <td style="text-align: center;"><b>Year 4</b></td> <td style="text-align: center;">437,500</td> </tr> <tr> <td style="text-align: center;"><b>Year 5</b></td> <td style="text-align: center;">425,000</td> </tr> <tr> <td style="text-align: center;"><b>Year 6</b></td> <td style="text-align: center;">4,12,500</td> </tr> <tr> <td style="text-align: center;"><b>Year 7</b></td> <td style="text-align: center;">4,00,000</td> </tr> </table>	<b>Year 1</b>	71,250	<b>Year 2</b>	231,250	<b>Year 3</b>	450,000	<b>Year 4</b>	437,500	<b>Year 5</b>	425,000	<b>Year 6</b>	4,12,500	<b>Year 7</b>	4,00,000
<b>Year 1</b>	71,250														
<b>Year 2</b>	231,250														
<b>Year 3</b>	450,000														
<b>Year 4</b>	437,500														
<b>Year 5</b>	425,000														
<b>Year 6</b>	4,12,500														
<b>Year 7</b>	4,00,000														
<b>\QA/QC procedures to be applied</b>	-														
<b>Purpose of data</b>	Calculation of emission reduction														
<b>Calculation method</b>	<p>The proportion of operational stoves obtained from the survey is multiplied by the total commissioned stoves and their equivalent operational year fraction to arrive at this value</p> <p><math>N_{y,i,j}</math> = proportion of operational stoves monitored (<math>U_{py}</math>) x Total ICS distribution x Equivalent operational year fraction of stoves</p>														
<b>Comments</b>	-														
<b>Data / Parameter</b>	$\eta_{new, i,j}$														
<b>Data unit</b>	Fraction														

<b>Description</b>	Efficiency of the improved cookstove type i and batch j implemented as part of the project activity
<b>Source of data</b>	Measurement through Water Boiling Test (WBT)
<b>Description of measurement methods and procedures to be applied</b>	<p>For the project activity efficiency of the device will be monitored by conducting water boiling test (WBT) annually as per the following,</p> <ol style="list-style-type: none"> <li>i. Conduct WBT test on a sample of three improved cookstoves with three tests conducted for each stove. The test can be carried out by project proponents by themselves or stove manufacturers or other third parties.</li> <li>ii. Efficiency to be tested is high-power thermal efficiency. The high-power thermal efficiency is the average of the Cold Start and Hot Start phases</li> <li>iii. The average of all results for each device type/model and batch shall be taken as the efficiency for each device type and batch.</li> <li>iv. If the standard deviation of the test results indicated above is very small (<math>\leq 0.05</math>) and 95/10 precision requirement is met (in this case, the value of the t-distribution for 95 per cent confidence shall be used instead of Z value), the efficiency determined is acceptable, otherwise more sample tests would be required until 95/10 precision is met</li> </ol>
<b>Frequency of monitoring/recording</b>	Annually
<b>Value applied</b>	<p>For ex-ante calculation, the value below is applied</p> <p>SmartHome Pro – 37.9%</p>
<b>QA/QC procedures to be applied</b>	Measuring instruments viz., Thermometer & Weighing used in WBT to be either duly calibrated or purchased newly
<b>Purpose of data</b>	Calculation of emission reduction
<b>Calculation method</b>	High power thermal efficiency will be calculated following Water Boiling Test protocol
<b>Comments</b>	Equation 5 of the methodology has been used to estimate the Ex-Ante values
<b>Data / Parameter</b>	$\mu y$
<b>Data unit</b>	Fraction

Description	Adjustment to account for any continued use of pre-project devices during the year y
Source of data	Monitoring
Description of measurement methods and procedures to be applied	<p>Minimum sample size of each batch j will be in line with the guidelines provide in section 6.4 below</p> <p>This parameter will be monitored using one of the following methods:</p> <ol style="list-style-type: none"> <li>1) If the baseline cookstoves are decommissioned and no longer used, as determined by the monitoring survey its value is 0 and Bold, adjusted is equal to <math>B_{old}</math>.</li> <li>2) If both the improved project cookstove and baseline cookstove are used together in the project scenario then surveys will be conducted to record the average continued operation of baseline cookstoves in a sample of households. The usage survey is designed to capture the cooking habits and stove usage pattern of households in the region, including quantification of use of baseline cookstoves, by formulating questions and collecting evidence to determine the frequency of usage of both the improved cookstoves and baseline cookstoves</li> </ol>
Frequency of monitoring/recording	At least once every two years
Value applied	0.1 for Ex-Ante ER Estimation
Monitoring equipment	Monitoring survey
QA/QC procedures to be applied	-
Purpose of data	Calculation of emission reduction
Calculation method	-
Comments	Assumed value for ER estimation (0.1), actual value will be monitored ex-post usage survey

