CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1. Title of the small-scale project activity:

Improved Woodstoves in Udaipur - Helping Women and Environment
Version: 4
Date: 5th Dec 2016

A.2. Description of the small-scale project activity:

Seva Mandir is a non-governmental organization (NGO) working for the development of rural and tribal population in Udaipur and Rajsamand districts of Southern Rajasthan. The work area of Seva Mandir encompasses 626 villages and 56 urban settlements. In total, the organization reaches out to around 70,000 households, influencing the lives of approximately 360,000 people. Seva Mandir mainly focuses on enhancing people's capabilities for self-development by working for improved literacy levels, better health status and sensitization against oppressive gender relations, creating sustainable improvements in the livelihoods base by revitalizing the natural resource base of communities and strengthening village institutions by creating an alternative paradigm of power structures and community interactions that reinforce the positive forces of cooperation, transparency, equity, justice and responsible citizenship[1].Through this project, Seva Mandir intends to disseminate Improved Cook Stoves (ICS)[2] GREENWAY JUMBO STOVE and/or GREENWAY SMART STOVE to rural families in all Tehsils of Udaipur District, Rajasthan State, which is a drought prone region of India[3].

The project was registered as a GS CDM project. This was voluntarily deregistered at the UNFCCC and registered as a GS VER project with the Gold Standard. To hand over the project to the communities with able guidance from SEVA MANDIR, the project proponent was changed from SEVA MANDIR (NGO) to the Community based Producer Company **- Udaipur Urja Initiatives** promoted by SEVA MANDIR at the time of transfer of project registration with THE GOLD STANDARD.

Udaipur Urja Initiatives (UUI) Producer Company Limited was registered in 2014 to enhance the access of rural communities to appropriate technologies and to market agro-produces. The enterprise currently works with communities of Udaipur and Rajsamand districts. SEVA MANDIR assists UUI is its activities. UUI is a membership-based entity, in which membership is taken by the purchase of share. Along with cook stoves, the enterprise is building activities on solar lights and trading of agriculture produces grown by its members and other families in the region.

Purpose of the project activity
Over 61 percent of the Rajasthan State is desert. Precipitation is scanty, and constitutes the only source of annually renewable water supply. The State is prone to frequent droughts[4]. Forests constitute 9.56% of geographic area of the state. The per capita forest area is only 0.06 ha, which is one of the lowest in the country[5]. The forest ecosystems of Rajasthan are characterized by arid and scanty vegetation. Land use pattern have been showing a decrease in forest land cover and increase in desert land. Increasing pressure from human and livestock population and indiscriminate and illegal exploitation of forest resources are among factors that have lead to further intensification of the problem. A trend of forests turning into open

[1] http://www.sevamandir.org
[2] Hereby referred in the PDD as ICS, wherein it means Chulika and/or Greenway Smart Stove.
[3] http://managedisasters.org/caseStudies01-rajasthan.asp#01
[4] http://www.rajasthan.gov.in/rajgovresources/actnpolicies/environment_policy.pdf
[5] http://www.rajasthan.gov.in/rajgovresources/actnpolicies/forestpolicy.pdf

scrubs has been observed. Degradation of forest lands has exacerbated the already existing problem of desertification. There is a need to maintain adequate forest cover in the state to mitigate climate change effects[5].

On an average, Udaipur and Rajsamand districts get around 625 mm rainfall annually, primarily during July and September. The region is largely drought-prone, witnessing droughts every three to four years. Above that, the highly erratic onset and distribution of monsoon across both regions and monsoon months create drought-like situations intermittently. Apart from this, most of the land falls under commons, which, along with the increasing population pressure has led to vast degradation of forests in the area.

The purpose of the project activity is to decrease fuel wood consumption by replacing inefficient traditional cook stoves in about 18,500 households with efficient fuel wood single pan GREENWAY JUMBO STOVE and/or GREEN SMART cook stoves, in a drought prone, biomass deficient region of India. The improved cook stoves on an average save 72% of households' fuel wood. Based on average thermal efficiency improvement of Greenway Jumbo and Greenway smart stove, each household saves about 2.19 t/year (ER Calculation sheet), while in the baseline, the consumption is 3.21 t/household/yr. The savings over the baseline fuel wood consumption is 2.19/3.21*100 = 68.22% (Emission Reduction calculation sheet). By reducing fuel wood consumption, the project activity reduces green house gas (GHG) emissions stemming from the use of non-renewable biomass. The ICS cook stoves will save 2.35 t of CO_2/yr/family in this region. The project activity is expected to prevent 41,440 tCO_2 emissions (after considering leakage) in a year by implementing ICS stoves in 18,500 households and a total of 402,246 tonnes of CO_2 for a period of 10 years (ER calculations sheet).

Implementation (Refer to section B.7.2; Implementation Plan) of the project depends on the successful validation and registration of the project as a CDM project activity since the project will be financed completely from carbon revenues. The ICS will be distributed in the project area only after registration of the project as a CDM activity.

Type of technology
Two Improved Cook Stove (ICS) models, GREENWAY SMART STOVE and GREENWAY JUMBO STOVE are chosen for the project activity.

Greenway Smart Stove (GSSV3) and Green Jumbo Stove are single burner high efficiency cook stoves designed as an eco-friendly and modern replacement for traditional mud and stove stoves. These stoves are award winning design innovation that uses no moving parts to deliver fuel savings up to 65%, minimizes harmful emissions of CO, CO_2 and Particulate Matter (PM) and delivers convenient cooking without any requirement of fuel processing or change in cooking habits thus solving the health, environment and fuel collection effort required for operating traditional stoves. The stove is the result of user centric research across various geographies. The stove operates on all solid fuels as wood, agro-waste, charcoal, coal and dry dung and thus does not require any refurbishing or recurring cost. Its intuitive combustion mechanism automatically adjusts to the operators requirements and requires no training or adaption for usage, thus making it flexible and easy to use.

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

Social benefits

- Reduces drudgery to women (due to reduced fuel wood use) who spend long hours and travel long distances to collect fuel wood.
- Improves overall health of women and children by reducing smoke in the kitchen, thus reducing health hazards from indoor air pollution.
- Better cooking time – the materials used in making the ICS transmit the heat effectively, cooking the food faster.
- Better cooking environment due to less smoke and carbon residue in the kitchen.
- Better quality of life – the rural communities get family time as the whole family can sit and eat together.

Environmental benefits

- Improves the local environment by reducing rate of degradation of forests and deforestation in the project area.
- Reduce indoor pollution – ICS emits less smoke and reduces morbidity from respiratory diseases and other health hazards, as well as the medical expenditure involved. A resource-poor household would need to spend limited available finances on medicines, further exacerbated by loss of wages from both not being able to work and having to look after the ill-person.
- Reduce global and local environmental pollution and environmental degradation by reduction in use of non-renewable biomass thus leading to reduction in GHG emissions.
- Less water and effort is needed for cleaning vessels as the cooking process is relatively smoke-free.

Economic benefits

- Employment opportunities for local communities through the CDM activity.
- Reduces purchase of fuel wood and/or wage equivalent from reduced firewood collection time.

Technological benefits:

- Introduction of new technology to the rural communities.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or/public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (host)	**Udaipur Urja Initiatives Producer Co. Ltd.** – Private Entity	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

India

A.4.1.2. Region/State/Province etc.:

Rajasthan

A.4.1.3. City/Town/Community etc:

All Tehsils[6] of Udaipur District

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

Udaipur district is located between 23° 46' and 25° 05' North latitude and 73° 09' and 74° 35' East longitude covering an area of 11,630.66 sq. km. administratively, the district is divided into 11 Tehsils[7]. The region is a semi arid zone with an average annual rainfall of about 650 mm, which is mainly received during monsoon season from July to September. The area is surrounded by Aravalli hill ranges from north to south. The topography of the area is represented by medium to high rocky hills, contours and plains.

[6] Tehsil is an administrative division, which consists of a city or town that serves as headquarters, with additional towns, and a number of villages. As an entity of local government, it exercises certain fiscal and administrative power over the villages and municipalities within its jurisdiction.

[7] http://rajcensus.gov.in/admin.html

Figure 1: Map showing Rajasthan State, Udaipur District where the project will be implemented.

A.4.2. Type and category (ies) and technology/measure of the small-scale project activity:

The type and category of the project activity according to Appendix B to the simplified modalities and procedures for small-scale CDM project activities is as follows:

Sectoral Scope – 3; Energy Demand
Project Type II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS
Project Category – II.G. Energy efficiency measures in thermal applications of non-renewable biomass, Version 3, EB 60.

The chosen technology involves energy efficiency improvement in thermal appliances involving use of non-renewable biomass by introduction of high efficiency biomass fired cook stoves for cooking and heating water.

Non-renewable biomass has been used since 31st December 1989 as shown in Section B.2.

Technology/measure
Two Improved Cook Stove (ICS) models, GREENWAY SMART STOVE and GREENWAY JUMBO STOVE from Greenway Grameen Infra. Pvt. Ltd are the chosen models for the project activity. Depending on the participating families' choice, either one or both models will be the model for project implementation.

Fig 2: Greenway smart stove and Grenway Jumbo stove

Greenway Smart Stove and Greenway Jumbo Stove: Manufactured by Greenway Grameen Infra. Pvt. Ltd, the Greenway Smart Stove (GSSV3) and Greenway Jumbo Stove are single burner high efficiency cook stoves designed as an eco-friendly and modern replacement for traditional mud and stone stoves. These stoves are an award winning design innovation that uses no moving parts to deliver fuel savings up to 65%, minimizes harmful emissions of CO, CO_2 and Particulate Matter (PM) and delivers convenient cooking without any requirement of fuel processing or change in cooking habits thus solving health, environment and fuel collection effort required for operating traditional stoves. The stove is the result of user centric research across various geographies. The stove operates on all solid fuels as wood, agro-waste, etc. and thus does not require any refurbishing or recurring cost. Its intuitive combustion mechanism automatically adjusts to the operators requirements and requires no training or adaption for usage, thus making it flexible and easy to use (Greenway Grameen Infra. Pvt. Ltd).

The specifications of Greenway Smart Stove are as follows:

- Stainless Steel Combustion Chamber
- Height 12 inches
- Long lasting Paint
- Loading Capacity of up to 25 Kg
- Fuel supporting steel grate
- Bakelite handles
- 4 point top versatile support like gas stove
- 1 year warranty
- Thermal efficiency 32.098% The thermal efficiency test was done in accordance with BIS 13152

The specifications of Greenway Jumbo Stove is as follows:

- Size: 12.4" x 10.6" x 11.6"
- Materials: Steel and Aluminium with Bakelite Handles
- Loading Capacity: 40 kg
- Secondary Air Induction Mechanism

- Warranty: 2 years
- Fuel Savings: 65%
- Smoke Reduction: 70%
- Ergonomic front loading design
- Thermal efficiency 31.17% based on thermal efficiency test conducted in accordance with BIS 13152

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Please indicate the chosen crediting period and provide the estimation of total emission reductions as well as annual estimates for the chosen crediting period. Information of the emission reductions shall be indicated using the following tabular format.	
Years	**Estimation of annual emission reductions in tonnes of CO_2e**
2014-2015 (starting from 21/01/2014)	0
2015-2016	0
2016-2017	41,440
2017-2018	41,440
2018-2019	41,440
2019-2020	41,440
2020-2021	41,440
2021-2022	41,440
2022-2023	41,440
2023-2024 (ending on 20/01/2024)	41,440
Total estimated reductions (tonnes of CO_2e)	**331,520**
Total number of crediting years	**10**
Annual average of the estimated reductions over the crediting period (tCO_2e)	**331,520**

A.4.4. Public funding of the small-scale project activity:

There will be no public funding involved in the project activity. CDM revenues will be utilized for the entire cost of implementing the project activity.

A.4.5.Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to Annex 13, EB 54, "Guidelines on assessment of debundling for SSC project activities", the proposed small-scale project activity is not a de-bundled component of a large project activity since there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous two years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

The same can also be confirmed by visiting the CDM website https://cdm.unfccc.int/Projects/projsearch.html

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Sectoral Scope – 3; Energy Demand
TYPE II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS
CATEGORY: II.G. Energy efficiency measures in thermal applications of non-renewable biomass; Version 03; EB 60
Guidelines on assessment of debundling for SSC project activities. version 03, Annex 13, EB 54.

General Guidelines to SSC CDM methodologies, Version 17, EB 61

Guidelines on the demonstration and assessment of prior consideration of the CDM, Version 04, Annex 13, EB 62

B.2 Justification of the choice of the project category:

This project is applicable as per the definition in the Annex B of the simplified methodologies for selected small-scale CDM project activity categories, Type II.G. Energy efficiency measures in thermal applications of non-renewable biomass; Version 03; EB 60

i. This category comprises appliances involving efficiency improvements in the thermal applications of non-renewable biomass. The project activity is introduction of GREENWAY SMART and JUMBO improved cook stove, high efficiency biomass fired cook stoves at household level for cooking, heating water and cattle feed preparation with an average thermal efficiency of 0.3163. In the baseline, inefficient cook stoves are being used with an efficiency of 0.10.
ii. The communities are using non-renewable biomass since 31st December 1989.
    - The Department of Forests, Government of Rajasthan, conducted a study to assess the demand and supply of fuel wood in the state[8]. According to the Sector Review Report of Rajasthan, National Forest Action Programme (NFAP), there have been imbalances in demand and supply of fuel wood since 1980, attributed mainly to unbridled growth of human and livestock population, shrinkage of resource base on account of expansion of agriculture and increasing industrialization and urbanization. Thus there is continued non-renewable wood being used since 1989 till date.

Table 1: Demand and Supply of fuel wood for Rajasthan State (in Mt)

S.No	Year	Demand	Supply	Gap	f_{NRB}
1	1980	5.12	0.96	4.16	0.81
2	1990	5.60	0.82	4.78	0.85

[8] http://www.rajforest.nic.in/?q=mutual-impacts-and-benefits-one

- Based on a study conducted by FAO in 1983[9], Rajasthan has been a fuel wood deficit state.

iii. Type II project activities or those relating to improvements in energy efficiency which reduce energy consumption on the supply and/or demand side, shall be limited to those with a maximum output of 60 GWh per year or an appropriate equivalent which is below 180 GWh_{th} and will remain under the limits of small-scale project activity during every year of the crediting period as shown below. The calculation of annual energy savings will be done as follows:

- Thermal energy savings per household are calculated by multiplying the annual biomass savings per household from ICS systems with its calorific value. The average efficiency of Greenway Jumbo Stove and greenway smart stove has been considered for energy savings.

$$\text{Energy Savings (GWh)} = B_{ysavings}.NCV_{biomass}$$

$$= B_{old}.(1-\frac{\eta_{old}}{\eta_{new}}).NCV_{biomass}$$

$$= 3.21\times(1-\frac{0.1}{0.3163})\times 4.167$$

= 9.147 MWh/household

= 0.0091 GWh/household

Where:

B_{old} = Quantity of woody biomass used in the absence of the project activity in tonnes = 3.21 t per household (see Section B.4.)

η_{old} = Efficiency of the system being replaced = 0.1 (see Section B.4.)

η_{new} = Efficiency of the system being deployed as part of the project activity as determined using the Water Boiling Test (WBT) protocol = weighted average values of greenway smart stove and Jumbo stove= (0.32098+0.3117)/2 = 0.3163 (see Section B.4.)

$NCV_{biomass}$ = Net calorific value of the non-renewable biomass that is substituted = IPCC default for wood fuel, 0.015 TJ/tonne, corresponds to 4.167 MWh/t (Reference SSC_233))

The maximum number of eligible households that can be disseminated with the stove in this project activity is therefore 180 GWh_{th}/0.0091 GWh per household =19,678 households. A total of 18,500 households will be replaced by the ICS.

Depending on the number of stoves that will be implemented for each of the model (Greenway smart stove and Jumbo stove), the weighted efficiency will be considered to estimate the energy savings as shown above. Accordingly, the number of households will be determined to remain under the limit of small scale project activity during implementation. The project activity will remain under the limit of small-scale project activity types (annual thermal energy savings below 180 GWh) during every year of the crediting period. The families have been identified and are from the database of Seva Mandir. Considering the above, AMS II.G, Version 3 is applicable to the project activity.

B.3. Description of the project boundary:

[9] M.R. de Montalembert & J. Clement. 1983. Fuel wood supplies in the developing countries. FAO Forestry Paper. FAO http://www.fao.org/docrep/x5329e/x5329e0b.htm#annex%20%20%20list%20and%20classification%20of%20fuelwood%20situations%C2%B9

According to II.G methodology, *the project boundary is the physical, geographical site of the efficient systems using biomass.*

This projects boundary will therefore encompass the sum of the all the physical, geographical sites of all individual households disseminated with the ICS under this GS VER project activity in the Tehsils of Udaipur District.

Thus the project boundary is the cooking activity with ICS by applicable number of stove user households (which will be below the limit of small scale project) in all the Tehsils of Udaipur District, Rajasthan State, India.