### 6.3 Monitoring Plan

The methods used for generating/measuring, recording, storing, aggregating, collating and reporting data and parameters set out in the above section 6.2 are detailed here:

- 1. Total Distribution Record:** The total distribution record documents the information as listed below for the technologies implemented. A carbon waiver including a warranty card will be

distributed with each stove distributed. PP shall be having two copies of the warranty card cum carbon waiver receipt, while one of the copies shall be handed over to the End User and the other copy is kept in the records of CME either in physical and electronic format. Further from 2023 onwards CME has moved the distribution process completely digital and the carbon waiver and warranty shall be recorded digitally rather than in physical format. Also, physical copy of warranty card cum carbon waiver receipt will be handover to End User for their reference. The total distribution record will be kept electronically and with supporting evidence from paper records and/or electronic records and will be provided to the VVB at verification.

The Total Distribution Record contains:

- a) Project / Project Instance ID
- b) Unique identification of stove using stove serial number
- c) Address, GPS coordinates and telephone (as available)
- d) Date of distribution and model/type of project technology distributed
- e) Cooking technology and fuel used in baseline scenario f) Quantity of project technology distributed as evidenced by invoices

Frequency: Ongoing

- 2) **Project Database:** Each project will have a specific Project Database that records each ICS crediting in that project instance. Every ICS listed in the Total Distribution Record will be transferred into the Project Database of the respective project instance as needed to expand the number of ICS deployed, until the maximum threshold for the project instance is reached. In addition to the information provided in the Total Distribution Record, the project instance specific Project Database will record user details (enough for end-user identification and follow-up) for all, or a subset of all, appliances deployed.

End-user details recorded are:

- a) Name
- b) Telephone, or address (as available)
- c) Type of stove (stove model & serial number) and fuel the ICS is replacing: Example – traditional or improved baseline stoves, or wood or charcoal fuel.

- 3) **Sampling Design:** Due to the large number of ICS envisioned to be distributed as part of the project to be included in the grouped project, it was not economically feasible to monitor each individual ICS unit distributed. Therefore, representative sampling will be undertaken as part of a project-

wide Sampling Plan. The Sampling shall be conducted biennially by meeting 95/10 confidence/precision.

Objectives and Reliability Requirements: The objective is to obtain an unbiased and reliable estimate of the proportion or mean value of the following parameters over the course of the monitoring period, with 95/10 for annual / biennial sampling.

1. Efficiency of the improved cook stove type i and batch j:  $\eta_{new,y,i}$  (Annually monitored)
2. Monitored proportion of operational stoves:  $U_{py}$  (Biennially monitored)
3. Baseline stove usage factor to account for use of baseline cookstoves along with improved cookstoves:  $\mu_y$  (Biennially monitored)

Target Population: The target population for the three parameters stated above are all ICS recorded in the project database.

Sampling Frame: For the parameters Stove Efficiency ( $\eta_{new,y,i}$ ) and proportion of operational stoves ( $U_y$ ), the ICS population will be stratified based on the stove models, which are part of the project. For monitoring baseline stove usage factor ( $\mu_y$ ) to account for use of baseline cookstoves along with improved cookstoves in the project scenario activity the ICS will be stratified based on the year of distribution/installation.

Sampling Method: The sampling was conducted using stratified random sampling technique over the aforesaid sampling frames created. The ICS population in each stratum was arranged by date of distribution, assigning them a sampling serial number. Random numbers were generated using the online random number generator ranging from 1 to total number of ICS in a given stratum and the samples corresponding to the random numbers obtained, were picked for sampling. This approach ensured that each ICS listed in the database has an equal chance of being selected. A slightly higher number of samples were picked than that needed to be monitored to cover for non-responses.

Sampling Size: The required sample sizes were derived using equation (1), (2), (3), (4) and (9) of Appendix 3 of the Guideline: Sampling and surveys for CDM project activities and programmes of activities, Version 04.0 for monitoring parameter as follows:

$$n \geq \frac{z^2 * N * V}{(N - 1) * precision^2 + z^2 * V}$$

Where:

n = number of ICS to be sampled

N = Total number of ICS in the population

$z$  = Constant referring to level of confidence (1.95 for 95% confidence)

Precision = Required precision (e.g., 10% = 0.1)

$$V = \frac{SD^2}{p^2}$$

Where (for proportion parameters):

$$SD^2 = \frac{\sum_{i=1}^k g_i * p_i * (1 - p_i)}{N}$$

$$\bar{p} = \frac{\sum_{i=1}^k g_i * p_i}{N}$$

Where:

$g_i$  = weight of strata  $i$  in the population

$p_i$  = expected proportion of strata  $i$  in the population

$k$  = total number of strata in the population

and Where (for mean parameters):

$$SD^2 = \frac{\sum_{i=1}^k g_i * SD_i^2}{N}$$

$$Mean = \frac{\sum_{i=1}^k g_i * m_i}{N}$$

Where:

$SD_i$  = expected standard deviation of strata  $i$  in the population.