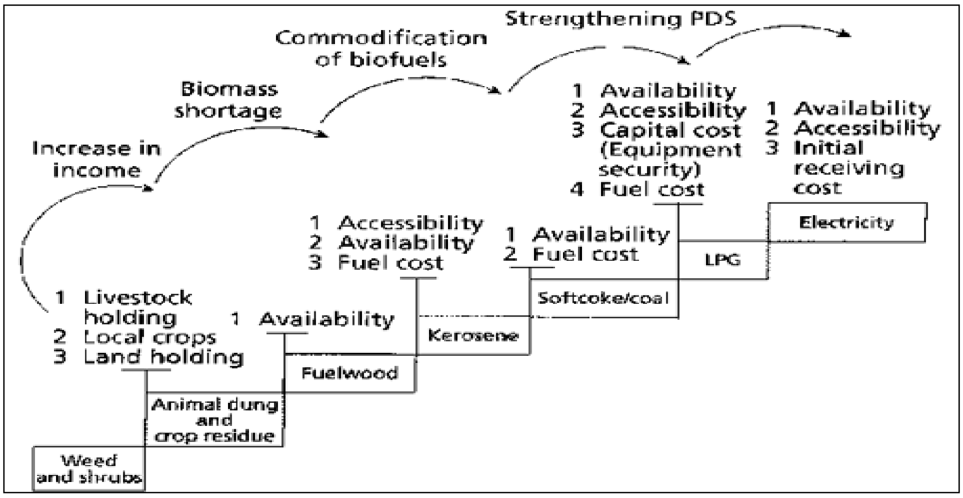
B.4. Description of baseline and its development:

In accordance with Paragraph 4 of the chosen methodology, Type II.G. Energy efficiency measures in thermal applications of non-renewable biomass, Version 3, EB 60:

It is assumed that in the absence of the project activity, the baseline scenario would be the use of fossil fuels for meeting similar thermal energy needs.

According to the general guidelines to SSC CDM methodologies, Version 17, EB 61, Paragraph 19, the steps for assessment of the alternatives of the project activity is not required as the methodology provides the emission factor and thus has precedence.

As seen from the energy ladder in India, the mix of present and future fuels used would consist of a solid fossil fuel (lowest in the ladder of fuel choice), a liquid fossil fuel (represents a progression over solid fuel in the ladder of fuel use choices) and a gaseous fuel (represents a progression over liquid fuel in the ladder of fuel use choices).



Source: Preeti Malhotra. Environmental implications of the energy ladder in rural India. Boiling Point. Issue 42. Household energy and the environment[10]

[10] http://www.hedon.info/BP42_EnvironmentalImplicationsOfTheEnergyLadderInRuralIndia

According to the methodology, the emission factor for the substitution of non-renewable woody biomass by similar consumers is based on weighted average basis and is considered as 81.6 tCO_2/TJ

Emission Reduction Calculations
According to the methodology, Para 5, the specific equations for calculations of Baseline emissions, Project emissions or Leakage is not provided, but only for emission reductions as follows:

Emission reductions would be calculated as:

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel} \quad \textbf{(1)}$$

Where:

ER_y	*Emission reductions during the year y in tCO_2e*
$B_{y,savings}$	*Quantity of woody biomass that is saved in tonnes*
$f_{NRB,y}$	*Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass*
$NCV_{biomass}$	*Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)*
$EF_{projected\_fossilfuel}$	*Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO_2/TJ*

Considering Option 2 of Para 6 of the methodology:

$$B_{y,savings} = B_{old} \cdot \left(1 - \frac{\eta_{old}}{\eta_{new}}\right) \quad \textbf{(3)}$$

Where:

B_{old} Quantity of woody biomass used in the absence of the project activity in tonnes

η_{old}
1. Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of system is being replaced;
2. A default value of 0.10 may be optionally used if the replaced system is a three stone fire, or a conventional system with no improved combustion air supply or flue gas ventilation system, i.e. without a grate or a chimney; for other types of systems a default value of 0.2 may be optionally used

η_{new} Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol. Use weighted average values if more than one type of system is being introduced by the project activity

Step 1: Determination of B_{old}

According to the methodology, Para 7 and Opting for Option (a) to determine B_{old}, it is derived as follows:

Calculated as the product of the number of systems multiplied by the estimated average annual consumption of woody biomass per appliance (tonnes/year). This can be derived from historical data or a survey of local usage.

The average annual consumption of biomass per capita (t/yr) was derived from survey methods for statistically determined sample in the project area. A sample survey was conducted covering 952 households of the project beneficiaries. The per capita woody biomass consumption is 0.74±0.02 t/year. The per capita woody biomass consumption is determined at 95/5 level, but the number of samples or households to determine this parameter was selected based on 90/10 confidence/precision level. The methodology adopted to conduct the survey is described in Annex 3. According to the survey, the annual consumption of biomass per family is **3.21 t/yr** (average adult equivalent/family is 4.34 members).

Thus, an annual consumption of 3.21 t/family/yr has been considered for the PDD based on sample survey conducted in the project area.

Step 2: Determining η_{old}

The baseline traditional cook stoves being replaced are three-stone fires and traditional cook stoves built of mud/clay/cement lacking a chimney and grate (Figure 3). These stoves can take either single or two pots at a time and use firewood as fuel. Most of the households have two stoves, wherein they use it for cooking, water heating, space heating, cattle-feed preparation, and lighting.The efficiencies are low and are of the order of 10%.

Thus according to the methodology, a default value of 0.10 is used as the replaced system is a three stone fires and conventional system with no improved combustion air supply or flue gas ventilation system, i.e. without a grate or a chimney.

Thus η_{old} is 0.10.

Figure 3: Traditional cook stoves used in the baseline in the project area

Step 3: Determining η_{new} Option 2 of the methodology has been used for determining B_y savings. Accordingly, η_{new} is the efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol. Use weighted average values if more than one type of system is being introduced by the project activity.Two types of system, Greenway Jumbo and/or

GREENWAY SMART cook stove will be introduced by the project activity, thus requiring weighted average values. The thermal efficiency of Greenway Jumbo stove is 31.17 % and of Greenway is 32.098%. Assuming 50% of each stove for the sake of estimation of emission reduction in the PDD, the weighted average is (31.17+32.098)/2 = 31.63%. Ex-post, the actual number of each system deployed will be multiplied by their respective efficiency.

Based on General Guidelines to SSC CDM methodologies, EB 59, para 9, equipment performance is satisfied by 9(b) and 9(d), wherein the national standard for the performance of the equipment type has been used which is the IS standard 13152 (Part I) on Solid Biomass Chulha-Portable (Metallic) by the Bureau of Indian Standard. The aforesaid standards are being used for testing and approval of various single pot metallic improved cook-stoves in the country[11]. According to para 9(d) of SSC guidelines, the manufacturer, Greenway Grameen Infra. Pvt. Ltd, has specified the thermal efficiency value based on national tests that has been certified by national certifiers, Indian Institute of Technology, Varanasi[12] and Department of Chemical Engineering, Indian School of Mines (approved stoves by the MNRE[13]) .

The test was conducted based on the Bureau of Indian Standards (BIS), IS 13152: Biomass Chulha – Specification, which is based on Water Boiling Test (WBT) protocol. The thermal efficiency for improved cook stove, when tested according to the specifications given in the standards, should not be less than 25% for an improved cook stove in India. According to the test reports of the thermal efficiency of Greenway Jumbo stove is 31.17% 0r 0.3117. Based on the test report conducted by Department of Chemical Engineering, Indian School of Mines the thermal efficiency of Greenway Smart Stove GSSV3 is 32.098% or 0.32098[14].

Thus η_{new} for GREENWAY JUMBO STOVE is 0.3117 and that of Greenway Smart Stove is 0.32098.

Assuming 50% of each stove for the sake of estimation of emission reduction in the PDD, the weighted average is (31.17+32.098)/2 = 31.63% or 0.3163. Depending on the number of stoves implemented for each system, the weighted average of the 2 systems deployed will be considered ex-post for emission reduction calculations.

Step 4: Determining $B_{y,savings}$

According to the methodology, option 2 has been used to determine $B_{y,savings}$.

$$B_{y,savings} = B_{old} \cdot (1 - \frac{\eta_{old}}{\eta_{new}})$$

Where:

B_{old} Quantity of woody biomass used in the absence of the project activity in tonnes

η_{old}
1. Efficiency of the system being replaced, measured using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of system is being replaced;
2. A default value of 0.10 may be optionally used if the replaced system is a three stone fire, or a conventional system with no improved combustion air

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11 http://www.mnre.gov.in/schemes/decentralized-systems/national-biomass-cookstoves-initiative/

12 http://iitbhu.ac.in/

13 http://mnre.gov.in/file-manager/UserFiles/approved-models-of-portable-improved-biomass-cookstove-manufactures.pdf

14 Thermal efficiency test report of Greenway smart stove

supply or flue gas ventilation system, i.e. without a grate or a chimney; for other types of systems a default value of 0.2 may be optionally used

η_{new} Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol. Use weighted average values if more than one type of system is being introduced by the project activity

A baseline survey of 26,076 households shows that 99% of the households use traditional cook stoves (Chulhas) built of mud/clay/brick. About 43% of households have one Chulha, while 56% households have two Chulhas. It is a cultural practice wherein flat bread and curry is prepared simultaneously on both the stoves. Thus each of the households will be given two single pot ICS stove to replace both the traditional cook stoves in the baseline. Thus fuel wood savings from cooking and heating water for bathing at a family level of 2 single pot appliances is considered to determine $B_{y,savings.}$ Both the traditional cook stoves will be dismantled during project implementation.

Using the equation $$B_{y,savings} = B_{old}.(1 - \frac{\eta_{old}}{\eta_{new}})$$

$$B_{y,savings} = 3.21 \times (1 - \frac{0.10}{0.3163})$$

$$B_{y,savings} = 2.19 \text{ t/household/year}$$

Thus $B_{y,savings}$ for the project is 2.19 t/household/yr or 2.19 t/2 single-pot cook stove/year

For clarity sake, throughout the PDD, $B_{y,savings}$ is discussed at a family (household) level.

Step 5: Determining $f_{NRB,y}$

Project participants shall determine the shares of renewable and non-renewable woody biomass in B_{old} (the quantity of woody biomass used in the absence of the project activity) the total biomass consumption using nationally approved methods (e.g. surveys or government data if available) and then determine $f_{NRB,y}$ as described below. The following principles shall be taken into account:

Demonstrably renewable woody biomass (DRB)

Woody biomass is "renewable" if one of the following two conditions is satisfied:

I. *The woody biomass is originating from land areas that are forests where:*
   (a) *The land area remains a forest; and*
   (b) *Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and*
   (c) *Any national or regional forestry and nature conservation regulations are complied with.*

II. *The biomass is woody biomass and originates from non-forest areas (e.g., croplands, grasslands) where:*
   (a) *The land area remains as non-forest or is reverted to forest; and*

(b) *Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and*

(c) *Any national or regional forestry, agriculture and nature conservation regulations are complied with.*

Non-renewable biomass:

Non-renewable woody biomass (NRB) is the quantity of woody biomass used in the absence of the project activity (B_{old}) minus the DRB component, as long as at least two of the following supporting indicators are shown to exist:

- *A trend showing an increase in time spent or distance travelled for gathering fuel-wood, by users (or fuel-wood suppliers) or alternatively, a trend showing an increase in the distance the fuel-wood is transported to the project area;*
- *Survey results, national or local statistics, studies, maps or other sources of information, such as remote-sensing data, that show that carbon stocks are depleting in the project area;*
- *Increasing trends in fuel wood prices indicating a scarcity of fuel-wood;*
- *Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass.*

Thus the fraction of woody biomass saved by the project activity in year y that can be established as non-renewable is:

$$f_{NRB,y} = \frac{NRB}{NRB + DRB} \qquad \textbf{(2)}$$

Project participants shall also provide evidence that the trends identified are not occurring due to the enforcement of local/national regulations.

Based on the above concept, a national study was conducted by the Forest Survey of India, Ministry of Environment and Forests, Government of India to assess the woody biomass demand and availability at the state and national level in India during 1995. Based on the same concept and the national, local, remote sensing data and peer-reviewed research papers, the renewable and non-renewable component of biomass has been established at the district level for the project area as detailed below and shown in Table 4.

Renewable Biomass

The land use pattern for Udaipur District in which the project will be implemented is as follows:

Table 3 –Land utilization pattern for Udaipur District - 2010[15] (ha)

Land Use Type	**Area (ha)**
Forests	414,485
Land not available for cultivation	493,627
Permanent pastures and other grazing lands	88,534
Land under miscellaneous tree crops and groves	3,182

[15] District Statistics Handbook, Udaipur, Department of Economics and Statistics, Udaipur. 2010

Wasteland	128,549
Cultivable follow land & Current fallow	79,960
Net area Sown	253,807
Total Geographic Area	**1,462,105**

I. The biomass is originating from land areas that are forests where:

i. The land area remains a forest; and
ii. Sustainable management practices are undertaken on these land areas to ensure, in particular, that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
iii. Any national or regional forestry and nature conservation regulations are complied with.

The area classified as forests is as follows:

(a) The total area under forests for Udaipur District is 414,485 ha (Table 3) accounting for 28.24% of the geographic area[15]. This area will remain as forests.
(b) These forests are classified as Tropical Dry Deciduous and Dry Thorn Forests[16]. Keeping in view to see that any national or regional forestry and nature conservation regulations are complied with, The National Conservation Strategy and Policy Statement on Environment and Development' by the Ministry of Environment and Forests[17] states that "meeting the rights and concessions for requirements of fuel wood, fodder, minor forest produce and small timber of the rural and tribal population with due cognizance of the carrying capacity of forests". Undertaking sustainable management practices on these land areas to ensure that there is no systematic decrease of carbon stocks, the sustainable rate of extraction from tropical dry deciduous forests are 0.22 and for Dry Thorn Forests are 0.24 t/ha/yr (Ravindranath *et al*. 2001[18]). Thus an average of 0.23 t/ha/yr is considered for sustainable harvest for forest areas.
(c) Thus the renewable biomass component from the project area is Area (ha) x sustainable harvest (t/ha/yr) = 414,485 x 0.23 = 95,332 t/year.
(d) This estimation is conservative as the legal area classified as forests is considered. The actual area under forest vegetation according to satellite imagery is far lesser. For Udaipur district, the total area officially under forests is 28.24%[15], while according to satellite imagery the actual area under forest vegetation is 23.21% of geographic area[16].

II. The biomass is woody biomass and originates from croplands and/or grasslands where:

i. The land area remains cropland and/or grasslands or is reverted to forest; and
ii. Sustainable management practices are undertaken on these land areas to ensure in particular that the level of carbon stocks on these land areas does not systematically decrease over time (carbon stocks may temporarily decrease due to harvesting); and
iii. Any national or regional forestry, agriculture and nature conservation regulations are complied with.

Here along with cropland, all other land use categories that have woody biomass are considered. Accordingly the following land use classification as given in Table 3, are considered under this category:

[16] http://www.webline.co.in/fsi/sfr2009/rajasthan.pdf
[17] http://moef.nic.in/downloads/about-the-ministry/introduction-csps.pdf
[18] Ravindranath, N.H., Sudha, P & Sandhya Rao. 2001. Forestry for sustainable biomass production and carbon sequestration in India. Mitigation and Adaptation Strategies for Global Change 6: 233-256.

(a) Land not available for cultivation (b) Permanent pastures and other grazing lands (c) Wasteland Cultivable follow land & Current fallow (d) Net area Sown. The same principle of carry capacity based on mean annual increment is considered for biomass originating from croplands and other land categories.

- The total area under (a) to (d) is 10,44,438 ha.
- The total number of trees on these lands is 8 trees/ha. This is based on State of Forest Report, Forest Survey of India, 2003[19].
- Total Culturable Non-Forest land[20] (CNFA) is defined as the net geographical area lying outside recorded forest and forest cover, which can support tree vegetation (excluding areas under wetlands, riverbeds, perennial snow covered mountains, etc.). Thus this area includes all lands other than forests.
- Average standing biomass of CNFA in the project area is 2.34 t/ha. This is based on the following calculations:
  - Based on the area of CNFA and standing stock of trees outside forests (TOF), the standing biomass per tree is 0.26 t (FSI, 2011).
  - Thus total standing biomass is 8 trees/ha x 0.26 t/tree = 2.07 t/ha
- The mean annual increment is 2.84% of the standing biomass (Shailaja and Sudha,1997[21]). Thus the mean annual increment is 0.0588 t/ha/yr
- The sustainable harvest = mean annual increment = 0.0588 t/ha/yr
- Thus the renewable biomass component for this land use for the project area is
  Area (ha) x sustainable harvest (t/ha/yr) = 1,044,438 ha x 0.0588 t/ha/yr = 61,499 t/year.

i. Misc. Tree crops & groves not included in net area sown
- The total area under tree crops is 3,182 ha.
- Sustainable extraction rate is 2 t/ha/hr (Ravindranath *et al*, 2001)[9].
- Total sustainable biomass is 3,182 ha x 2 t/ha/yr = 6,364 t/yr.

Thus summarizing the above steps, Table 4 below shows the renewable biomass available as woody biomass.

Table 4: Renewable Biomass Calculations for the project area

NRB Calculations			
Item	**Value**	**Unit**	**Source**
RENEWABLE BIOMASS IN THE PROJECT AREA			
Total Geographical Area	14,62,105	Ha	Hand Book of Statistics 2010, Udaipur District
I. Renewable biomass from forests			
Forest Land	4,14,485	Ha	Hand Book of Statistics 2010, Udaipur District
Sustainable rate of woody biomass extraction from Tropical	0.23	t/ha/yr	Ravindranath et al. 2001

[19] State of Forest Report, Forest Survey of India, 2003.
[20] FSI, 2009. http://www.webline.co.in/fsi/sfr2009/glossary.pdf
[21] Shailaja Ravindranath and Sudha Premnath. 1997, Biomass Studies. Field Methods for Monitoring Biomass. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Dry Deciduous Forests (0.24) and Dry Thorn Forests (0.22)			
Renewable biomass extraction from forests	**95332**	**t/yr**	**Area x sustainable rate of extraction**
II. Renewable biomass from Culturable non-forest land			
Total Culturable Non-Forest land	10,44,438	Ha	Hand Book of Statistics 2010, Udaipur District
No of trees/ha of Culturable Non Forest Area	8	trees/ha	State of Forest Report – 2003, FSI, 2003
Mean Annual Increment	2.84%	Of standing Biomass	Shailaja and Sudha, 1997
Average Standing biomass/tree	0.26	Tonnes	Based on Indian State of Forest Report, FSI, 2011
Average Standing biomass/ha	2.07	Tonnes	Calculated
Mean Annual Increment	0.0588	tonnes/ha	Calculated
Sustainable extraction from trees on CNFA	**61,449**	**Tonnes**	**Area x sustainable rate of extraction**
III. Renewable biomass from Plantation			
Total Plantation area including misc tree crops and groves	3,182	Ha	Hand Book of Statistics 2010, Udaipur District
Sustainable extraction rate from plantations	2.00	t/ha/year	Ravindranath et al. 2001
Sustainable extraction from plantations	**6,364**	**tonnes**	**Calculated**
Total Sustainable Biomass Available	**1,63,144**	**tonnes/year**	**Calculated**

The woody biomass requirement of the District and the renewable and non-renewable biomass used is shown below:

Adult Equivalent using Fuel wood	18,72,377	Adult Equivalent	Hand Book of Statistics 2010, Udaipur District.
Fuel wood requirement per adult	0.74	tonnes/year	Based on household survey
Total fuel wood requirement	**13,85,559**	**tonnes/year**	**Calculated**
Renewable Woody Biomass (DRB)			
Renewable Woody Biomass	**1,63,144**	**tonnes/year**	**Calculated**
Non Renewable Woody Biomass (NRB)			
Non Renewable Woody Biomass	**12,22,415**	**tonnes/year**	**Calculated**
Fraction of non-renewable biomass ($f_{NRB,y}$)			
$f_{NRB,y}$	**0.88**		**Calculated**

The fraction of non-renewable woody biomass used in the absence of the project activity is 0.88.

Complementary studies for non-renewable biomass

To complement the survey results, other national and local studies have been provided.

- According to the National Forestry Action-Programme India, Ministry of Environment and Forests, Govt. of India,[22] "the per capita availability of forestland in India is one of the lowest in the world, 0.08 hectares, against an average of 0.5 hectares for developing countries and 0.64 hectares for the world. The consumption of fuel wood in India is about five times higher than what can be sustainably removed from forests. The estimated fuel wood consumption in the country is about 380 million cum. About 70 percent of the fuel-wood is accounted for by households. Around 80 percent of the rural people and 48 per cent of urban people use fuel-wood."

- The Forest Survey of India, Ministry of Environment and Forests, Govt. of India conducted a study on demand and supply of fuel wood, timber and fodder in India"[23]. Projection of annual fuel wood and its sustainable availability has been determined at the state level. According to the study, in Rajasthan State, the total annual consumption of woody biomass during 2006 is 10.9 million tonnes of which only 0.0696 million tonnes is sustainably available. Thus at the state level, the non-renewable woody biomass accounts for 0.99.

- A national study was conducted by the Forest Survey of India, Ministry of Environment and Forests, Government of India to assess the woody biomass demand and availability at the state and national level[24]. Based on the study, the consumption of fuel wood for each of the state was determined based on surveys conducted at household level for each of the state. The annual production of wood from forests was determined from records of each of the forest division in the state. Using this data, the state and national level data was generated. Further, the production of wood and fuel wood from the trees outside forests was determined from short rotation, medium rotation and long rotation species. Also the trees harvested for industrial wood provide substantial quantity of fuel wood as by-product. This has also been accounted for the production fuel wood from trees outside forests. Thus according to the study, the total fuel wood consumption for Rajasthan state is 18.782 Mt. Fuel wood production from forests and from trees outside Forests account for 0.05 Mt and 1.541 Mt respectively. Therefore the total fuel wood production of DRB component is 1.591 Mt. Thus the NRB component of fuel wood consumption is 17.191 Mt. This accounts for an f_{NRB} of 0.91. The following table summarizes the calculations for f_{NRB} based on FSI, 2011.

f_{NRB} Calculations for Rajasthan State based on Forest Survey of India, 2011		
Parameter	**Value (Tonnes)**	**Source of Data**
Consumption	1,87,82,000	Forest Survey of India, 2011
Production - From Forest	50,000	Forest Survey of India, 2011
Production - From trees outside Forests	15,41,000	Forest Survey of India, 2011

[22] http://envfor.nic.in/nfap/pressure-forest.html

[23] FSI, 1996. Fuelwood, timber and fodder from forests of India: Demand and Supply of Fuelwood, Timber and Fodder in India. Forest Survey of India, MoEF, Govt. of India.

[24] State of Forest Report. 2011. Forest Survey of India, Ministry of Environment and Forests, Government of India.

Non-Renewable Biomass, NRB	1,71,91,000	Consumption minus Production from forests and outside forests
Demonstrably Renewable Biomass, DRB	15,91,000	Production from forests and from trees outside forests
Fraction of Non- Renewable Biomass (f_{NRB})	**0.91**	(NRB/NRB+DRB) Based on formula given in AMS-II.G ver03. Methodology

The latest data shows a f_{NRB} as 0.91 for the state of Rajasthan, while for the project activity, 0.88 has been used for emission reduction calculations, which is conservative.

The supporting indicators are shown through the following:

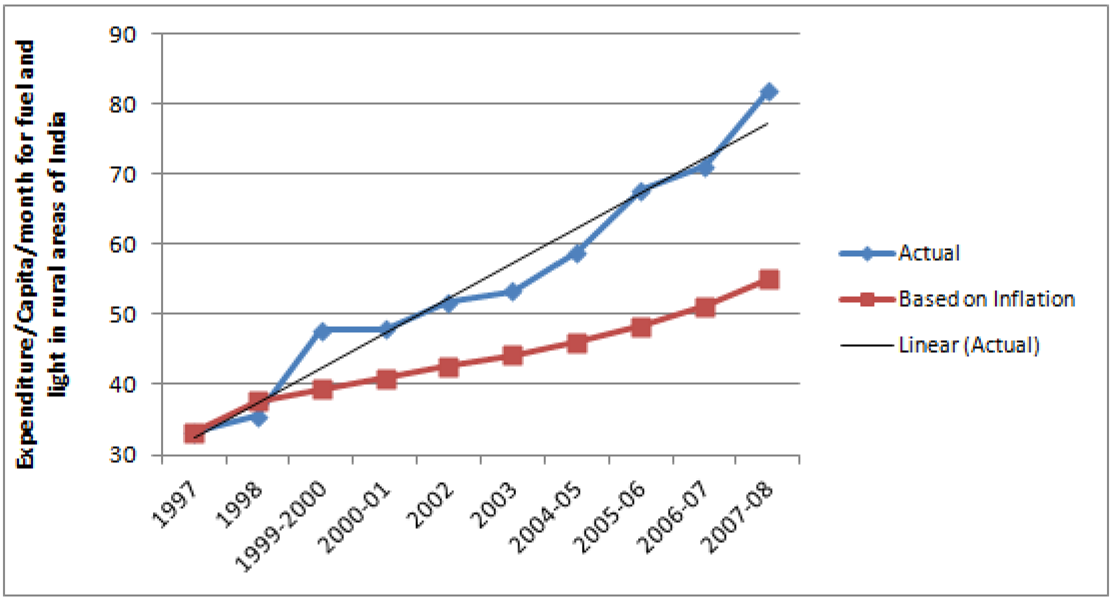
i) Survey results, national or local statistics, studies, maps or other sources of information, such as remote-sensing data, that show that carbon stocks are depleting in the project area;

- A GIS study conducted in Kherwara Tehsil[25], shows a decrease in forest land and increase in wasteland. This is attributed to deforestation by the local tribal inhabitants for firewood for own consumption and selling.
- According to a study conducted in Udaipur by FAO[26], the tropical dry forests of in this region over many decades have been subjected to heavy exploitation and over-utilization by a growing rural population. The tribal communities live in this region around foothills and valleys of the Aravalli hill ranges. Growing population has led to loss of forests, fragmentation of landholdings, soil erosion, and low productivity of the farmlands. These uplands were once covered with dry deciduous forests but are at present largely degraded. Substantial areas have degenerated to grasslands and open scrub forests. Dry forests in these areas often merge into arid or even desert margin zones where natural tree cover becomes increasingly sparse and characterized by low stocking density and loss of important tree species. This is caused by unregulated and unsustainable exploitation for fuel wood and other wood and non-wood products.
- According to the Rajasthan State Environment Policy Report, 2010, use of biomass fuels by the rural households in the State for cooking, has resulted in loss of vegetation, deforestation and significant burden of disease from indoor air pollution. Loss of forest cover has also caused scarcity of fuel wood for the rural communities[27]. A large part of timber, small timber and fuel wood demand is met from harvesting of mature trees standing on farmland[28].
- A survey conducted by NCAER[29] in Rajasthan showed that 82,7% of respondents reported lesser availability of fuel wood compared to that 5 years back.

ii) Increasing trends in fuel wood prices indicating a scarcity of fuel-wood;

[25] Giriraj Kumar Songara and Nidhi Rai. 2010. Land use and land cover change driven by green marble mining in Kherwara Tehsil Udaipur (India) using remote sensing and GIS. The Ecoscan. 4(1): 103-106, 2010.
[26] Michael Kleine, Ghazala Shahabuddin, Promode Kant. Case studies on measuring and assessing forest degradation: Addressing forest degradation in the context of Joint Forest Management in Udaipur, India. Forest Resources Assessment Programme, Working Paper 157, Rome, Italy, 2009.
[27] Rajasthan State Environment Policy, 2010. Department of Environment, Government of Rajasthan, Jaipur. http://india.gov.in/allimpfrms/alldocs/15379.pdf
[28] http://www.rajasthan.gov.in/rajgovresources/actnpolicies/forestpolicy.pdf
[29] NCAER, 2002, Evaluation survey of the National programme on Improved Chulha, National Council of Applied Economic Research, Sponsored by Ministry of Non-Conventional Energy Sources, Government of India.

Yearly Consumer Expenditure Survey among Indian households is carried out by the National Sample Survey Organisation (NSSO). Information on energy sources used both for cooking and lighting was collected as part of the survey. The survey conducted during 2004 presented separately the energy used for cooking and lighting in rural areas, which shows that fuel wood consumption accounted for 54% of the total consumption expenditure. As such, it can be seen that there is an increase in price beyond the yearly inflation rate, indicating scarcity.



NSSO[30] data on expenditure on firewood and light in rural areas of Rajasthan

iii) Trends in the types of cooking fuel collected by users that indicate a scarcity of woody biomass.

- Biomass remains, by far, the predominant fuel for rural households. A study was conducted in rural areas of Rajasthan, wherein residents interviewed in this study expressed concern about rising fuel wood shortages, which force poorer households to turn to dung and crop residues and commercialized fuel wood supplies over the years[31]. Also when household survey respondents were asked whether, during the past five years, they had switched fuels for cooking, reported that they had switched to another fuel, largely because of their inaccessibility to fuel wood and high cost of supplies, rather than the inconvenience of using fuel wood for cooking[31]. In Rajasthan, households switched from fuel wood to crop residues and dung cake, which are usually recognized as inferior fuels. The survey conducted by Seva Mandir also shows that respondents have shifted to inferior fuels such as dung cake over the years due to scarcity of fuel wood.

[30] 1997 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=442&type=NSSO
1998 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=448&type=NSSO
1999-2000 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=454&type=NSSO
2000-01 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=476&type=NSSO
2002 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=484&type=NSSO
2003 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=490&type=NSSO
2004-05 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=509_P2&type=NSSO
2005-06 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=523&type=NSSO
2006-07 http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=527&type=nsso
2007-08 http://mospi.nic.in/Mospi_New/upload/530_final.pdf

[31] Energy strategies for Rural India: Evidences from Six States, ESM 258. ESMAP, 2002.

As required by the methodology, the above conditions clearly prove the use of non-renewable woody biomass in the project area. The trends identified are not occurring due to the enforcement of any local/national regulations.

Thus the f_{NRB} considered for the PDD is 0.88

Step 6: The Emission Factor - $EF_{projected\_fossilfuel}$

According to the methodology, emission factor for the substitution of non-renewable woody biomass by similar consumers is 81.6 tCO_2/TJ.

Thus $EF_{projected\_fossilfuel}$ is 81.6 tCO_2/TJ.

Step 7: Calculating ER_y

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$

Parameters	Description of Parameter	Value
$B_{y,savings}$ (t/family/yr)	Quantity of woody biomass that is saved in tonnes	2.19
f_{NRBy}	Fraction of woody biomass that is non-renewable	0.88
$NCV_{biomass}$ (TJ/tonne)	Net Calorific Value of wood	0.015
$EF_{projected\_fossilfuel}$ (tCO_2/TJ)	Emission factor for substitution of non-renewable woody biomass by similar users	81.6
ERy (tCO_2/family/yr)	**Emission Reduction/year**	**2.35**
ERs generated/household/yr		**2.35**

This equates to emissions reduction of 2.35 tCO_2/ household/yr.

The emission reduction per household is multiplied with the number of households operating in the project activity. Calculating for 18,500 households (actual households will depend on the cook stove model and their number that will be implemented), the ER_y for the project activity is 18,500 x 2.35 = 43,475 tCO_2/year. The actual calculation of emission reductions of the project activity will be based on the number of each cook stove model and households supplied with the stoves and their start of operation as recorded in the monitoring database. The details are explained in the monitoring section of the PDD.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to Annex 13, Guidelines on the demonstration and assessment of prior consideration of the CDM, Version 04, project activities with a starting date on or after 2 August 2008, the project participant must inform a Host Party designated national authority (DNA) and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date and shall contain the precise geographical location and a brief description of the proposed project activity, using the standardized form F-CDM-Prior Consideration. Such notification is not necessary if a project design document (PDD) has been published for global stakeholder consultation or a new methodology proposed to the Executive Board for the specific project before the project activity start date.

The PDD was published for global stakeholder consultation during 03 Aug 11 - 01 Sep 11, which is before the start date of the project activity i.e. 01/01/2013 and thus satisfies prior consideration of CDM for the project activity.

According to Appendix B of the simplified modalities and procedures for small-scale CDM project activities; Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The alternatives to the project activity to provide the energy for the stove at the household level are from:

i. Fossil fuels from solids such as Coal, Liquid fossil fuels such as kerosene and gaseous fossil fuels such as LPG;
ii. From grid Electricity;
iii. Renewable energy technology such as Biogas;
iv. Continuation of the current situation i.e. use of traditional cook stove;
v. Implementation of the project in the absence of CDM revenue.

All the described alternatives are in compliance with mandatory laws and regulations.

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

i. ***From Fossil Fuels:*** Solid fossil fuels coal and charcoal are not used by the communities in this region and hence is eliminated as an alternative and is not considered for barrier analysis.

   For the use of kerosene as the main fuel, three litres of kerosene are supplied each month via the public distribution system in the project area of Udaipur district, at a subsidised rate of Rs.15.25 per litre, to ration card holders[32]. Additional kerosene can be bought at the market rate of Rs.20-40 per litre[33]. Approximately 23 litres of kerosene are required to meet the cooking requirements of an average rural household per month to provide the same level of energy using fuelwood (Annex 3). Reliance on kerosene as the sole cooking fuel would therefore equate to a monthly cost

[32] http://www.statisticstest.rajasthan.gov.in/wpi.aspx
http://www.food.rajasthan.gov.in/documents/Kerosene_Orders.pdf
[33] As communicated by the villagers in the project area

of Rs. 605 for the average family at an average of Rs. 28/litre purchased from the open market. Kerosene is still too expensive for families to buy in the open market, and only three litres per month is given through the Public Distribution System in the project area. Therefore subsidies for kerosene are inadequate for meeting the cooking requirements of poorer women.

This proves to be high costs compared to using traditional cook stoves and makes the poor rely on biomass, which are procured with no costs.

LPG as a cooking option is very expensive. The lump sum initial investment required for LPG installation (including security deposit, regulator, LPG hose, cylinder and gas stove) is about Rs. 3000-3500.[34] A 14.2-kg cylinder of LPG costs approximately Rs. 381[35] after subsidy and will last an average family approximately less than a month if used to meet all cooking requirements. An LPG connection (deposit for the pressurised cylinder/canister) and stove constitute a large upfront cost (when compared with the equipment required for other fuels), so that the few who can afford the fuel cannot make the initial investment[36]. The poor rural communities participating in this improved cook stove project are unable to afford the upfront costs of the LPG kit since the majority are agricultural labourers and daily-wage workers with an income of less than US1$/capita/day.