$m_i$  = expected mean of strata  $i$  in the population.

Stratified Random Sampling was applied by dividing the population into various strata. The expected parameter values were determined based on project developer's knowledge and experience as per para 13(b) and 13(c) of the "Standard: Sampling and surveys for CDM project activities and Programmes of activities".<sup>4</sup>

The organizational structure, responsibilities and competencies of the personnel that carried out monitoring activities.

Person	Role
Project implementer database administrator	The database administrator is responsible for updating and maintaining all electronic databases. Required competencies include experience with data management systems (eg. Excel, STATA, or SPSS), minimum 2 years working experience in a similar field, and at minimum a bachelor’s degree from an institution of higher education.
Monitoring team	<p>The monitoring team will be assigned by the project proponent to conduct the user interviews and appliance tests during the periodic sampling and reports the results to the database administrator. The skills and experience required for the data collection activities include:</p> <ul style="list-style-type: none"> <li>• Experience conducting surveys/tests</li> <li>• Experience conducting door-to-door surveys of biomass consumption</li> <li>• Local language skills (especially important for input to questionnaire design and interviewing of end users)</li> <li>• English language skills</li> <li>• Cultural awareness</li> <li>• Numerical proficiency</li> <li>• Data entry skills</li> </ul>

The procedures used for Quality Assurance

1. Ensuring end user awareness. At the time of distribution, the ICS customer is made aware that they are required to participate in monitoring activities. This will be via training distribution personnel to explain the importance of monitoring to each customer.
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. For example, when conducting sampling to estimate the parameter  $\mu_y$  a simplified approach has been designed to avoid the need for asking customers how much money they spend on fuel.
3. Drawing on local knowledge. The local contractors to be hired by the project proponent in the country 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, e.g., to explain to the end user that their old stove will not be removed if they admit to its continued use.
4. Quality of contractors. Any third parties hired by the project proponent 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. The project proponent 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/standards). Training will also be provided on how to deal with non-responses, refusals and other problems should these occur.

## 7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

### 7.1 Data and Parameters Monitored

<b>Data / Parameter</b>	$N_{y,i,j}$
<b>Data unit</b>	Number
<b>Description</b>	Number of project devices of type i and batch j operating during year y
<b>Source of data</b>	Monitoring
<b>Description of measurement methods and procedures to be applied</b>	<p>Proportion of operational stoves (<math>U_{py}</math>) is measured based on a representative sample. Sampling standard has been used for determining the sample size to achieve 95/10 confidence precision according to methodology requirement.</p> <p>The proportion of operational stoves obtained from the survey is multiplied by the total commissioned stoves and their equivalent operational year fraction of the stoves to arrive at this value</p> <p><math>N_{y,i,j}</math> = monitored proportion of operational stoves (<math>U_{py}</math>) x Total ICS distribution x Equivalent operational year fraction of stoves</p>
<b>Frequency of monitoring/recording</b>	At least once every two years
<b>Value applied</b>	288
<b>Monitoring equipment</b>	Monitoring Survey
<b>QA/QC procedures to be applied</b>	-
<b>Purpose of data</b>	Calculation of emission reduction
<b>Calculation method</b>	$N_{y,i,j} = 0.95 (U_{py}) \times 1,648 \text{ (Total ICS distributed)} \times 0.184 \text{ (Equivalent operational year fraction)} = 288$

<b>Comments</b>	-
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<b>Data / Parameter</b>	$\eta_{new, i, j}$
<b>Data unit</b>	Fraction
<b>Description</b>	Efficiency of the improved cookstove type <i>i</i> and batch <i>j</i> implemented as part of the project activity
<b>Source of data</b>	Measurement through WBT
<b>Description of measurement methods and procedures to be applied</b>	The efficiency of the project device was monitored by conducting Water Boiling Tests (WBTs) for the required sample size as per the methodology requirement
<b>Frequency of monitoring/recording</b>	Annually
<b>Value applied</b>	SmartHome Pro – 35.5%
<b>QA/QC procedures to be applied</b>	Measuring instruments viz., Thermometer & Weighing scales used in WBT to be either duly calibrated or purchased newly
<b>Purpose of data</b>	Calculation of emission reduction
<b>Calculation method</b>	High power thermal efficiency will be calculated by following Water Boiling Test protocol
<b>Comments</b>	The weigh scales and thermometers used in the WBT has been duly calibrated.