Further, there is also a lack of infrastructural support (e.g. lack of facilities for refilling LPG cylinders at the doorstep) that further prohibits the widespread adoption of LPG in the rural context. In India, LPG is supplied through distribution outlets of oil marketing companies. Currently, rural areas of the country are located far from such distribution centres, so that users have to pay for the extra costs of cylinder supply. For the project area, the LPG distributors are in Kherwara Town. There is no home delivery and they have to bring their empty cylinder along with their connection card to book their refill, which incurs additional cost for transportation. This infrequent delivery of refill cylinders serves as a disincentive against switching entirely to LPG[37]. Due to logistical problems the few rural LPG users that exist often have to wait for long duration to get a cylinder refilled. Due to such circumstances it is impossible for even a wealthy rural household to rely on LPG as its main cooking fuel.

Presently, Government of India is planning a large scale implementation of distributing LPG cylinders in rural households. Locations for setting up of Rajiv Gandhi Gramin LPG Vitrak (RGGLV)[38] are identified broadly based on potential of average monthly sale of 600 LPG cylinders of 14.2 kg and 1800 customers with monthly per capita consumption of about 5 kg, The assessment of refill sale potential is based on several factors including population, population growth rate, economic prosperity of the location and the distance from the existing nearest distributor. Though RGGLV will be launched in Kherwara, it is still a business proposition. Thus it is not a scheme, wherein there is a reach to all the rural households irrespective of their economic conditions. The initial investment barrier would still prevail making it difficult for the rural population to adopt LPG as cooking fuel.

[34] http://www.iocl.com/Products/LiquefiedPetroleumGasFAQ.aspx shows the investment cost for LPG connection. Additionally, LPG hose pipe is Rs. 200 and minimum stove cost is Rs. 1800 http://www.prestigesmartkitchen.com/home-gas-stoves-l-p-gas-stoves

[35] http://www.statisticstest.rajasthan.gov.in/wpi.aspx Document: WPI / CPI-MPR (October-2011).

[36] Antonette D'Sa and K.V.Narasimha Murthy. 2004. Report on the use of LPG as a domestic cooking fuel option in India. International Energy Initiative.

[37] http://siteresources.worldbank.org/INDIAEXTN/Resources/Reports-Publications/Access-Of-Poor/KeroseneLPG.pdf

[38] http://www.iocl.com/Talktous/Brochure_RGGLV1261009.pdf

Thus in rural areas, the penetration of LPG, especially in the lower MPCE class are zero (Fig 4)[39], due to high initial investment costs. Thus investment barrier prevents the adoption of LPG.

Thus fossil fuels such as LPG and kerosene is too expensive for low income rural households in the project areas who use biomass (mainly fuel wood) for cooking.

ii. ***Electricity;*** The number of households using electricity for cooking is zero[39]. There is no evidence that people with very low income are moving towards cooking with electricity because there is no electricity distribution network in most areas and even if there is network, it is very expensive to cook with electricity and the supply of electricity is unreliable due to several hours of load shedding in the dry season. Rural households use electricity only for lighting. The survey conducted in the project area also shows that rural communities are not dependent on electricity for cooking and lighting.

iii. ***Renewable energy technology such as Biogas:*** An individual 2 meter cubed biogas unit costs approximately Rs.16,200[40]. This is a sum that far exceeds what the target population of this project can afford. They are not able to save or obtain personal loans to meet this cost. This can be evidenced by the low rate of biogas units installed. In rural households biogas is being used by 0.2% of families at national level and none in Rajasthan[39]. Its penetration in the lower economic strata in rural areas is thus also zero. Even during the survey conducted in the project area, only 4 households of 26,076 households have biogas units.

The high up-front investment cost of a biogas plant and at least two cattle heads required to feed the digester is a barrier for majority of low income farmers in the project area. So even with subsidy offered by the government[41] none of the households are able to afford and switch over to biogas fuel.

Thus biogas is not a financially viable option for the rural poor.

iv. ***Continued use of traditional cook stove for cooking:*** The use of traditional wood stoves represents the baseline situation in the local area leading to CO_2 emission. The traditionally used cook stoves are the 3-stone stove with no associated costs, and a mud/clay/cement plastered stove built with nominal costs. In India, the most commonly used stove for cooking is the traditional chulha. This stove has no chimney, and consists of stones plastered with mud to form a rough cube that is one-foot square, with one side left open to feed fuel. Smoke from the stove goes directly into the room. A traditional cook stove in rural India is usually installed and maintained at zero cost. It is fabricated *in-situ* by housewives using locally available clay or mud (Fig 3). The fabrication usually involves a labour investment of 3-4 hrs. For maintenance, the traditional cook stove is plastered regularly with fresh clay and water. The opportunity cost for regular construction and maintenance is considered negligible[42]. The running cost of all the above cook stoves is also not considered an investment barrier as biomass is collected free from local wasteland, forest land, and agricultural

[39] NSSO 2010. Household Consumer Expenditure in India, 2007-08. National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India.
[40] http://www.mnre.gov.in/schemes/decentralized-systems/schems-2/
[41] MNRE website: http://www.mnre.gov.in/schemes/decentralized-systems/schems-2/
[42] P.Sharath Chandra Rao, Jeffrey B.Miller, Young Doo Wang, John B. Byrne. Energy microfinance intervention for below poverty line households in India. Energy Policy 37 (2009) 1694 - 1712

land[43]. The rural poor do not have much cash to spend on energy and use the fuels they collect to meet their cooking needs[42].

Therefore, at the national level 75% of households and at the state level in Rajasthan 94% of households use firewood as the primary source of energy in rural areas[39]. In households from the lower economic strata, nearly 100% of households use firewood for cooking[39]. Reddy *et al.*, 2009 studied the share of household income spent on energy in various income groups. For cooking, the low- and middle-income groups in rural areas prefer firewood over kerosene/LPG as the cost for the latter is close to one-fifth of their income, whereas the former is available virtually free[44]. Self-collected fuels do not have a monetary cost; their collection and use are guided by opportunity costs that depend on the productivity of labour in fuelwood collection vis-a-vis the opportunity to earn income in alternative employment. The high-energy budget in household consumption expenditure leaves the poor with little for other needs like food, health and education (Reddy, 2009). Thus it can be seen that firewood has been the dominant cooking fuel in rural India. According to the NSSO 2010 report[45], fuel wood is the main source of energy for 94.4% families in rural Rajasthan and 100% for the low MPCE category (NSSO, 2008). Compared to NSSO, 2008, there has been a 0.3% increase in the percent of families using fuel wood and 0.32% decrease in families using LPG.

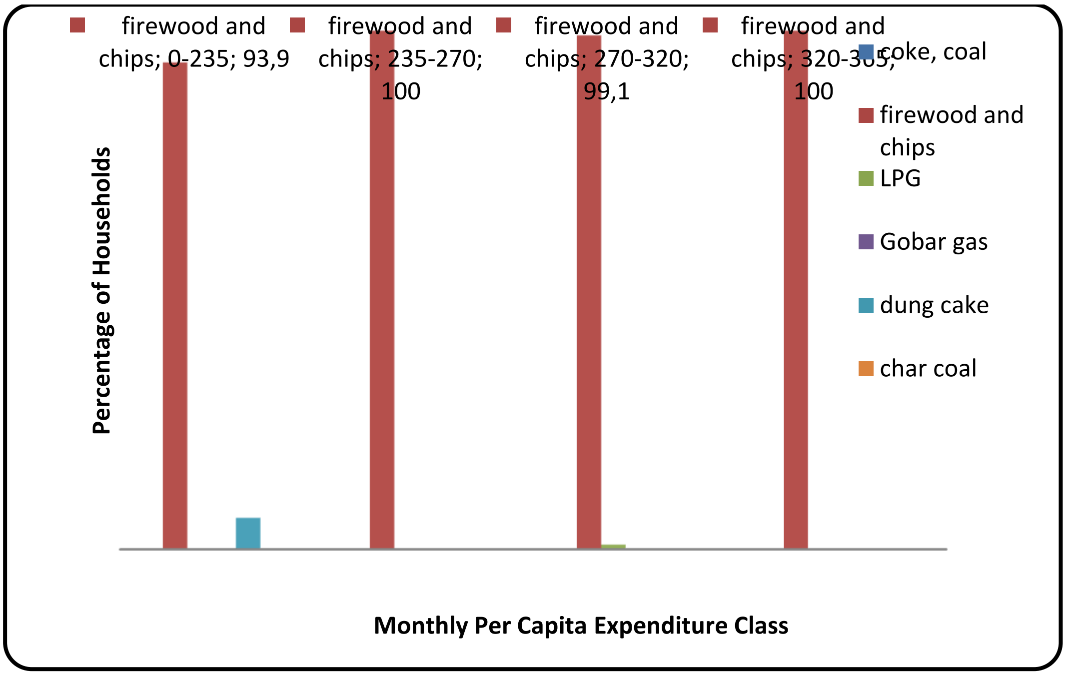


Fig 4: Primary source of energy for cooking in lower MPCE (Monthly Per Capita Expenditure) class by primary source of energy for cooking

Thus there is no investment barrier to the continued use of traditional cook stoves and non renewable biomass for cooking.

[43] N.C. Saxena. Forest, People and Profit net equations for sustainability. Planning Commission, Govt. of India.
[44] Reddy.B.S., Balachandra. P., Nathan.H.S.K. (2009). Universalization of access to modern energy services in Indian households - Economic and policy analysis. Energy Policy 37 (2009) 4645–4657.
[45] NSSO, 2010. NSS 64th Round: Household Consumer Expenditure in India, 2007-08, National Sample Survey, Ministry of Statistics and Programme Implementation, Government of India

v. ***Implementation of the project in the absence of CDM revenue:*** A Greenway Jumbo stove costs Rs. 2,499 and GREENWAY SMART STOVE costs Rs. 1,499[46] which is substantial initial funding for the user. The ICS may be more resource-efficient, but is a serious barrier due to high initial capital costs[47].

Based on the survey conducted in the project area, the target families are predominantly farming households (53%) having less than an acre of land, agriculture labourers (43%) and are below the poverty line with a per capita income of less than 1$/day. Poor households in rural areas in India still have very little access to formal finance. A Rural Finance Access Survey, conducted jointly by the World Bank and the National Council of Applied Economic Research, India, indicates that rural banks serve primarily the needs of the richer rural borrowers: some 66% of large farmers have a deposit account; 44% have access to credit. Meanwhile, the rural poor face severe difficulties in accessing savings and credit from the formal sector: 70% of marginal/landless farmers do not have a bank account and 87% have no access to credit from a formal source. Thus, access to formal credit for farmers to implement energy saving devices is an issue[42]. As such, the communities prefer to use the traditional cook stove instead of purchasing an improved cook stove which involves initial capital cost.

Similar activities in the region have been only implemented with subsidies under the National Programme of Improved Stove (NPIC)[29]. Agents who installed the stove during programme implementation did not continue to supply stoves as the subsidy based programme was closed[47]. A National Programme on Improved Cook Stoves (NPIC) was launched by the Ministry of Non-Conventional Energy Sources (Ministry) in December 1983 in order to promote efficient use of biomass fuels, reduce pressure on forest resources, reduce indoor air pollution and alleviate the drudgery of collecting biomass fuels. The potential of Improved Cook Stoves (ICS) in India is 120 million[48]. Installation of improved stoves slowed down significantly after March 2000; in the first 9 months of the year 2001–2002, the number of stoves installed was 700,346[49], corresponding to an annual rate of slightly below 1 million stoves. In 2002 the NPIC was deemed a failure[50,] and funding was discontinued. Responsibility for continued ICS dissemination was passed to the states. From 2001–05, the annual growth rate of ICS installation has been 1%; however, since 2006 none were installed.

According to ESMAP[51], of the 7 percent of rural households that adopted ICSs by the end of 2000, most reverted to traditional stoves as the ICSs developed cracks or needed spare parts. Since installation of improved stoves slowed down significantly after March 2000, the number of households using improved stove at present will be well below 6 million; this implies that of the 120 million households (i.e. about 650 million people) of the country that depend on biomass fuels

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[46] https://paytm.com/shop/p/greenway-appliances-jumbo-stove-HOMGREENWAY-APPGREE47157F6EFA0F0 and https://paytm.com/shop/p/greenway-appliances-smart-stove-HOMGREENWAY-APPGREE471579E656B00

[47] Amulya K. N. Reddy. Science and technology for rural India, Current Science, Vol. 87, NO. 7, 10 October 2004.

[48] Ravindranath. N.H. and Balachandra. P. 2009. Sustainable bioenergy for India: Technical, economic and policy analysis. Energy, 34, 1003–1013.

[49] Ministry of New and Renewable Energy (MNRE). Annual report; 2001–02.

[50] Soma Bhattacharya and Maureen L. Cropper. April 2010. Options for Energy Efficiency in India and Barriers to Their Adoption. A Scoping Study. RFF DP 10-20. http://www.rff.org/documents/RFF-DP-10-20.pdf

[51] ESMAP (Joint UNDP/World Bank Energy Sector Management Assistance Programme). Clean household energy for India: reducing the risks to health. Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank; 2004.

for cooking, more than 118 million households (i.e. more than 625 million people) still depend on traditional stoves.

In December 2009, a new initiative "National Biomass Cook Stove Initiative" was launched by the Ministry of New and Renewable Energy. The programme envisages providing clean energy through achieving quality of energy services from cook stoves comparable to that of LPG. The initiative is, however, limited to only pilot-scale projects, enhancement of technical capacity by establishing state-of-the-art testing, certification and monitoring facilities, and strengthening R&D programmes in key technical institutions[52]. To reach the benefits to the rural communities, at least 15 million improved stoves need to be distributed every year for the next decade to supply 87 percent of households across India[53.] Hence, in spite of nearly two decades of the existence of these programmes, their impact on the rural energy scenario and on the development scenario in general, has been limited as is evident from the low penetration level of modern fuels in rural areas[54],[45].

Even if a potential user is fully knowledgeable about the net benefits accruing from improved cook stoves, the user will not necessarily make the required investment. Neither are there subsidies for its implementation. Thus the high initial cost is a barrier.

In addition, operation and maintenance, institutional coordination, education and training to the users are essential for continued use of the stoves. The improved cook stove needs to be repaired periodically if the user is expected to use it continuously and not revert back to using traditional stoves. It was noted that when women did not perceive the usefulness of the stove, many parts were removed and reused for other purposes[55].

Also, the subsidy approach only ensured distribution of stoves but did not address their sustained use or demand for more stoves. The stoves fell into disuse due to lack of follow-up on maintenance and quality control. Thus stoves lasted for only two years before cracking or needing replacement part, which was rarely available. They reverted to the traditional cook stoves and it did not succeed in creating a culture for use of improved stoves. Thus enough financial resources are required for operation and maintenance of stoves and subsequent replacement of stoves[56]. In the project activity, the stove models have an operational lifetime between 9,875 to 20,000 hours, while different stove parts have differential operational lifetime, requiring replacement and hence financial resources. Stores with spare parts of the stoves have to be maintained in the project activity.

A maintenance team has to be constituted for continuous repair and maintenance of the cook stoves. This is to ensure that the communities will not revert to traditional cook stove once the stove falls to despair. The NGO will have to educate them on the proper use of ICS. As described in section

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[52] http://pib.nic.in/newsite/erelease.aspx?relid=60448

[53] Wilkinson, P *et al*., 2009. Public health benefits of strategies to reduce greenhouse gas emissions: Household energy. The Lancet, Volume 374, Issue 9705, Pages 1917 – 1929. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(09)61713-X/fulltext#tbl5

[54] Leena Srivastava and I.H. Rehman (2006). Energy for sustainable development in India: Linkages and strategic direction. Energy Policy 34,643–654.

[55] Sinha, B. The Indian stove programme: an insider's view – the role of society, politics, economics and education. National Institute of Science, Technology & Development Studies (NISTADS), CSIR, New Delhi.

[56] Andrew Mitchell, 2010. Indoor Air Pollution, Technologies to Reduce Emissions Harmful to Health: Report of a Landscape Analysis of Evidence and Experience. USAID-TRAction Project. University Research Co., LLC, Harvard School of Public Health.

B.7, demonstration will be held in every village to display the correct use, operation and maintenance of ICS. The stoves will also be monitored regularly for usage.

Udaipur Urja Initiatives is a producer company of rural households formed by Seva Mandir the NGO and does not have access to capital. The following issues also hold good to the recently formed producer company too. It has been working for the development of rural and tribal population and mainly focuses on enhancing people's capabilities for self-development by working for improved literacy levels, better health status and sensitization against oppressive gender relations and creating sustainable improvements in the livelihoods base by revitalizing the natural resource base of communities[57]. The local bank also refused to provide loans without guarantee, marginal money and collateral security. Further, the bank is not willing to bank on market fluctuation of CER price for repayment. There is no risk-free income stream in this project and the bank is not willing to lend for the project activity. Thus, besides CDM funding, no other external funding sources are available for the project in this region.

In addition, the NGO does not have the wherewithal to have a team for training, operation and maintenance of ICS units and its monitoring. The CDM revenue will help i) access to capital ii) provide training and continuous service and maintenance to all the households using ICS under the CDM project, as described in section B 7.2 and iii) all the stoves implemented under the project will be kept operational for the next 10 years by either replacing the parts or the stove as and when it is non-functional through CDM revenue.

The continued combustion of non-renewable biomass fuel is the cheapest option, leading to higher GHG emissions. Thus even now all the households use traditional fuel wood stoves. There is an investment barrier preventing this project activity taking place in the absence of CDM. This project will be implemented exclusively with carbon finance through the forward sale of CERs after registration of the project as a CDM activity.

Depending on the model, a ICS stove will cost between Rs. 1,499[58] to Rs. 2,499[59]. Two ICS stoves will be given per family. Irrespective of the number of stoves given, the energy savings per household will remain the same. The life of the Greenway Smart Stove and Jumbo Stove is 20,000 hours.

According to EB 59, Para 36, simple cost analysis can be applied to small scale projects involving distributed, household end-use energy efficiency measures considering only the certified emission reductions (CERs) revenue as the income and the project participant (PP) expenses as the only costs, in cases where:
(a) The project involves distributed, household end-use energy efficiency measures;
(b) The PP receives no revenue other than the CERs revenue; and
(c) The PP actually supplies the energy efficiency measures (equipment).

In these cases, the end-user energy cost savings or other end-user benefits/costs do not have to be considered.

[57] http://www.sevamandir.org
[58] https://paytm.com/shop/p/greenway-appliances-smart-stove-HOMGREENWAY-APPGREE471579E656B00
[59] https://paytm.com/shop/p/greenway-appliances-jumbo-stove-HOMGREENWAY-APPGREE47157F6EFA0F0

- The project involves distribution of Improved Cook Stoves; Greenway Jumbo Stove and/or Greenway smart stove.
- The PP will receive no other revenue for purchase and distribution of improved cook stoves. Depending on the model, the stoves too will be replaced after its operational lifetime during the crediting period. As mentioned in section B.7.2, each family will contribute 20% of the price of ICS given to them. This money will be deposited in their respective village funds, already facilitated by Seva Mandir and in the Producer Company, and will be used later for repair and maintenance. Thus, the PP will not receive any revenue other than CER revenue. The legally binding end user agreement that will be signed between Udaipur Urja Initiatives and the end user clearly specifies these terms and conditions, a copy of which has been submitted to the Indian DNA during the approval of Host Country Approval.
- The PP i.e. Udaipur Urja Initiatives will supply energy efficient Improved Cook stoves (2 per household), which will be purchased through forward funding carbon revenues.

  Thus as per EB 59, Para 36, applying simple cost analysis for the project activity, the cost of implementation of ICS cook stoves (2/households), depending on the model(s) during the crediting period will vary from Rs. 46.25 to 81.40 million. This does not take into account cost of stove/stove part replacement, price escalation of stoves, costs that are associated with maintenance of stoves, CDM registration process (i.e. pre-project costs, documentation, monitoring costs, validations and verifications etc.). The project activity does not produce any economic benefit other than CDM revenues.

  The project reduces GHGs emitted through use of non-renewable biomass (firewood) as cooking fuels, by introducing widespread use of efficient wood stoves which replace existing inefficient traditional stoves usually 3 stone open fire. Carbon finance has been identified as the only feasible method for implementation of the project activity in the proposed area. As CDM is the only external source of funding for the area, the project will not move ahead without it. The project activity will be pre-financed with future CER revenue.

Conclusion

Taking into account the national and/or sectoral policies and circumstances, the emissions reductions would not occur in the absence of the proposed small-scale project activity. The proposed project has to overcome investment barriers and it is unlikely that improved cook stoves will be implemented in the project area. In the absence of CDM these barriers would automatically lead to continued use of traditional cook stoves for cooking and heating water for bathing, leading to higher emissions. As discussed above, currently the improved cook stove technology has no market share in the villages compared to the baseline cooking technology. Thus the traditional mud stove which is financially a more viable alternative to the project activity and is less technologically advanced has lower risks to performance uncertainty leading to higher emissions. On the other hand, the project activity has low market share and is technologically more advanced. This is evidenced by low penetration of improved cook stove for cooking in rural households of Rajasthan.

The project as a CDM activity will enable to overcome the described barriers and promote improved cook stoves in the project area. The described project activity is clearly additional because it will be financed completely through the revenues from forward financing of CER sales, and cannot be realized without the revenues from carbon credits. Thus it is clear that in the absence of the CDM project, which will provide the upfront investment for the establishment of cook stoves in households for the rural poor, this project will not happen.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

TYPE II - ENERGY EFFICIENCY IMPROVEMENT PROJECTS
CATEGORY: II.G. Energy efficiency measures in thermal applications of non-renewable biomass; Version 03; EB 60

According to the methodology, the baseline emission reductions will be calculated step-wise as described in section B.4.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$\mathbf{B_{old}}$
Data unit:	t/family/yr
Description:	*Quantity of woody biomass used in the absence of the project activity in tonnes*
Source of data used:	Baseline Sample Survey conducted in the Project Area.
Value applied:	**3.21 t/family/yr**
Justification of the choice of data or description of measurement methods and procedures actually applied :	The fuel wood use was determined through a baseline survey conducted in 2010 for 952 household (Annex 3). A sample size of 271 households (n_0) was determined on the basis of 90 precision along with the margin of error 10% and the formulae used was $n_o = \frac{(cv^2.t^2{}_{\alpha,v})}{e^2}$ where n_o= size of sample, $t^2{}_{\propto,v}$ = critical value of student's t test with significance level $\propto$ and v degree of freedom, e= acceptable error, cv=coefficient of variation, v=degree of freedom = n-1.
Any comment:	This parameter is fixed for the entire crediting period

Data / Parameter:	$\boldsymbol{B_{y,savings}}$
Data unit:	t/household/yr
Description:	*Quantity of woody biomass that is saved in tonnes*
Source of data used:	Calculated
Value applied:	**2.32 t/family/yr**
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using the equation $B_{y,savings} = B_{old}.(1-\frac{\eta_{old}}{\eta_{new}})$ $B_{y,savings} = 3.21\times(1-\frac{0.10}{0.3163})$ $B_{y,savings}$ = 2.19 t/family/year **Thus $\mathbf{B_{y,savings}}$ for the project is 2.19 t/family/yr**
Any comment:	η_{new} = 0.3117 and 0.32098 for single pot of Greenway Jumbo stove and Greenway smart stove respectively, is based on WBT tests by accredited laboratory based on the Bureau of Indian standards (BIS) 13152: Biomass Chulha – Specification. For calculations η_{new} is considered as average of thermal efficiencies of both models (0.3117 and 0.32098). Actual woody biomass

	savings will be determined based on number of each of the models (greenway jumbo stove and greenway smart stove) that will be implemented. η_{new} will be determined biennially- and vintage-wise.

Data / Parameter:	***$NCV_{biomass}$***
Data unit:	TJ/tonne
Description:	*Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)*
Source of data used:	IPCC
Value applied:	**0.015**
Justification of the choice of data or description of measurement methods and procedures actually applied :	The net calorific value of woody biomass is as given in the methodology.
Any comment:	This parameter is fixed for the entire crediting period

Data / Parameter:	***$EF_{projected\_fossilfuel}$***
Data unit:	tCO_2/TJ
Description:	*Emission factor for the substitution of non-renewable woody biomass by similar consumers.*
Source of data used:	II.G, Version 3 methodology
Value applied:	**81.6**
Justification of the choice of data or description of measurement methods and procedures actually applied :	As given in the methodology
Any comment:	This parameter is fixed for the entire crediting period

Data / Parameter:	***η_{old}***
Data unit:	
Description:	*Efficiency of the baseline system being replaced, measured using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of systems are encountered;*
Source of data used:	II.G, Version 3 methodology
Value applied:	**0.10**
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to the methodology, 0.10 default value may be optionally used if the replaced system is the three stone fire or a conventional system lacking improved combustion air supply mechanism and flue gas ventilation system i.e., without a grate as well as a chimney. The replaced systems in the project area will be conventional system lacking improved combustion air supply mechanism and flue gas ventilation system.
Any comment:	This parameter is fixed for the entire crediting period

Data / Parameter:	$f_{NRB,y}$
Data unit:	
Description:	*Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass*
Source of data used:	Determined using nationally approved method using government data and data from peer reviewed journals.
Value applied:	**0.88**
Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on survey results, national and local statistics, studies, maps and other sources of information such as remote sensing data that show that carbon stocks are depleting in the project area. Accordingly, the f_{NRB} is assessed at 0.88. **Thus f_{NRB} = 0.88**
Any comment:	This parameter is fixed for the entire crediting period.

Data / Parameter:	Diversion of non-renewable biomass saved under the project activity by non-project households
Data unit:	tonnes / hh/yr
Description:	Diversion of non-renewable biomass saved under the project activity by non-project households
Source of data used:	Based on the methodology B_{old} will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages.
Value applied:	**0.11 t/HH/yr**
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to II.G, Version 3, B_{old} can be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. **3.21 – (3.21*0.95) = 3.21 - 3.05 = 0.16 t/Household/yr**
Any comment:	This parameter is fixed for the entire crediting period. Surveys will not be conducted to determine leakage

B.6.3 Ex-ante calculation of emission reductions:

Emission Reductions (tCO_2) = Baseline Emissions – Project Activity Emission – Leakage

According to the methodology, Para 5, the specific equations for calculations of Baseline emissions, Project emissions or Leakage is not provided, but only for emissions reductions.

Baseline Emissions

The parameters and values for baseline emissions are explained in Section B.4. The activity data is as follows:

Fuel wood Usage for Rajasthan (B_y)		
Activity Data	**Value**	**Source of data**
Fuel wood Consumption (t/capita/yr)	0.74	Sample Survey

No. of persons/family	4.34	Field Survey, 2010
Fuel wood Consumption (t/family/yr)	**3.21**	**Calculated**

Non Renewable Biomass (f_{NRB}) for Udaipur Division, Rajasthan		
Activity Data	**Value**	**Source of data**
DRB (t/yr)	171029.61	Calculated based on statistics
NRB (t/yr)	1224419.20	Calculated based on statistics
f_{NRB}	**0.88**	**Calculated**

Biomass Savings ($B_{y, savings}$)		
Activity Data	**Value**	**Source of data**
B_y	3.21	
η_{old}	0.1	II.G methodology
η_{new}	0.3163	Laboratory Certificate
$B_{y,savings}$	**2.19**	**Calculated**

Emission Reductions

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$

Parameters	Description of Parameter	Value
$B_{y,savings}$ (t/family/yr)	Quantity of woody biomass that is saved in tonnes	2.19
f_{NRBy}	Fraction of woody biomass that is non-renewable	0.88
$NCV_{biomass}$ (TJ/tonne)	Net Calorific Value of wood	0.015
$EF_{projected\_fossilfuel}$ (tCO_2/TJ)	Emission factor for substitution of non-renewable woody biomass by similar users	81.6
ERy (tCO_2/family/yr)	**Emission Reduction/year**	**2.35**
ERs calculated/household/yr		**2.35**
ER calculated for 18,500 households		**43,475**

Project Emissions

According to the methodology, there are no project emissions.

Leakage

According to the methodology

Leakage related to the non-renewable woody biomass saved by the project activity shall be assessed based on ex post surveys of users and the areas from which this woody biomass is sourced (using 90/30 precision for a selection of samples). The following potential source of leakage shall be considered:

(a) *The use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass* *used by the non-project households/users, that is attributable to the project activity, then B_{old} is adjusted to account for the quantified leakage.*

(b) *Alternatively,* B_{old} *is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.*

If equipment currently being utilised is transferred from outside the boundary to the project activity, leakage is to be considered.

There will be no transfer of equipment currently utilized from outside the project boundary to the project activity.

Based on the methodology, B_{old} will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys will not required.

Thus B_{old} is considered as 3.05 taking into account leakage factor. Thus survey will not be conducted to account for leakage.

According to the methodology, Version 3, after considering leakage, the emission reduction calculations are as follows:

Activity Data	Value
B_{old}	3.21
B_{old} adjusted for leakage (B_{old} x 0.95)	**3.05**
η_{old}	0.10
η_{new}	0.3163
$B_{y,savings}$	2.09
f_{NRBy}	0.88
NCVbiomass (TJ/tonne)	0.015
EFprojected_fossilfuel (tCO_2/TJ)	81.6
ER_y (tCO_2/yr)	**2.24**
ERs calculated/HH	**2.24**
ER calculated for the project activity (18,500 HHs)	**41,440**

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of Project activity Emissions (tCO_2e)	Estimation of Baseline Emissions (tCO_2e)	Estimation of Leakage (tCO_2e)	Estimation of Overall Emission Reductions (tCO_2e)
2014-2015 (start date 21st January 2014)	0	0	0	0
2015-2016	0	0	0	0
2016-2017	0	43,475	2,035	41,440
2017-2018	0	43,475	2,035	41,440
2018-2019	0	43,475	2,035	41,440
2019-2020	0	43,475	2,035	41,440
2020-2021	0	43,475	2,035	41,440

2021-2022	0	43,475	2,035	41,440
2022-2023	0	43,475	2,035	41,440
2023-2024	0	43,475	2,035	41,440
Total (tonnes of CO_2e)	**0**	**347,800**	**16,280**	**331,520**

B.7 Application of a monitoring methodology and description of the monitoring plan:

According to AMS.II.G. Version 3:

Monitoring shall consist of checking the efficiency of all appliances or a representative sample thereof, at least once every two years (biennial) to ensure that they are still operating at the specified efficiency (η_{new}) or replaced by an equivalent in service appliance. Where replacements are made, monitoring shall also ensure that the efficiency of the new appliances is similar to the appliances being replaced.

Monitoring shall also consist of checking of all appliances or a representative sample thereof, at least once every two years (biennial) to determine if they are still operating or are replaced by an equivalent in service appliance.

- Monitoring will consist of biennial check of ICS disseminated to determine the share of appliances that are still operating at the specified efficiency (η_{new}). Where appliances are found to be operational but with a changed efficiency the actual efficiency determined in monitoring will be applied to calculate emission reductions.
    - Water Boiling Test will be carried out biennially on representative samples using the standard testing protocol developed by PCIA. After two years, a two-year-old stove will be tested; whereas after four years, a four-year-old stove will be tested. The value obtained from the test will be used to calculate the emission reductions of the systems for the years of operation till next tests will be conducted. Representative stoves for the vintage year will be tested for determining the efficiency. Thus during the first two years, 31.17% for Greenway Jumbo Stove and 32.098% for Greenway Smart Stove will be the efficiency applied; during the third year, the efficiency determined will be applicable for 3rd and 4th year of operation and so on.
    - The scenarios for acceptable change in the efficiencies of ICS during the crediting period would be a lower efficiency of 25% (as fixed by MNRE to qualify as improved cook stoves) and higher efficiency of 31.17% for Greenway Jumbo Stove and 32.098% for Greenway Smart Stove. If the efficiencies are found to be lesser than 25%, emission reduction for a vintage, emission reduction will not be considered and the stoves will be replaced with higher efficiencies.
    - The representative stoves will be tested for a 95/5 precision (95% confidence interval and 5% margin of error). In cases where the result indicates that 95/5 precision is not achieved, the lower bound of a 95% confidence interval of the parameter value will be chosen as an alternative to repeating the survey efforts to achieve the 95/5 precision.
- Monitoring will also consist of checking of all the appliances to determine if they are still operating or replaced by an equivalent in service appliance.
    - Where there is replacement of appliances, the replaced devices are considered with their related efficiency as applicable. If the appliance is replaced with a higher efficiency appliance, the same efficiency of the earlier appliance will be considered, to be

conservative. The procedures for monitoring the share of operational appliances and their respective efficiency(ies) are described in section B.7.2.

Monitoring shall ensure that:

(a) Either the replaced low efficiency appliances are disposed off and not used within the boundary or within the region; or

(b) If the baseline stoves usage continues, monitoring shall ensure that the wood fuel consumption of those stoves is excluded from B_{old} in equation 2.

A Users Agreement between Udaipur Urja Initiatives and the beneficiary family will be signed wherein the beneficiary is willing to use "ICS" instead of traditional stoves". Furthermore, they confirm that the traditional wood stove will not be used and will be disposed of. The ICS stove will be disseminated to the households only after they destroy the existing the 3-stone/mud stove used for cooking. This will also be verified during regular spot checks.

B.7.1 Data and parameters monitored:

Data / Parameter:	**No. of households in which ICS appliances will be used**
Data unit:	Number
Description:	Total Number of Households to which ICS appliances will be given to the beneficiaries after the project gets registered.
Source of data to be used:	Monitoring Database/ End User Agreements
Value of data	**18,500 based on average efficiencies of Greenway Jumbo Stove and Greenway Smart Stove**
Description of measurement methods and procedures to be applied:	- The number of households will be determined based on number of each model with their specific efficiencies that will be implemented. The total number of households will be fixed such that the total energy savings will be less than 180 GWh/year. -The ICS systems given to the beneficiaries will be recorded in monitoring database. -The beneficiary will sign an End User Agreement with Udaipur Urja Initiatives, in which the date of dissemination, the name of the user, the address, unique identification of the family (ration card number or election id number, etc.), Village, Tehsil, District where the user is residing is noted, to irrefutably identify the user. -The ICS has an identification number (Appliance-ID) which is also noted in the End User Agreement. The information from the End User Agreement will also be recorded in the monitoring database designed for monitoring of the project activity. This will be maintained by Udaipur Urja Initiatives throughout the crediting period.
QA/QC procedures to be applied:	-The database entries are made by the village monitors and zone workers appointed for this project. These entries will be supervised by the CDM Coordinator, CDM Project Officer and CDM Desk and IT Worker. -The database records and copies of the End User agreement will be maintained at the Udaipur Urja Initiatives office inUdaipur. -The CDM Coordinator will check on the End User Agreements. In case of inconsistencies, the assigned zone worker will take appropriate corrective actions.