<b>Data / Parameter</b>	$\mu_y$
<b>Data unit</b>	Fraction
<b>Description</b>	Adjustment to account for any continued use of pre-project devices during the year <i>y</i>
<b>Source of data</b>	Monitoring
<b>Description of measurement methods and procedures to be applied</b>	<p>Minimum sample size of each batch <i>j</i> has been determined in line with the guidelines provide in section above 6.4.</p> <p>To capture the parallel usage scenario in the HH wherein both the improved project cookstove and baseline cookstove were used together in the project scenario the survey was conducted to record the average continued operation of baseline</p>

	cookstoves in a sample of households. The usage survey is designed to capture the cooking habits and stove usage pattern of households in the region, including quantification of use of baseline cookstoves, by formulating questions to determine the frequency of usage of both the improved cookstoves and baseline cookstoves
Frequency of monitoring/recording	At least once every two years
Value applied	0.06
QA/QC procedures to be applied	-
Purpose of data	Calculation of emission reduction
Calculation method	-
Comments	-

## 7.2 Baseline Emissions

The methodology does not account for baseline emissions separately, but instead quantifies net emission reductions achieved by the project. Please refer to Section 7.5.

## 7.3 Project Emissions

The methodology does not account for project emissions separately, but instead quantifies net emission reductions achieved by the project. Please refer to Section 7.5.

## 7.4 Leakage

Leakage shall be considered as default 0.95 in accordance with methodology.

## 7.5 Net GHG Emission Reductions and Removals

Net GHG emission reductions are calculated by applying Equations 1 and 2 for project activities replacing baseline stoves using non-renewable biomass (charcoal)

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

Where:

- $ER_y$  = Emission reductions during year y in tCO<sub>2e</sub>

- $i$  = Indices for the situation where more than one type/model of improved cook stove is introduced to replace inefficient baseline stoves
- $j$  = Indices for the situation where there is more than one batch of improved cook stove of type  $i$
- $ER_{yij}$  = Emission reductions by improved cook stove of type  $i$  and batch  $j$  during year  $y$  in tCO<sub>2e</sub>

Where:

$$ER_{y,,} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times (EF_{wf,CO2} + EF_{wf,non\ CO2}) \times N_{y,,j} \times 0.95 \quad \text{Equation (2)}$$

- $B_{y, savings, i, j}$  = Quantity of woody biomass that is saved in tonnes per cookstove device of type  $i$  and batch  $j$  during year  $y$
- $f_{NRB,y}$  = Fraction of woody biomass that can be established as non-renewable biomass (fNRB)<sup>16</sup>
- $NCV_{wood\ fuel}$  = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.0156 TJ/tonne)<sup>17</sup>
- $EF_{wf, CO2}$  = CO<sub>2</sub> emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 112 tCO<sub>2</sub>/TJ)<sup>18</sup>
- $EF_{wf, non\ CO2}$  = non-CO<sub>2</sub> emission factor for the use of wood fuel in baseline scenario (IPCC default for wood fuel, 26.23 tCO<sub>2</sub>/TJ)<sup>19</sup>
- $N_{y, i, j}$  = Number of project devices of type  $i$  and batch  $j$  operating during year  $y$
- **0.95** = Discount factor to account for leakage

The quantity of woody biomass saved  $B_{y, savings, i, j}$  due to implementation of improved cook stoves was estimated by the following option set out in Equations 3.

$$B_{y,saving,i,j} = Bold \times \left(1 - \frac{\eta_{old}}{\eta_{new,i,j}}\right) \quad \text{Equation (3)}$$

Where:

- $B_{old}$  = Annual quantity of woody biomass that would have been used in the absence of the project activity (in tonnes per device) to generate useful thermal energy equivalent to that provided by the improved cook stove. The value of Bold can be sourced from historical data or baseline surveys. A default wood to charcoal conversion factor of 6 kg of firewood per kg of charcoal may be used in line with paragraph 35 of AMS II.G, version 11.

<sup>16</sup> Default values endorsed by designated national authorities and approved by the Board are available at <https://cdm.unfccc.int/DNA/fNRB/index.html>

<sup>17</sup> AMS II.G. Version 12

<sup>18</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Chapter 2 Stationary Combustion

<sup>19</sup> 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Chapter 2 Stationary Combustion

- $B_{old}$  value has been derived from the baseline study conducted in the project boundary which is 5.46 tonnes wood-eq/HH/year (This will be an ex-ante value)
- When the project households continue to use baseline cookstoves along with improved cookstoves,  $B_{old}$  shall be adjusted ex-post based on the percentage of project households found to continue such practice according to Equation 4. For such cases, the quantity of woody biomass saved  $B_{y, savings, i, j}$ , due to implementation of improved cook stoves shall be calculated using an adjusted value to account for ex-post use of baseline stoves in addition to improved cookstove

$$B_{old, adjusted} = B_{old} \times (1 - \mu_y) \quad \text{Equation (4)}$$

- $\mu_y$  = Baseline stove usage factor to account for use of baseline cookstoves along with improved cookstoves. [Value applied for the Monitoring Period 1 (MP 1) is 0.06]

$B_{old, adjusted}$  = Adjusted  $B_{old}$  to account the ex-post usage of firewood in baseline cookstove(s) by project households in addition to improved cookstove (in tonnes per device). (Value applied for the MP 1 is 5.13 tons wood-eq/HH/year)

$\eta_{old}$  = Efficiency of baseline cookstove (Ex-ante value applied is 16.5%)

$\eta_{new,i,y}$  = Efficiency of the improved cook stove type i and batch j determined through water boiling test (WBT). (Value applied for the MP 1 is 35.5%)

PP has conducted WBTs for 36 samples much higher than the minimum samples requirement by adopting the WBT protocol. The high-power thermal efficiency was determined by taking average between Cold Start and Hot Start phases by conducting three tests for each ICS. **Sample Size Calculation**

Stove Thermal Efficiency $\eta_{new,i,j}$				
Stove Model (Sampling Frame)	Total Sales (Sampling Frame Size)	Expected Mean Efficiency (%)	Expected SD (%)	Calculated Sample Size (n)
SHS-PRO	1648	35.6%	3.56%	6
Sample size determination				
Estimated efficiency (mean)				35.6%
Estimated Standard Deviation of efficiency (SD)				3.56%
$V_{mean} = (SD/mean)^2$				0.01
Minimum Sample Size required (efficiency)				4
tDistribution sample size adjustment			Iteration 1	11
			Iteration 2	5
			Iteration 3	8
			Iteration 4	6
			Iteration 5	7
			Iteration 6	6

Monitored Result				
Stove Model (Sampling Frame)	Sampling frame size	Monitored Sample Size	Monitored Efficiency (%)	Monitored Standard Deviation
SHS-PRO	1648	36	35.5%	0.92%
Reliability Check				
Samples Monitored				36
Mean Efficiency				35.5%
Standard error of mean				0.15%
Relative precision (Margin of error) (%)				0.87%
Result				Ok, acceptable
Lower Bound confidence value				not applicable

Proportion of operational stoves (Uy)			
Stove Model (Sampling Frame)	Total Sales (Sampling Frame Size)	proportion of operational stoves (Uy) (%)	Calculated Sample Size (n)
SHS-PRO	1648	95%	30
Sample size determination			
Estimated Uy (p)			95.0%
Estimated Standard Deviation of Uy (SD)			21.79%
$V_{Uy} = (SD/p)^2$			0.05
Sample Size required (Uy)			30
tDistribution sample size adjustment		Iteration 1	22
		Iteration 2	23
		Iteration 3	23
		Iteration 4	23
		Iteration 5	23
		Iteration 6	23
Monitoring Results			
Stove Model (Sampling Frame)	Sampling frame size	Monitored Sample Size	Monitored Usage
SHS-PRO	1648	121	95%
Reliability Check			
Samples Monitored			121
Monitored Uy (p)			95.04%
Standard Error of Uy			1.90%
Relative precision (Margin of error)			3.91%
Result			Ok, acceptable
Lower Bound confidence value			not applicable

Use of Baseline Stove per Vintage ( $\mu_y$ )				
Stove Model (Sampling Frame)	Total Sales (Sampling Frame Size)	Expected Mean value (tonnes per year)	Expected SD	Calculated Sample Size (n)
2022	1648	0.10	0.01	7
Sample size determination				
Estimated ( $\rho$ )				0.10
Estimated Standard Deviation (SD)				0.01
Vmean = (SD/ $\rho$ ) <sup>2</sup>				0.01
Minimum Sample Size required				4
tDistribution sample size adjustment			Iteration 1	11
			Iteration 2	5
			Iteration 3	8
			Iteration 4	6
			Iteration 5	7
			Iteration 6	6
Monitoring Results				
Stove Model (Sampling Frame)	Sampling frame size	Monitored Sample Size	Monitored Mean Value of use of baseline stove	Monitored Standard Deviation
2022	1648	121	0.36	0.077
Reliability Check				
Samples Monitored				121
Mean value				0.36
Standard error of mean				0.007
Relative precision (Margin of error) (%)				3.67%
Result				ok acceptable
Applicable Value				0.06

ER Calculation for the Monitoring Period 1 is given below:

$$ER_{y,i,j} = B_{y,savings,i,j} \times NCV_{wood\ fuel} \times f_{NRB,y} \times (EF_{wf,CO_2} + EF_{wf,non\ CO_2}) \times N_{y,i,j} \times 0.95$$