Any comment:	The data can be tallied with the time of stock arrival and dissemination.

Data / Parameter:	**Start date of usage of appliances by the family**
Data unit:	dd/mm/yy
Description:	The start date of usage of ICS by each of the households.
Source of data to be used:	Monitoring database of Udaipur Urja Initiatives
Value of data	The start date of usage of each of the appliance will be after satisfactory functioning of the ICS. This date will be reflected in the end user agreement that will be signed between Udaipur Urja Initiatives and the participating family and also entered into the monitoring database of Udaipur Urja Initiatives.
Description of measurement methods and procedures to be applied:	-For each ICS appliance that has been disseminated to the communities, the information will be recorded in the End User Agreement and also stored electronically in the monitoring database along with identification number of the appliance and the type. -The End User Agreement will be signed with the Participating Family approximately one week after satisfactory functioning of ICS in their homes.
QA/QC procedures to be applied:	Data will be collected from the End User Agreement, tallied with the time of stock arrival and dissemination. The data will be stored for the crediting period of the project activity and an additional two years.
Any comment:	

Data / Parameter:	η_{new}
Data unit:	
Description:	Efficiency of ICS
Source of data to be used:	Water-Boiling Test for every 2 years once in operation.
Value of data	**0.3163 (average of 0.3117 for Greenway Jumbo stove and 0.32098 for Greenway Smart Stove – used for ER calculations)**
Description of measurement methods and procedures to be applied:	Water Boiling Test will be carried biennially on representative samples using the standard testing protocol developed by PCIA. After two years, a two-year-old stove will be tested; whereas after four-years, a four-year-old stove will be tested. The value obtained from the test will be used to calculate the emission reductions of the systems for that year of operation.
QA/QC procedures to be applied:	To confirm the quality, the efficiency of ICS appliance will be measured by repeating the Water Boiling Test biennially. Representative samples of, Greenway Jumbo Stove and/or Greenway Smart Stove, from the first vintage, i.e. sold since the project start date until the end of the first monitoring period will be tested biennially. The stoves for the vintage year will be tested for determining the efficiency. Thus during the first two years, efficiency at the time of implementation (i.e. 31.17% for Greenway Jumbo and 32.098% for Greenway Smart Stove) will be the efficiency applied; during the third year, the efficiency determined will be applicable for 3rd and 4th year of operation and so on. The scenarios for change in the efficiencies of ICS during the crediting period would be a lower efficiency of 25% and higher efficiency of 31.17% for Greenway Jumbo Stove and 32.098% for Greenway smart stove. The stoves will be obtained from frequent users who use it at least 2 times a day. The mean value of the tests will be taken. It will tested for 95/5 precision (95% confidence interval and 5% margin of error). In cases where

	the result indicates that 95/5 precision is not achieved, the lower bound of a 95% confidence interval of the parameter value will be chosen as an alternative to repeating the survey efforts to achieve the 95/5 precision.
Any comment:	The tests will be supervised by the CDM Coordinator.

Data / Parameter:	**Non-usage of ICS**
Data unit:	Days
Description:	Usage of non-renewable biomass in case of non-performance of ICS
Source of data to be used:	The days not used for each of the appliance at the village level will be maintained on the digitized monitoring database.
Value of data	**Dependent on the number of days ICS are under repair**
Description of measurement methods and procedures to be applied:	As and when ICS is not functional, the beneficiaries will report to the village monitor, who in turn will inform the zone worker/ maintenance team member for repair of the unit. A log book will be maintained for the reason of non-functioning and number of days under repair.
QA/QC procedures to be applied:	ERs will be reduced for the non-functional days of the units.
Any comment:	

Data / Parameter:	**Operation days of ICS**
Data unit:	Number
Description:	No. of days in a year ICS will be operational
Source of data to be used:	Monitoring database
Value of data	**365 days**
Description of measurement methods and procedures to be applied:	A ICS starts to generate emission reductions once it is disseminated to the household and the user signs the End User Agreement. The appliance generates emission reductions only after a week of installation and becoming fully operational. The number of days a stove was in operation in the year will be determined after deducting the days of non-usage.
QA/QC procedures to be applied:	The copy (paper and electronic) of the users will be maintained at the office in Udaipur on a monthly basis. The Project Officer and CDM Desk Worker will cross check the database entries and take corrective measures for any errors. They will suggest and comment on appropriate corrective measures if needed.
Any comment:	

Data / Parameter:	**Number of improved cook stoves that would get replaced during the crediting period**
Data unit:	Number
Description:	If the stove is damaged and cannot be repaired, the stove will be replaced by another ICS.
Source of data to be used:	Monitoring database
Value of data	**Will vary from year to year**
Description of measurement methods	- In case the replacement of ICS within the household is necessary, e.g. due to damage, the household will receive a new ICS with a corresponding new identification number (Appliance ID).

and procedures to be applied:	- The household will sign a new end user agreement where the number is noted and updated on the monitoring database.
QA/QC procedures to be applied:	A copy of the old agreement will be stapled with the new agreement, and the same will be updated on the monitoring database. The last date of use of the old ICS will be recorded.
Any comment:	

Data / Parameter:	**The traditional cook stove are disposed/not used in the households in which ICS is implemented**
Data unit:	Numbers
Description:	The low efficient traditional cook stoves are disposed off during the implementation of the project activity. In subsequent years, they not used in the households in which ICS is implemented.
Source of data to be used:	Monitoring solution of Udaipur Urja Initiatives
Value of data	**Number of households for which the project will be implemented**
Description of measurement methods and procedures to be applied:	-The usage of ICS systems given to the beneficiaries will be recorded in the monitoring database. - The non-usage of the traditional cook stoves will be recorded through the surveys conducted at village level for each of the beneficiary.
QA/QC procedures to be applied:	- The database entries are made by the village monitors and zone workers appointed for the project activity. These entries will be supervised by the CDM Coordinator. - If the baseline stoves usage continues, monitoring shall ensure that the wood fuel consumption of those stoves is excluded from B_y in equation 3 of the methodology.
Any comment:	

Ex-post calculation of emission reductions, for each year:

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$

Where:

ER_y	*Emission reductions during the year y in* tCO_2e
$B_{y,savings}$	*Quantity of woody biomass that is saved in tonnes (2.32 t/family)*
$f_{NRB,y}$	*Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass (0.88)*
$NCV_{biomass}$	*Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)*
$EF_{projected\_fossilfuel}$	*Emission factor for the substitution of non-renewable woody biomass by similar consumers. (81.6* tCO_2/TJ *)*

Calculations of biomass savings ($B_{y,savings}$*)*

$$B_{y,savings} = \sum_{i=1}^{n} B_{old}.L_y.N_{y,i}.(1-\frac{\eta_{old}}{\eta_{new}})$$

Where:

B_{old} *Quantity of woody biomass used in the absence of the project activity in tonnes [3.21 t/family(two 1 pot)/yr fixed throughout the crediting period]*

η_{old} *Efficiency of the baseline system/s being replaced (0.10 fixed for the entire crediting period)*

η_{new} *Efficiency of the system being deployed as part of the project activity (fraction) as determined using the Water Boiling Test protocol.*

L_y *Leakage Factor determined for the year y. This is fixed for the entire crediting period (0.95).*

$N_{y,i}$ *Appliance operating per year and vintage*

Number of appliances operating per year ($N_{y,j}$)

$$N_{y,i} = \sum_{j=1}^{N_{y,i}} n_{y,j} . t_{y,j}$$

Where:

$n_{y,j}$ = Appliance operating per year and vintage

$t_{y,j}$ = Fraction of operating time per household (appliance(s)) per vintage

B.7.2 Description of the monitoring plan:

I. Implementation plan

The proposed project will be implemented only after registration with the UNFCCC as a CDM activity. The purchase of Improved Cook Stoves (ICS) will be made after receiving forward funding of carbon revenue. Two ICSs will be given to each of the participating households. Every month about 2,300 ICS will be distributed, which means the distribution will be completed within a year of registration.

A series of meetings at village, zone and block level were organized to raise awareness on climate change issues, benefit of Improved Cook stoves, and provisions of CDM. The present model GREENWAY JUMBO STOVE and Greenway was selected by the women of project villages after testing and using this and other models for a few months. About 10 GREENWAY JUMBO STOVEs and Greenway Smart Stoves are now being rotated by participating households for 2-3 days each to understand the process of using it, and this will be continued till the final distribution.

At the time of distribution, a meeting will be organized in each settlement, in which the end user agreement will be read, whose terms have been shared in earlier village meetings. This will involve re-emphasizing on the regular usage of Improved Cook stove, assisting the village monitors to record the non-usage and their reasons, and dismantling the traditional stoves. Along with that, each family will contribute 20% of the price of ICS given to them. This money will be deposited in their respective village funds, already facilitated by Seva Mandir and the producer company account, and will be used later for repair and maintenance.

After distribution, the households will be trained individually and in groups in lighting and use of the stove. At the end of a week, once the household is satisfied with their performance and use, they will be encouraged to completely remove the traditional stoves to ensure that all further cooking is only done on the Improved Cook stove. The End User Agreement will be signed by the households at the end of this period and on their being satisfied with the stove. The monitoring system will then be initiated, which is elaborated in the following sections. The emission reduction will be calculated from the day of initiating the complete usage of the stoves.

A CDM Team will be appointed to facilitate the implementation and monitoring of the project. A Standard Operation Manual will be prepared in local language on the usage and maintenance of the Improved Cook stove, and on the monitoring requirement of the project and shall be distributed to the CDM team members.

Following is the monitoring strategy which will be followed to ensure that the usage of the ICS is maximized and that the project's carbon emission reduction targets are adhered to. The details presented below are indicative and the strategy and the specifics will be modified from time to time to suit field conditions at any given moment.

II. **Project Team**

The project team will comprise of the following members:

(a) CDM Coordinator: One coordinator will be assigned to work at the organization headquarter and will administer the following tasks:

- Coordinate and monitor overall implementation of all activities of the project, ensuring that the carbon emission reduction targets are met and defined sustainable development indicators are fulfilled.
- Communicate and liaison with the CDM consultants, DNA, DoE and the buyers.
- Prepare regular progress updates for the organization's management and board, and the buyers.
- Fulfil all legal and accounting needs of the project.

(b) Project Officer: This person will be based at the block headquarter and will be responsible for the following:

- Coordination of field implementation of the project, ensuring efficient supply of ICS, maintaining inventory, and approval for replacements.
- Supervise maintenance team, and ensure that repairs and replacements are done on time for minimal down time.
- Monitor the data entry of Improved Cook Stove usage from household records, and generate progress reports from the digitized monitoring system.
- Discuss progress results with the project team to identify problems/ good practices, and incorporate them in execution/ monitoring strategy. Share the village/ zone specific problems in their respective monthly meetings.
- Conduct random checks personally and coordinate the audit team.
- Coordinate with the ICS manufacturer for timely replacement, and ensure that all repair and replacement information is fed into the digitized system.
- Assist Zonal team to resolve conflicts, when required.
- Organize periodic trainings for village level monitoring system project team and village committees on CDM and CC issues.
- Ensure completion of all accounting requirements regarding the project.

(c) Project Assistant: One project assistant will be appointed at the block level to manage following tasks:

- Manage the technical issues related to the monitoring software and computer hardware installed at the block and zone level.
- Assist the zonal team to resolve their issues on data entry and usage of software.
- Coordinate with the software provider for updates and technical issues.
- Assist the project officer in activities like inventory maintenance and accounting.
- Be a part of the Audit team and supervise data entry.

(d) Zone CDM worker: One zone worker will be assigned per zone (6 for total 6 zones) and his/her responsibilities will include:

- Effective field implementation of the project, efficient supply of ICS, maintaining inventory, and approval and facilitation of replacements on a zonal level.
- Supervise maintenance team, and ensure that repairs and replacements are done on time for minimal down time.
- Undertake/ monitor data entry of ICS usage from the household records collected.
- Discuss progress results with the village level monitoring system in monthly meetings.
- Conduct random checks as part of the audit team.
- Facilitate dialogue of village institutions with households not adhering to the agreed terms.
- Assist village level monitoring systems and institutions to resolve conflicts, if any arise.

(e) Maintenance Team: This will comprise of 2 young people for each zone responsible for maintenance and repair. The youth will undergo intensive training given by the manufacturer(s) on repair and maintenance of the ICS and will undertake the following tasks:

- Visit to villages/ zones to repair the damaged ICS based on requests.
- If replacement is required from the manufacturer, inform the zone CDM worker and help in sending ICS to the block.
- Conduct random visits to households along with village level monitoring team to monitor their usage and guide them on proper practice of using ICS.
- Visit each village as per pre-decided and announced dates.

(f) Village Monitors: The monitoring data collection at the household level will be carried out by Village Representatives selected from different sources, depending on Seva Mandir’s activities and reach in the villages. These will be preferably selected from the village level institutions developed by Seva Mandir, like SHGs (Self Help Groups), YRCs (Youth Resource Centers), etc. In villages where this will not be a feasible option, village representatives will be appointed separately in consultation with the village institutions. These could be existing part-time para-workers associated with any programme of the organization, or semi-educated women/men agreeing to undertake the task. One representative will be assigned to a cluster of 80 to 120 households. Their responsibilities will include:

- Recording the data of non-usage and its reasons for each household on a monthly basis.
- In case of damaged ICS, undertake minor repair if possible or inform the zone worker/ maintenance team for a temporary replacement.
- Provide monthly data to the zone workers for consolidation.
- Assist the maintenance team member in their regular field visits.
- Have dialogue with households not adhering to the agreed terms, and if not able to resolve, inform the village institution.
- Facilitate village institutions to resolve conflicts, if any.

III. **Governance**

The governance of the project will be undertaken by the Village Development Committees (GVCs) of the villages. These democratically elected committees have the responsibility for managing the village funds, providing leadership and managing a variety of local development activities. These include convening village meetings, monitoring and evaluating on-going development works, making payments to village level para-workers and facilitating interaction with the formal government bodies. Their tasks for this project will include:

- Set up and monitor the performance of the village level monitoring systems.
- Interface between the project team and ICS users.
- Review the monthly progress reports of ICS non-usage and their reasons, and resulting emission reductions.
- Dialogue with the households not adhering with the terms of end users agreement, and resolve the conflicts if any.
- Assist in identifying new households in the case of drop-outs due to the migration or non-adherence.
- Undertake random checks with the village level monitoring system and project staff as part of audit team.
- Share and discuss climate change related aspects known to them during trainings and meetings organized under the project.

IV. Monitoring Strategy

The monitoring strategy is focused on the two main monitoring requirements: tracking usage of Improved Cook Stove, and tracking slippage to old traditional mud/brick cook stoves.

Tracking usage of Improved Cook Stoves:

This primarily means tracking that the given ICS are being used regularly by the participating households. The monitoring of the usage will be done through following process:

- The appliance codes will be fed into the digitised monitoring software against each family.
- The date on which the complete shift on ICS happens will be recorded and entered into the software.
- At household level, a monitoring card will be issued in which the household members will record their daily use of ICS. The card will have a simple system of keeping the note of usage. If an ICS is not used, the household will make a note of the reason. Where the household members are not able to keep the daily record, the respective village monitors will help in doing that during their meetings/visits.
- At village level, the respective village level monitoring system will conduct monthly visits and meetings, depending on the monitoring requirements of households. The records maintained by households in the monitoring books will be verified by the village monitors.
- The records collected will be entered in the monitoring software once a month by the zone workers or village monitors. The entered data will be collated at the block by the project assistant to generate the progress reports.

Tracking non-slippage to traditional stoves:

Maintenance of improved stoves is an important aspect of ensuring non-slippage to old stoves. The monitoring strategy for non-slippage and the maintenance strategy in case of breakdown is as follows:

- A tripartite End User Agreement will be signed between the user, GVC and Udaipur Urja Initiatives with all participating families after one week of satisfactory use of the ICS. The agreement will clearly define roles and responsibilities of all three parties in terms of implementation and monitoring of the CDM project. Before signing the agreement, it will be ensured that the households have dismantled their traditional stoves and shifted completely to ICS.