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

$$B_{old,adjusted} = B_{old} \times (1 - \mu_y)$$

$$B_{old,adjusted} = 5.46 \times (1 - 0.06)$$

$$= 5.13 \text{ tonnes/year/HH}$$

$$B_{\text{Savings},i,j} = [ (5.13) \times (1 - (16.5\% / 35.5\%)) ]$$

$$= 2.749 \text{ tonnes /HH/year}$$

$$ER_y = 2.749 \times 0.0156 \times 0.90 \times (112 + 26.23) \times 288 \times 0.95$$

$$= \underline{\underline{1,459 \text{ tCO}_2\text{e}}}$$

Year	Baseline emissions or removals (tCO <sub>2</sub> e)	Estimated project emissions or removals (tCO <sub>2</sub> e)	Estimated leakage emissions (tCO <sub>2</sub> e)	Net GHG emission reductions or removals (tCO <sub>2</sub> e)
(07-05-2022 to 31-10-2022)	1,459	-	-	1,459
<b>Total</b>	<b>1,459</b>	<b>-</b>	<b>-</b>	<b>1,459</b>

Also, the following table summaries the estimated ex-ante GHG emission reductions and removals and the achieved emission reductions and removals for this monitoring period

<u>Pro-rated Ex-ante emissions reductions/removals</u>	<u>Achieved emissions reductions/removals</u>	<u>Percent difference</u>	<u>Justification for the difference</u>
169,004	1,459	86.3%	During the MP 01 ICS distribution counts to 1,648 only, hence this difference

# APPENDIX 1: CALIBRATION CERTIFICATES

Precision balance

Calibration Date	26/08/2022
Serial Number	SGW-300H



**ECOLAB NIG. LTD.**  
 No. 32 Ali Akilu Road, Opp. AP Filling Station, U/Shanu Bus stop, P.O. Box 2030, Kaduna.  
 PHONES: 08034517413, 08059474156 E-mail: ecolab\_08@yahoo.com

**CALIBRATION CHECK CERTIFICATE: SCALE 3**

Calibration Object:	Precision balance
Manufacturer	My Weight
Type	KD – 8000
Serial number	ESNS6784224992T
Date of Calibration check	26 – 08 – 2022
Temperature	25°C
Place	Ecolab Nig. Ltd, Kaduna, Nigeria.

**Measurement Results:**

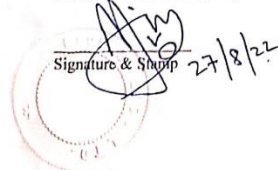
Measuring	Load	Indication
No. 1	5000g	5000g
No. 2	5000g	5000g
No. 3	5000g	5000g
No. 4	5000g	5000g
No. 5	5000g	5000g

In line with accuracy of  $\pm 1g$  tick  if yes

I hereby confirm that the calibration was performed according to the national standard and relevant part of the international guideline EURAMET CG 8:

**Institution:** Ecolab Nigeria Limited

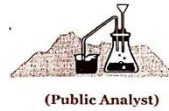
**Name:** M.M. Namadi (PhD)

Signature & Stamp  27/8/22

Water & Soil Test, Toxicity Test, Microbiology, Pollution Monitoring, Air Quality Monitoring

Thermometer and sensor

Calibration Date	26/08/2022
Serial Number	SGW-300H



**ECOLAB NIG. LTD.**  
 No. 32 Ali Akilu Road, Opp. AP Filling Station, U/Shanu Bus stop, P.O. Box 2030, Kaduna.  
 PHONES: 08034517413, 08059474156 E-mail: ecolab\_08@yahoo.com

**CALIBRATION CHECK CERTIFICATE: Thermometer & Sensor**

Calibration Object:	Thermometer with sensor
Date of calibration check:	26 - 08 - 2022
Temperature:	25°C
Place:	Ecolab Nig. Ltd, Kaduna, Nigeria
Altitude	2056.10ft
Co-ordinates	N: 10°36'50.08" E: 007°22'18.824"

**Thermometer:**

Manufacturer:	GREINSINGER ELECTRONIC
Type:	GMH 3710
Serial Number:	320402476

**Sensor:**

Manufacturer:	GREINSINGER
Type:	GTF 401-2-GE
Serial Number:	D-93128

**Measurement results**

Measuring	Ice water	Indication
No. 1	Ca.0°C	0.00°C
No. 2	Ca.0°C	0.00°C
No. 3	Ca.0°C	0.00°C
No. 4	Ca.0°C	0.00°C
No. 5	Ca.0°C	0.00°C

Water & Soil Test, Toxicity Test, Microbiology, Pollution Monitoring, Air Quality Monitor



(Public Analyst)

# ECOLAB NIG. LTD.

No. 32 Ali Akilu Road, Opp. AP Filling Station, U/Shanu Bus stop, P.O. Box 2030, Kaduna.  
 PHONES: 08034517413 , 08059474156 E-mail: ecolab\_08@yahoo.com

**Standard Deviation: 0**

Measuring	Ice water	Indication
No. 1	Water boiling Temperature	100°C
No. 2	Water boiling Temperature	100°C
No. 3	Water boiling Temperature	100°C
No. 4	Water boiling Temperature	100°C
No. 5	Water boiling Temperature	100°C

**Standard Deviation: 0**

I hereby confirm that the calibration was performed according to the national standard and relevant part of the international guideline EURAMET CG 8:

**Institution:** Ecolab Nigeria Limited

Name: M.M. Namadi (PhD)

  
 Signature & Stamp

Water & Soil Test, Toxicity Test, Microbiology, Pollution Monitoring, Air Quality Monitory

Moisture Meter

Calibration Date	14/08/2022
Serial Number	3510207500



(Public Analyst)


# ECOLAB NIG. LTD.


No. 32 Ali Akilu Road, Opp. AP Filling Station, U/Shanu Bus stop, P.O. Box 2030, Kaduna.  
 PHONES: 08034517413, 08059474156 E-mail: ecolab\_08@yahoo.com

Client Name: UpEnergy Group  
 Date Received: 13/08/2022  
 Date Reported: 14/08/2022  
 Job Requested: Moisture Content Calibration  
 Sample Type: Wood Charcoal  
 Sample Origin: Abuja

**CALIBRATION RESULT**

S/N	SAMPLE DESCRIPTION	EQUIPMENT ID	TEMPERATURE	MOISTURE CONTENT (Average %)
1.	Wood Charcoal	TROTEC T500 Serial No. 3510207500	22°C	7.8

Laboratory Analyst *MM Namal sign* 

Chief Technologist *A Ngol sign* 

## APPENDIX 2: FNRB ASSESSMENT

PP has calculated the fNRB as 0.90 as per the guidelines outlined in CDM tool 30 v4 with the latest available data from the reliable data sources such as UN / FAO / IPCC etc as summarized below,

#	Parameters	Obtained Value	Source of Information
1	Woody biomass for Energy Applications in domestic and industrial segments ( $HW \times N + CE$ )	162,806,115 Tonnes	Woody biomass for Energy Applications in domestic and industrial segments for the 2020 vintage from "Energy Statistics Database" from United Nation's Database. As per para 15 of the TOOL 30, version 4, <i>For the parameters HW and N, an aggregated value (HW x N) may be used in the calculation, if official statistics provide total household wood fuel consumption (HW x N) but not disaggregated values for HW and N separately.</i> Accordingly, the value (HW x N) and CE, as a single value (HW x N + CE) has been sourced from the UN Energy statistics database (energy application) Source: <a href="http://data.un.org/Data.aspx?q=fuelwood&amp;d=EDATA&amp;f=cmID%3aFW">http://data.un.org/Data.aspx?q=fuelwood&amp;d=EDATA&amp;f=cmID%3aFW</a>
2	Commercial woody biomass consumption for non-energy applications (e.g. construction, furniture) in the applicable area in the relevant period (NE)	17,905,553 Tonnes	Commercial woody biomass consumption for non-energy applications (e.g. construction, furniture) i.e., Roundwood consumption from FAO Statistics Food & Agriculture Organization of United Nations for the latest available vintage 2019 Source: <a href="http://www.fao.org/faostat/en/#data/R">http://www.fao.org/faostat/en/#data/R</a>
3	Total consumption of woody biomass ( $H = HW \times N + CE + NE$ )	180,711,667 (tonnes)	Calculated based on #1 & #2
4	Mean Annual Increment of woody biomass growth per hectare in sub-category i of forest areas in the relevant period ( $MAI_{forest,i}$ )	2.50 (tonnes/ha/yr)	Mean Annual Increment (MAI) of woody biomass growth Woody biomass values for forest areas are sourced from IPCC report i.e. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories  Source: <a href="https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch04_Forest%20Land.pdf">https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch04_Forest%20Land.pdf</a>