- During the distribution meetings, the households will be explained the significance of non-usage in terms of loss of ERs. They will be asked to immediately inform the village monitors or the zone CDM worker in case of damage or non-functioning of ICS.
- During the household visits, meetings or otherwise, if any ICS is found not functioning or functioning improperly, the village monitors will immediately inform the zone CDM worker or the maintenance team and arrange for a temporary replacement. Till the time a replacement is arranged, if required, the family will be helped in organizing a sharing with the neighbours. The note of the technical problem and date of informing to zone team will also be noted in the maintenance book.
- Zone CDM worker, will inform the maintenance team about a major breakdown and immediately arrange for a replacement from the additional stock of 3 ICS kept at each zone.
- Maintenance team will visit the household during the next scheduled zone visit and try to undertake minor repairs. Where a component has been replaced, the mechanic will report the details of the components that were used for replacement. The damaged components will also be replaced by the manufacturer. The replacement ICS will be brought back to the zone office by the mechanic after the damaged ICS starts functioning.
- If the damage is due to a manufacturing defect or is not repairable by the maintenance team, the ICS will be brought to the block office. Here, the project officer will approve sending of the ICS to the manufacturer, and a new one for the additional stock will be sent to the zone.
- All replacements of components or ICS will be undertaken by the manufacturer free of cost during the warranty period. After that, the cost will be met from the contribution made by families and deposited in the respective village funds.
- In case of full replacement, the household will receive a new Improved Cook Stove with a corresponding new appliance code. A new end user agreement where the new code is mentioned will be signed. A copy of the old agreement will be stapled with the new agreement, and the same will be updated on the monitoring database. The last date of use of the damaged ICS will be recorded.
- In case of a drop-out of a user, the ending date of ICS use will be noted and recorded in the database. The drop-outs will be replaced by other interested households using the traditional cook stove within the project boundary, so that the number of systems operating remains the same.

Features and Use of Monitoring Database

The data collected through monitoring processes will be entered on a monthly basis into a database custom built for this project by the company Tristle Technologies Pvt. Ltd.

This monitoring software will be intuitive and easy to use by the field staff. The reports generated will be verified by the Zone CDM Workers and Project officer and assistant with field data.

The reports will track inventory from purchase to installation. The package also insists on recording supplier information, the Appliance ID number of ICS appliance, and accurately tracks the point to point movement of stock. Even the destruction of stock through inadvertent breakage, etc. is tracked. The knowledge of objective standards like number of installations, breakdowns, timely replacement, etc. will be used to measure the project team’s performance. These, along with budget realizations, will keep a wider audience constantly informed on progress and financial health. They will also give up-to-date information on the volume of ERs generated. Verification data needed by DoE and auditors will also be available readily through the software.

The monitoring software package will include the following datasets:

- Implementation Progress (at all levels of Project Area-village, zone, block)
- Participating Families
- Carbon Investor
- Budget Realization
- Breakdowns
- Stakeholders
- Inventory Stock at different levels

There will be different levels of control in the software usage:

- Administrator Panel
  - Assign Project Officer and Project Assistant
  - Define Zones, Gram Panchayats, Villages
  - Define Participating Families
  - Define Carbon Investors
  - Manage Budgets and Realization
  - Define Items, Costs, Suppliers and Installation Types
  - Manage various Tables
- CDM Coordinator/Project Officer Panel
  - Assign Zone CDM workers
  - Assign particular villages to chosen Carbon Investors
  - Purchase Inventory
  - Transfer Inventory to the Zone
  - Record End User Agreements
- Zone Worker Panel
  - Appoint Village Monitors
  - Record Installations
  - Log Breakdowns & Repairs
  - Record Weekly Monitoring

V. Leakage Monitoring

B_{old} will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages. Thus case surveys for determining leakage will not be conducted.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

05/12/2106
Dr. Sudha Padmanabha
Fair Climate Network[60]
19/1, Alexandria Street, Richmond Town
Bangalore – 560025, Karnataka, India.

[60] http://www.fairclimate.com/tech/team/

The Technical Team of Fair Climate Network assists grass root NGOs in pro-poor CDM projects. FCN is not a project participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/01/2016 – Likely Start Date for implementation (issuance of purchase order) of Improved Cook Stoves

C.1.2. Expected operational lifetime of the project activity:

10y-0-m

Based on manufacturers certificate, the operational lifetime for Greenway Jumbo and Smart stove is 20,000 hours (9 years)[Fehler! Textmarke nicht definiert.]. If any component of a ICS or the appliance is not functional, it will be replaced immediately to assure an operating lifetime of 10 years, spanning the CDM crediting period.

C.2 Choice of the crediting period and related information:

Fixed crediting period

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

N/A

C.2.1.2. Length of the first crediting period:

N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

21/01/2014 after postponing by a year after registration

C.2.2.2. Length:

10-y-0-m

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The project activity does not fall under the purview of the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest, Government of India, 2006[61]. Hence, it is not required by the host party. The project does not lead to any adverse environmental effects. In fact, there are positive impacts of the project in reduction of indoor air pollution; carbon monoxide and particulate matter[62].

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Not applicable

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The stakeholder's meeting was conducted at Kalal Bhawan, Kherwara, District - Udaipur, Rajasthan, India on the 25th February 2011 between 11.30 and 13.30.

[61] http://www.envfor.nic.in/legis/eia/so1533.pdf

[62] Christoph A. Roden, *et al.*, 2009. Laboratory and field investigations of particulate and carbon monoxide emissions from traditional and improved cookstoves. Atmospheric Environment 43 (2009) 1170–1181.

 

Invitations were sent through letters, emails and personally to various categories of stakeholders to attend the meeting. An agenda of the meeting and a non-technical summary was also provided. The agenda of the meeting included discussion on the purpose of the consultation, description of the project activity, demonstration of the improved cook stove, answering and clarification on the project activity, discussion of the sustainable development checklists for the project and methods by which to monitor them.

The meeting was attended by nearly 498 members, which included the local communities, policy makers, and government officials as shown below:

Category	Male	Female	Total
Local People	200	247	447
Local Policy Makers	20	15	35
Local Officials	10	5	15
GS NGOs	0	1	1
Total	**230**	**268**	**498**

The stakeholders meeting invited local stakeholders' comments as follows:

- During the meeting, any clarifications on the project activity were addressed.
- Evaluation forms were filled in by some of the stakeholders which allowed us to gain an overall perspective of the stakeholders on the project activity.
- Written comments were invited from those who were not able to attend the meeting
- A public announcement through newspaper advertisement to seek comments.

The evaluation forms were analysed for the comments. The comments received during the meeting were also recorded.

E.2. Summary of the comments received:

Based on the evaluation forms filled in by the participants, the following stakeholders provided the feedback:

Category	Total
Local People	172

Govt. Officials	10
Policy Makers	15
Gold Standard NGO's	01
Total	**198**
Male	159
Female	39

There were positive comments from the meeting. The local communities expressed that the meeting was very informative. They were appreciative of the fact that the project activity will reduce fuel wood requirement, smoke and improve health conditions of women and children.

The NGO sector was appreciative of the fact that forward ER sales will fund the project activity and Seva Mandir is reaching out to a large number of families. The Sustainable Development assessment of the project activity was done is a participative manner.

The government officials and policy makers viewed that the project activity will save local environment and the health of women. The project activity will strengthen the ties of Seva Mandir with the local communities.

There were no negative comments.

The Stakeholders' comments during the meeting and the responses are provided below:

Stakeholder's Name	Stakeholders' comments	Explanation
Basanti Devi, Jalpaka	In our houses we use two Chulhas (stoves) for cooking food. This saves time as we prepare two dishes at a time. Chulika is designed as single pot stove, so it will be better if we are provided with two stoves.	We are very much aware about your practice of using two chulhas. The Chulika is very efficient and can cook food with lesser time compared to traditional stoves, consuming less wood. We anyway have decided to provide each beneficiary household with two CHULIKA Stoves.
Shanta Devi, Bhankara	At what Price Chulika will be given to us?	The Original rate of Chulika is Rs 1350/- only. We will take 20% of the amount from each beneficiary household. The received money will be deposited in the Village Gram Vikas Kosh (GVK), which later will be used for repair and maintenance.
Surya Devi, Kherwara	Who will be the beneficiary of the Project?	Poor families that are using traditional stoves daily – mud stove, three stone stove and not using LPG /kerosene will be beneficiaries of the project.

Narmada, Rani	Some people have LPG and even Biogas in their house. Will they be included under this project?	Under the CDM project, only traditional stove users will be covered under the Project.
Neeta Ji, Kherwara	I have used this chulha and was very happy to find that the consumption of wood is nearly half less compared to our traditional stove. There is no problem in preparing rice and dal but the chapati we prepare remains uncooked sometime. So, still some modification is required in this aspect as maize roti is our staple food.	Timely demonstration of cook stove is being done so that the users are satisfied. We have given and tested different models and as per the feedback have finalized Chulika. Still the modification will be done as per the necessity, requirement and suitability to the climate change aspect.
Nousin, Udaypur	When are we going to get the Chulha?	A soon as the project is registered, you will get CHULIKA. The whole process will take about one year.

E.3. Report on how due account was taken of any comments received:

There were no negative comments to consider any mitigation action. The comments were with regard to the stove design. Training will be given to the communities for proper use of ICS as the stove is designed to maximize thermal efficiency and reduce fuel wood use and smoke.

Further to initial selection of Chulika, other models were also short listed and used by the primary stakeholders. The Greenway Smart Stove is also found by the communities to suit the regional cooking pattern. Thus, during implementation, this stove will also be considered for implementation. Depending on each households's choice, either Greenway Jumbo Stove or greenway smart stove or both stoves (2 per households) will be implemented.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Udaipur Urja Initiatives Producer Company Limited
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Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The funding will not result in a diversion of official development assistance to the project.

Annex 3

BASELINE INFORMATION

Project Description: The project activity is introduction of high efficiency biomass fired cook stoves at a household level for cooking and heating water for bathing. In the baseline, inefficient cook stoves are being used for cooking and heating water for bathing. The purpose of the project activity is to replace inefficient traditional cook stoves at a household level with efficient fuel wood Improved Cook stoves in a biomass deficient Udaipur District of Rajasthan State in India. This district has greatly diminished biomass resources and the wood demand far exceeds the available renewable woody biomass. Udaipur Urja Initiatives intends to disseminate Improved Cook Stoves (ICS) in all tehsils of Udaipur District, Rajasthan.

The project will be implemented upon registration of the project as a CDM project activity, as the project will be financed completely from carbon revenues.

Sampling Objective: The objective of sampling is to gather baseline information required for development of the CDM project on improved cooking stoves in tehsils of Udaipur District in Rajasthan. The specific objectives were to: (i) Collect background data relating to demographic, economic, gender aspects, etc. (ii) Collect information on appliances in use for cooking, heating, animal feed cooking, etc. (iii) Collect data and estimate the mean annual fuel wood use per household with a 90/10 confidence/precision for the crediting period and (iv) Collect data on biomass production from the forest and establish proportion of non-renewable biomass being used by the local people.

Target Population and Sampling Frame. The NGO Seva Mandir is working in Udaipur District on rural development issues. The sampling frame for the baseline survey was developed from the region.

Based on the limit of the small scale project activity (actual thermal energy savings below 180 GWh), the target families will be determined, which is based on the number of stoves that will be implemented per model. A survey was conducted in 2010-11 for 26,076 households in 136 villages falling under 39 Gram Panchayats of Kherwara and Rishabhdev tehsils.

Gram Panchayat	Village	Total
Kherwara Tehsil		
Asariwada	Asariwada	188
	Bhilwada	54
	Damorwada	172
	Karmala	44
	Rehata	69
Balicha	Balicha	568
	Budra	196
	Gaduniya	155
	Ganganagar	219
	Kheraghati	339
	Rajnagar	204
Barothi	Barothi	458
	Devnal	201

	Gathiya	17
	Godiya	2
	Gohawada	43
	Nichla Talab	214
	Nichla Thuriya	84
	Suvedra	152
Bawalwada	Bawalwada	277
	Garaja	126
Bhanda	Bhanda	125
	Bhatki	1
	Futala	59
	Gogarwada	144
	Kahliya Pada	2
	Kenawada	15
	Khutvada	182
	Salala	61
Bhomtawada	Bhagorpada	222
	Bhomtawada	227
	Boslati	257
	Khadkaya	93
	Vav	14
Dabayacha	Dabayacha	311
	Ukhedi	257
Deri	Chatol	3
	Govind Dev	35
	Nagar	165
	Rani	110
Dhikwas	Bhalai	232
	Dhikwas	266
	Magra	282
	Samlai Panva	198
	Ubhara	63
	Vavai	79
Guda	Adaghar	236
	Babri	123
	Bhandva	78
	Demat	213
	Guda	223
	Kadianala	161
Harshawada	Gatrali	198
	Harsawada	198

	Puspa	4
	Satsagda	91
Jawas	Jawas	224
	Joonthri	605
	Samited	271
	Sareri	47
Jayara	Jayara	289
	Kakradungra	203
	Kuveria	82
	Sukhapada	181
Kanbai	Badanpura	163
	Kanbai	556
	Sukhbawdi	76
Kanpur	Bhakhra	339
	Chikalwas	149
	Kanpur	589
Karawada	Dechra	102
	Godava	59
	Karawada	100
Karcha	Karcha Khurd	205
Katarwas	Katvi	238
Larathi	Larathi	586
Mahuwal	Bhatadiya	181
	Malifala	150
Navaghara	Katar	69
	Kharwas	91
	Rachha	89
	Ranawada	440
Naya Goun	Mahida	210
	Modivasa	167
	Naya Goun	3
Pahada	Haldugata	33
	Kharadiwada	314
	Pahada	168
Patia	Chikli	74
	Jhanjhari	328
	Juwarwa	283
	Patia	106
	Retda	135
Saklal	Chittora	234
	Saklal	48

Sarera	Itwa	138
	Sarera	56
Suveri	Vanibor	195
Thana	Belva	18
	Ghati	187
	Thana	210
Kherwara Total		**17701**
	Rishabhdev Tehsil	
Bichiwara	Bichiwara	329
	Chourai	368
	Godiyawada	198
	Karji	166
Dhelana	Bhalun	258
	Dhelana	81
	Gumanpura	128
	Pagara	30
Garnala	Garnala	130
	Obri	8
Ghodi	Ghodi	404
Jalpaka	Dama Talab	163
	Jalpaka	307
	Maal	115
	Magra Maal	280
	Nala Pipla	105
	Pancha Padla	336
	Ramabawdi	93
Kalyanpur	Bhagor	110
	Kalyanpur	367
	Rajol	487
Katev	Dolpura	200
	Katev	427
	Shayampura	121
Kojawada	Kojawada	501
	Pareda	387
Nichla Mandwa	Nichla Mandwa	183
Pandyawada	Amarpura	252
	Deopur	230
	Pandyawada	152
Sagwada	Daban	45
	Gadawan	586
	Kaakan	228

	Kanji	50
	Sagwada	550
Rishabhdev Total		**8,375**
Grand Total		**26,076**

To be precise of the data and also to build a database of all the families, 26,076 households or more than 100% of the target population were visited and survey information collected to irrefutably substantiate all our findings. The interviewed households were rural households which in each case have an equal probability of selection. The households that will receive ICSs will be from the above sampled households.

Village level volunteers were involved in collecting information at household level. They were given orientation and training by Seva Mandir to collect information.

From the database, sample survey was conducted in 952 households to study the quantity of woody biomass used at the family level. The sample unit, which is the minimum unit or the clearly defined unit for constructing the sample frame is the traditional wood stove used in each household.

Desired Precision/Expected Variance and Sample Size: Based on the survey of 26,076 households, there is little heterogeneity in the sample. Thus, Simple Random Sampling was undertaken to further assess quantity of fuel wood consumption as i) considerable knowledge of entire population is known before the sample was selected and ii) the population being studied is relatively homogeneous with respect to fuel wood usage being studied.

Further, the sample size to conduct the fuel wood survey was determined on three parameters: The variability, the level of confidence required and the acceptable level of error using the following formula:

$$n_o = \frac{(cv^2 . t^2_{\alpha,v})}{e^2}$$

Where:

n_o = size of sample

$t^2_{\propto,v}$ = critical value of student's t test with significance level $\propto$ and v degree of freedom

e = acceptable error

cv = coefficient of variation

v = degree of freedom = n-1

- The desired precision for the baseline fuel wood estimation is ±10%
- The confidence level is at 90% which has a critical t value of 1.645.
- The coefficient of variation is assumed at 1.

Thus $n_o = \frac{(1^2 x 1.645^2)}{(10\%)^2} = 271$

Procedures for Administering Data Collection and Minimizing Non-Sampling Errors: The process of data collection for the CDM activity started in November 2009. Seva Mandir has divided Kherwara and Rishabhdev tehsils into 6 administrative zones. Seva Mandir's zonal workers are in charge of each zone. The survey was conducted by selected village level men/women or surveyors after thorough training and scrutiny by Seva Mandir. The minimum qualification for the surveyors was 8th Standard. The local surveyors were trained to conduct the survey and fill in the questionnaire. They visited each of the household to collect information. Seva Mandir project staff conducted the quality check by visiting the villages for which data was collected and cross-checked. A total of 90 interested and trained surveyors were selected and the survey was initiated in March 2010.

Structured interview and field studies were conducted to obtain data on use of woody biomass by the rural households. A household level questionnaire was designed, field tested by Seva Mandir and Fair Climate Network Technical Team (Consultant). Village level volunteers were given orientation and trained for field data collection. The measurement of fuel consumption from sample households was based on the manual Biomass studies by Shailaja Ravindranath and Sudha (1997).