#	Parameters	Obtained Value	Source of Information
5	Mean Annual Increment of woody biomass growth per hectare in sub-category i of other land areas in the relevant period ( $MAI_{other,i}$ )	0.47 (tonnes/ha/yr)	<p>Mean Annual Increment (MAI) of woody biomass growth Woody biomass values for other areas are sourced from IPCC report i.e. 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories</p> <p>Source:  <a href="https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch05_Cropland.pdf">https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/4_Volume4/19R_V4_Ch05_Cropland.pdf</a></p>
6	Extent of forest and other land area in sub-category i in the relevant period (ha)	$F_{forest,i} = 21,626,950$ ha  $F_{other,i} = 69,450,050$ ha	<p>The land area details of forests and other lands with vegetation are sourced from FAO from Food &amp; Agriculture Organization of United Nations for the latest available vintage 2020</p> <p>Source: <a href="https://www.fao.org/faostat/en/#home">https://www.fao.org/faostat/en/#home</a></p>
7	Extent of non-accessible area within forest and other land area in sub-category i in the relevant period (ha)	$P_{forest,i} = 6,173,500$ ha  $P_{other,i} = 34,860,000$ ha	<ul style="list-style-type: none"> <li>- The information regarding protected forests and forests with long-term management plan are sourced from Global Forest Resources Assessment, 2020, FAO, Nigeria</li> <li>Source: <a href="https://www.fao.org/3/cb0037en/cb0037en.pdf">https://www.fao.org/3/cb0037en/cb0037en.pdf</a></li> <li>- The non accessible area within other land areas is estimated based on the land area obtained from FAO for the latest available vintage 2020 and based on the scientific research work Daniel C. Miller Juan Carlos Muñoz-Mora Luc Christiaensen, 2016. Prevalence, Economic Contribution, and Determinants of Trees on Farms across Sub-Saharan Africa. Policy Research Working Paper 7802, World Bank, Africa Region Office of the Chief Economist, WPS7802</li> <li>Source: <a href="https://openknowledge.worldbank.org/server/api/core/bitstreams/697bca60-28f9-5606-93c0-ce6b6d65e5cb/content">https://openknowledge.worldbank.org/server/api/core/bitstreams/697bca60-28f9-5606-93c0-ce6b6d65e5cb/content</a></li> </ul>
8	Biomass Accessibility Factor	42%	<p>The consideration of accessible biomass factor of 42 % for Nigeria in the RB calculation, is to account for the fraction of renewable biomass from various categories which is accessible for harvest. The accessibility for biomass was considered as average between two timeframes – &lt; 1 hours and up to 3 hours – for the accessible biomass factor used in the calculation of RB sourced from the peer reviewed literature Maina, Y. B. Umar, N. K. and Egbedimame, A. B. 2020. An Empirical Analysis of the Impact of Household Fuel Wood Consumption on the Environment in Nigeria. Journal of the Environment, Vol. 14, No. 3 September, 2020 &amp; the publication by GACC in 2014 titled "Geospatial Analysis and Modeling of Non-renewable biomass: WISDOM and beyond."</p> <p>Source: <a href="ajol-file-journals_406_articles_214771_submission_proof_214771-4837-530093-1-10-20210921%20(2).pdf">ajol-file-journals_406_articles_214771_submission_proof_214771-4837-530093-1-10-20210921%20(2).pdf</a></p>

#	Parameters	Obtained Value	Source of Information
			<a href="https://www.researchgate.net/publication/312021671_Pan-tropical_analysis_of_woodfuel_supply_demand_and_sustainability_2014">https://www.researchgate.net/publication/312021671_Pan-tropical_analysis_of_woodfuel_supply_demand_and_sustainability_2014</a>
9	Comparison of the calculated value of fNRB against the values for fNRB reported in relevant scientific literature (including the minimum requirements as per para. 6-a-i of the TOOL30 ver.4)	-	<p>The mean fNRB value from the quoted literature in CDM tool 30 v4 works out to 49.5% vis-à-vis 90% based on the independent study conducted by a Forestry Expert on behalf of the PP as per CDM tool 30 v4. This difference in the fNRB value can be attributed to the following reasons</p> <ul style="list-style-type: none"> <li>➤ The relevant scientific literature quoted as per CDM tool 30 (i) Bailis, R.; Drigo, R.; Ghilardi, A. &amp; Masera, O. (2015) is dated 2015 and the data points used in this research work is further older as 2009.</li> <li>➤ As a matter of fact, the fuelwood used for total energy supply at Nigeria is 210,432 k cubic metre in 2009, which significantly increased to an extent 24% to 260,913 k cubic metre during 2020 (Source : “Energy Statistics Database” from United Nation’s Database <a href="https://data.un.org/Data.aspx?d=EDATA&amp;f=cmID%3AFW">https://data.un.org/Data.aspx?d=EDATA&amp;f=cmID%3AFW</a>)</li> <li>➤ On the other hand, total forest area in Nigeria sums to be 23,423.28 k hectare in 2009 and a sharp decline is noticed in recent years. In 2020 Nigeria has only 21,626.95 k hectare of total forest area, this indicates ~7.6% of the total forest area is deforested as compared with 2009 scenario. (Source: “Food &amp; Agriculture Organization of United Nations” <a href="https://www.fao.org/faostat/en/#data/RL">https://www.fao.org/faostat/en/#data/RL</a>)</li> </ul> <p>There are different ways to calculate fNRB including geo-spatial approach, but PP appointed an independent 3<sup>rd</sup> party expert to carry out extensive analysis to calculate the fNRB as per the guidelines outlined in CDM tool 30 v4 with the latest available data from the reliable data sources such as UN / FAO / IPCC etc.</p>