- The type of cooking device used in the sample household was recorded.
- The person who cooks for the household was requested to set aside an approximate quantity of cooking fuel required for a week prior to cooking in the morning.
- The house was visited in the morning before the start of cooking activity.
- The type and weight of the fuel set aside was recorded.
- The fuel from weighed bundle was used for cooking every day.
- After 7 days in the evening after cooking, the remaining fuel was weighted and value recorded.
- The average fuel wood use/day was estimated.
- The timeline use of fuel wood over the 20 years period was also conducted based on PRA.
- The data from the survey was compiled using Microsoft Excel and analysed.

Implementation: The baseline survey was conducted from March 2010 in 136 villages by the 90 trained village level surveyors. Information for 26,076 households was collected to understand the baseline scenario for the project activity. The surveyors visited each household to collect the information. Seva Mandir staff conducted the quality check by randomly visiting the villages for cross-check. Further, in 952 households across 28 villages, a sample survey was conducted to assess fuel wood consumption. Data entry in Microsoft Excel was done by the Data Entry Operators appointed by Seva Mandir. Data was analysed by the FCN Tech Team. Thus there was no conflict of interest of those involved in data collection and analyses. The details of zones, villages and households are provided in an excel sheet. The details of survey are as follows:

Zone	Village	Total
Bavalwara	Bhakhra	20
	Bhalai	15
	Bhankhara	10
	Bhatki	20
	Dhikwas	15
	Katar	15
	Katvi	10
	Magra ii	15
	Nichla talab	15
	Racha	15
Dabayacha	Babri	48
	Bhakhra	10
	Bhanka	10
	Bhanwa	85
	Gaduniya	82
Kalyanpur	Bicchiwada	45

	Chourai	59
	Karji	45
Naya goun	Chittora	30
	Gatrali	5
	Harshawada	15
	Kharadiwada	30
	Modiwasa	15
	Rani	15
	Ghati	14
Sagwada	Kakan	145
Suveri	Pareda	74
	Sareri	75
Grand Total		**952**

Survey Findings

The baseline survey revealed a total population of 5681 members from 952 households indicating an average family size of 5.97. The male to female ratio is 1.05. The proportion of children less than 18 years is 46.75 percent. The average adult equivalent per household is 4.34±0.097 at 95% confidence level. The adult equivalent is based on PCIA guidelines, wherein standard adult equivalent for male, female and children respectively were of 1, 0.85 and 0.5. adult[63]. This is in conjunction with a study done by NCAER[29], wherein the average household adult male number is 1.89; adult female is 1.78; Children is 2.82; and thus the adult equivalent is 4.81, calculated based on adult equivalent conversion by PCIA guidelines.

	Based on NCAER Study	
	Number	**Adult Equivalent**
Male Adult	1.89	1.89
Female Adult	1.78	1.51
Children	2.82	1.41
Total	**6.49**	**4.81**

The data on the status of occupation for the surveyed households revealed that predominantly farming households constitute 53% and agriculture labourers constitute 43% of the sample households. Other occupation i.e. wage-earners, small businesses, salaried persons and the unemployed constitute the remaining 4% of the population.

An analysis of the annual income per capita shows that all the families are having an income of less than $1/capita/day. According to the survey, 8.7% of families have an annual income of less than 5000, 5.3% them from 5000-10000, 35% from 10000-20000, 18% from 20 to 30 thousand and 32% above 40 thousand. According to their income group, 77% of the families have Below Poverty Line Ration card (less than Rs. 10,000 annual income), 21% families have Above Poverty Line ration cards (greater than Rs. 10,000 annual income) and 2% families have Antyoday Ration Card (households headed by widows or disabled).

The baseline survey of 26,076 families show that about 98.23% of households are using traditional cook stove build of mud/brick/cement/stone thus depending on fuel wood or woody biomass for cooking. Nearly 1.7% of the households have traditional cook stoves along with gas connections. Thus, even the few

[63] http://www.pciaonline.org/files/KPT_Version_3.0_0.pdf

households that have gas connections do not rely completely on them and are primarily dependant on the traditional cook stove. Usually gas is used to prepare coffee/tea and quick snacks. The main meals are prepared on the traditional cook stove. Reasons preventing its use were reported to be; too high a cost, the perception that it was unsafe and prone to explosion, and logistical problems associated with refilling empty gas bottles in rural areas. No household reported using dung cakes or coal as a major source of fuel. All households reported to be using kerosene supplied through the public distribution system as a cooking fuel to kindle the fire. About a litre/month is used for this purpose. It is seen that although this cooking fuel was available to everyone, most used the fuel for lighting purposes. Thus only 0.05% households use kerosene primarily for cooking in the project area. Biogas is being used only in 4/26,000 families in the project region. Thus the baseline scenario is in line with the study conducted by NSSO (Figure 4) and the same baseline prevails even now.

The energy resource uses by the surveyed households show that about 99% of households use fuel wood for cooking food, heating water and preparing animal feed in varying degree on their traditional cook stove. About 8% were found to be also using agriculture residue. Households are additionally using dung cakes along with fuel wood due to unavailability and high costs of fuel wood.

Nearly 44% of the households have their Chulhas inside their homes, 3% cook outside and about 53% have Chulhas both inside and outside the house. ICS will thus help the communities in continuing their practice of cooking where ever they want.

About 27% of the households purchased fuel wood from the nearby fuel wood depot or the wood seller carrying wood on his camel. This wood source is primarily from forests and wastelands. About 63% of the households collected fuel wood from forests, wastelands, and 10% of households both collected and purchased fuel wood.

Respondents were asked if it takes more time to collect fuel wood today than it had taken to collect the equivalent amount 20 years ago. 100% of respondents replied that it takes more time today due to greater scarcity of availability of fire wood.

Respondents were asked to recall the price of fuel wood twenty years back to that now. A tractor load of fuel wood costing Rs. 500 then now costs Rs. 1200. A head load costing Rs. 1-5 now costs Rs. 25-30. Likewise a camel load of wood costs about Rs 400 today which didn’t exist during 1980s. The greater distances to travel to collect fuel wood has created this business at the village level. This price rise is far greater than what can be attributed to inflation alone and supports the idea that the prices have risen due to the increasing scarcity of available firewood to local communities.

The results from the fuel wood use survey indicate that average woody biomass use is 0.74±0.02 t/capita/yr at 90/10 confidence/precision level. At a household level, for 4.34 adult equivalents, 3.21 tonnes per household per year is being used. A study was conducted by the Joint UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP)[64] in six states of India to examine all forms of energy use and to determine whether households in rural areas have access to modem forms of energy use. In addition, it specifically targeted its analysis and recommendations toward poor households, who spend a significant proportion of their time and income on energy. According to the survey, the annual per capita energy consumption is as follows:

[64] Energy Strategies for Rural India: Evidence from Six States, ESM 258, August 2002.

Table 2.1 Annual Consumption of Energy for Domestic Activities
(per person in KgOE)

Type of energy use	*Andhra Pradesh*	*Himachal Pradesh*	*Maha-rashtra*	*Punjab*	*Rajasthan*	*West Bengal*
Cooking	136.2	251.2	154.7	193.9	286.6	212
Water heating	57.6	67.7	95.4	48.6	38.1	18.8
Space heating	6.4	47.2	26.9	14.7	19.2	neg.
Feed preparation (per animal)	4	15.7	neg.	13.2	44.7	neg.
Domestic lighting	12.3	11.6	7.8	7.0	6.6	11.6
Total	216.5	393.4	286.8	277.4	395.2	252.6

This translates to wood equivalent[65] of 3.87 t/family/yr for a family of 4.34 adult equivalents as shown below:

Per Person	KgOE	Kg wood
Cooking	286.6	762.2
Water Heating	38.1	101.3
Total	324.7	863.6
Feed preparation@1 animal	44.7	118.9
Total persons/family		4.34
Total Use per family (t/family)		3.75
Feed preparation (t/family)		0.12
Total/family (t/family/yr)		**3.87**

Respondents reported spending an average of 3.5 hours to collect fuel wood and spend nearly 6 hours cooking. This is alarming because such prolonged time periods spent using traditional wood stoves in what are typically unventilated kitchens often results in negative health impacts such as eye inflammation, lung infection and skin diseases.

Establishment of proportion of non-renewable biomass being used by the local people has been elaborated in section B.4.

Energy Equivalent

The energy equivalent of baseline fuel wood usage for kerosene and LPG as shown below, corresponds to 23 litres of kerosene and 15.5 kg LPG for a month.

Data	Fuel wood	Source of Information	LPG	Source of Information	Kerosene	Source of Information

[65] 1 kg wood = 0.376 KgOE (ESMAP, 2002)

Kgs/month	269	Baseline Survey	15.5	LPG Cylinder capacity	23	Litres/ month
Calorific Value (TJ/tonne)	0.015	Methodology, II.G	0.047 3	IPCC, 2006	0.0438	IPCC, 2006
Efficiency	10%	Methodology, II.G	55%	World Bank Report[66]	40%	World Bank Report[55]
Energy Content to Pot (MJ)	403	Calculated	403	Calculated	403	Calculated

[66] http://siteresources.worldbank.org/INDIAEXTN/Resources/Reports-Publications/Access-Of-Poor/KeroseneLPG.pdf

Annex 4

MONITORING INFORMATION

The detailed monitoring plan is included in section B.7.2. The sampling plan to monitor the parameters is described here based on EB 65 Annex 2, "Standard for sampling and surveys for CDM project activities and programme of activities", which details information relating to: (a) sampling design; (b) data that will be collected; and (c) implementation plan.

The various parameters that need to be monitored as described in section B.7 are as follows:

- (i) Number of households in which ICS appliances will be used
- (ii) Start date of usage of appliances by the family
- (iii) Non-usage of ICS
- (iv) Number of improved cook stove than would get replaced during the crediting period
- (v) The traditional cook stoves are disposed/no used in the households in which ICS is implemented.
- (vi) Checking the efficiency of representative sample thereof at least once every two years that they are still operating at specified efficiency.

The above parameters from (i) to (v) will be monitored for all the improved cook stoves that will be implemented under the project activity through village monitors. Only parameter (vi), i.e. checking the efficiency of representative samples at least once every two years will be done for representative samples.

a) Sampling Design

(i) Objectives and Reliability Requirements: The objective of the sampling effort is to determine the mean value of parameter (vi) i.e. checking the efficiency (η_{new}) of representative samples at least once every two years that they are still operating at specified efficiency.

The reliability requirements for sample size is 95/5 confidence/precision during the crediting period.

(ii) Target Population: The target population is the rural households where improved cook stoves (Greenway Jumbo Stove and/or Greenway smart stove) will be implemented and are operational in Udaipur district of Rajasthan State, India. These rural households are from Tehsils of Kherwara and Rishabhdev. The target population are from the biomass scarce district of Udaipur and are predominantly using fuel wood in the baseline scenario.

(iii) Sampling Method: The sampling method chosen for the project area would be stratified random sampling. The grouping of population for the strata will be the stove model that is being used by the families depending on whether just one model or both the models are going to be implemented and the Tehsils. If only one stove model will be implemented, then the two Tehsils will be 2 strata. If both stoves would be implemented, stratified random sampling will be conducted with 4 strata, i.e. two models of cook stoves in 2 Tehsils. It will also be easy to implement as the sampling frame (household details for which ICS has been implemented) will be collected and stored in the monitoring database.

(iv) Sample Size: According to Annex 2, EB 65, the sample size will be determined using the equation

$$n \geq \frac{1.96^2 NV}{(N-1)\times 0.05^2 + 1.96^2 V}$$

Where:

$$V = \left(\frac{SD}{mean}\right)^2$$

n	Sample size
N	Total number of households (18,500)
Mean	Overall Mean
SD	Overall standard deviation
1.96	Represents the 95% confidence required
0.05	Represents the 5% relative precision

A pilot study of minimum 3 stoves from each model and Tehsil will be conducted to determine the mean and standard deviation.

The overall mean and standard deviation will be estimated. The equations will be weighted according to the total number of households and model type in each Tehsil.

The overall standard deviation is estimated as follows:

$$SD = \sqrt{\frac{(g_a \times SD_a^2) + (g_b \times SD_b^2) + (g_c \times SD_c^2) + (g_d \times SD_d^2)}{N}}$$

Where

SD	Weighted overall standard deviation and SD_a *to* SD_d is the standard deviation of the groups
g_a *to* g_d	Size of the group where g_a to g_d are the groups in the Tehsils with stove models.
N	Population total

$$mean = \frac{(g_a \times m_a) + (g_b \times m_b) + (g_c \times m_c) + (g_d \times m_d)}{N}$$

Where:

mean	Weighted overall mean
m_a *to* m_d	Mean of the groups within Tehsils and the stove models

Proportional allocation of number of households will be done to each of the Tehsils and stove model type. Hence the size of the sample from each Tehsil and model type will be proportional to the size of the households in each Tehsil and model types in the project area. The equation for each of the strata will be:

$$n_1 = \frac{g_a}{N} \times n$$

The sample will be drawn at random from the sampling frame. This will be done using random number tables or using the random number generator of appropriate software.

Assuming each Tehsil has the following number of households, and mean and standard deviation efficiency as determined in the field:

Taluk	Type of Stove	Number of Households	Mean stove efficiency	Standard Deviation in efficiency
Kherwara	Greenway Jumbo Stove	4625	0.3117	0.03117
Kherwara	Greenway Smart Stove	4625	0.32098	0.03209
Rishabhdev	Greenway Jumbo Stove	4625	0.3117	0.03117
Rishabhdev	Greenway Smart Stove	4625	0.32098	0.03209

Substituting the values from the above table to the equations gives:

$$SD = \sqrt{\frac{(4625 \times 0.03117^2) + (4625 \times 0.032098^2) + (4625 \times 0.03117^2) + (4625 \times 0.032098^2)}{18500}} = 0.03164$$

$$mean = \frac{(4625 \times 0.4029) + (4625 \times 0.32098) + (4625 \times 0.4029) + (4625 \times 0.32098)}{18500} = 0.31634$$

Substituting these values into the equation for V gives:

$$V = \left(\frac{0.03164}{0.31634}\right)^2 = 0.0100022$$

And hence, for the sample size:

$$n \geq \frac{1.96^2 \times 18500 \times 0.0100022}{(18500 - 1) \times 0.05^2 + 1.96^2 \times 0.0100022} = 16$$

Assuming proportional allocation, which means that the number of households that will be sampled from each of the stratum is proportional to the size of the stratum within the population.

Taluk	Type of Stove	Number of Households	Sample size calculations	Number of households
Kherwara	Greenway Jumbo Stove	4625	$\frac{4625}{18500} \times 16$	4
Kherwara	Greenway Smart Stove	4625	$\frac{4625}{18500} \times 16$	4
Rishabhdev	Greenway Jumbo Stove	4625	$\frac{4625}{18500} \times 16$	4
Rishabhdev	Greenway Smart Stove	4625	$\frac{4625}{18500} \times 16$	4

Scaling up for any non-responses at 80%, the total numbers of households to be sampled are (5+5+5+5=20).

(***v) Sampling Frame:*** The sampling frame to be used is the complete listing of all the rural households for which ICS has been distributed under the project activity in the project area. Each of the Greenway Jumbo Stove will have a unique Appliance ID with all the required details of the family.

(b) Data:

(i) Field Measurements: The variable to be measured and recorded on field is efficiency of cook stoves (η_{new}). Statistically valid sample of the locations where the systems are deployed, with consideration strata as described above will be used to determine the number of stoves to be tested for efficiency of stoves biennially. Since the parameter of interest is not subjected to seasonal fluctuations, the testing will be done at an interval of every 2 years from implementation. Water Boiling Test will be carried biennially on statistically determined representative samples using the standard testing protocol developed by PCIA. After two years, a two-year-old stove will be tested; whereas after four-years, a four-year-old stove will be tested. The value obtained from the test will be used to calculate the emission reductions of the systems for that year of operation. For in-between years, the efficiency test results obtained from the previous tests will be applied. The stoves will be obtained from frequent users who use it at least 2 times a day. The mean value of the tests will be taken. It will be tested for 95/5 precision (95% confidence interval and 5% margin of error).

(ii) Quality Assurance/Quality Control: To confirm the efficiency of appliance(s), it will be measured by repeating the Water Boiling Test biennially. In cases where the result indicates that 95/5 precision is not achieved, the lower bound of a 95% confidence interval of the parameter value will be chosen as an alternative to repeating the survey efforts to achieve the 95/5 precision. Experts in testing the cook stove efficiency will be involved to test the efficiency of cook stoves. They will be involved in training the field staff to conduct the tests and validate the test results.

(iii) Analysis: The data obtained from the tests will be entered into Microsoft Excel sheets, analyzed and compared with the original efficiency of the stoves. Where appliances are found to be operational but with a changed lesser efficiency, the actual efficiency determined in monitoring will be applied to calculate emission reductions.

(c) Implementation:

(i) Implementation Plan: The implementation of sampling effort will be done by the NGO in consultation with CDM consultant and experts to conduct stove efficiency tests. The collected data will be analysed for emission reduction calculations and inclusion in the monitoring report.

As described in B.7.1 and elaborated in B.7.3., parameters (i) to (v) described above will be monitoring continuously by village monitors for all the households. For parameter accounting for leakage, B_{old} will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages. Hence surveys for determining leakage will not be conducted. Thus there is no specific sampling plan required for monitoring these parameters.

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