PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	**Laya Surakshana VER Project for Tribal Communities**
Version number of the PDD	1
Completion date of the PDD	02/06/2014
Project participant(s)	LAYA
Host Party(ies)	India
Sectoral scope and selected methodology(ies)	Sectoral Scope: - 03; Selected Methodology: Small-scale Methodology: Energy efficiency measures in thermal application of non-renewable biomass, Version 06. Sectoral Scope – 04; Selected Methodology: Small-scale Methodology; Low greenhouse gas emitting safe drinking water production systems, Version 4.
Estimated amount of annual average GHG emission reductions	**26,673 tCO_2**

SECTION A. Description of project activity
A.1. Purpose and general description of project activity
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LAYA Resource Centre has been working with the adivasi or tribal (indigenous) communities for more than 25 years. LAYA's work on climate change is especially with reference to its impacts on vulnerable tribal communities. LAYA has been playing a vital role in bringing forward the voices of the marginalized communities who have largely been bearing the brunt of climate change.

This VER project is implementation of household level i) Improved Cook stove SARALA and ii) zero energy water filters for point of use application through Bio-Sand Filter. The purpose of the project is to disseminate energy efficient improved cook-stoves SARALA and Bio-sand water filter for tribal households in Paderu Mandal of Visakhapatnam District and Addateegala Mandal of East Godavari District in Andhra Pradesh, India.

Laya implemented a GS registered project under the Community-focused Micro Scale Scheme "**Laya Paderu Energy Efficient Woodstoves Project**"**.** This project was limited to only 3,750 households (due to cap of 5,000 VERs under the scheme). LAYA is working in 2 Mandals namely, Paderu and Addateegala. The project has not reached all the Mandals and villages in which LAYA is working. Also there is great demand from the communities for these energy efficient stoves. Hence LAYA has taken up implementation of efficient cook stoves along with implementation of Bio-filters in this region. The unique ID of each of the stove will differentiate the SARALA stoves built in the previous project and the proposed CDM project. Also the villages in which this project will be implemented will be different from the previous project to have a clear distinction of both the projects. Management Information System (MIS) based monitoring software will be utilized to make a clear distinction of both the projects based on the unique ID of cook stoves.

This project is well in line with the National initiative of the Ministry of New and Renewable Energy, Government of India, which aims to primarily enhance the availability of clean and efficient energy for the energy deficient and poorer sections of the society. The various intervention options being initiated by the Ministry of New and Renewable Energy, for realizing this objective also include dissemination of improved stoves.

One of the main activities of the project will be to introduce SARALA stoves in the target communities and to train women and men in constructing and using the stoves. Trained promoters will conduct trainings and supervise the stove construction. The project will provide the necessary construction materials, such as mould for construction, mud bricks, clay, a cast iron grate and a chimney for construction. The improved stove was developed by the Centre for Sustainable Development, Indian Institute of Science. The training conducted for stove promoters was promoted by LAYA, wherein the help of Desi Technology Solutions, Bhubaneswar was used to facilitate basic training. Based on the knowledge acquired from the training and their long time experiences, LAYA will be providing SARALA Improved cook stoves to about 6,000 households in this region through forward funding of VERs.

The traditional cook stoves currently used by the rural tribal communities are relatively inefficient at 10% while the proposed Improve Cook Stove SARALA has efficiency greater than 24%. The use of Sarala will save fuel wood by reducing consumption, which will thereby reduce greenhouse gas (GHG) emissions.

Secondly, through this project initiative the NGO LAYA, is providing a zero energy Bio Sand Water Filter for point of use application, which is an adaptation of the traditional slow sand filter for intermittent use, making it suitable for household use. The filter container can be made of concrete or plastic locally and is filled with layers of specially selected and prepared sand and gravel. The Bio-sand filter makes several innovative improvements that permits "as-needed" intermittent use, enhances effectiveness to eliminate sediments, bacteria, viruses, compounds, cysts, worms and other impurities. Pathogens and suspended solids are removed through a combination of biological and physical processes that take place in the bio-layer and within the sand layer. The advances of this technology is; it also removes turbidity, quality of water improves with time, no on-going costs, no replaceable parts, durable and robust, fabricated from local materials small enough to fit into smallest kitchen and is easy to maintain.

The project will provide safe drinking water, which otherwise is achieved in the baseline through boiling water on traditional cook stove using fuel wood, as water is sourced through streams and wells.

Implementation of the proposed GS VER project will be after successful registration of the project with Gold Standard as the project will be financed through forward carbon finance. Implementation of SARALA Stoves will be over 2 years period wherein every month 250 stoves will be constructed totalling 6,000 units and 250 bio-sand filters will be constructed monthly for 4 years totalling 12,000 units in 4 years starting from January 2015.

The project activity is an end-use energy efficiency improvement category is defined as the reduction in the amount of energy required for delivering or producing non-energy physical goods or services.

As specified in GS Toolkit 2.2, the aim of the project activity is to promote forward funding carbon revenues for implementing the project activity and thus mitigate climate change and promote local sustainable development. The project activity generates credible greenhouse gas (GHG) emission reductions and will contribute to environmental integrity and local sustainable development.

A.2. Location of project activity

A.2.1. Host Party(ies)

>> India

A.2.2. Region/State/Province etc.

>> State: Andhra Pradesh

A.2.3. City/Town/Community etc.

>> i. Paderu Mandal of Visakhapatnam District
ii. Addateegala Mandal of East Godavari District

A.2.4. Physical/Geographical location

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Fig 1: Map showing the project area: State – Andhra Pradesh; District – Visakhapatnam and East Godavari

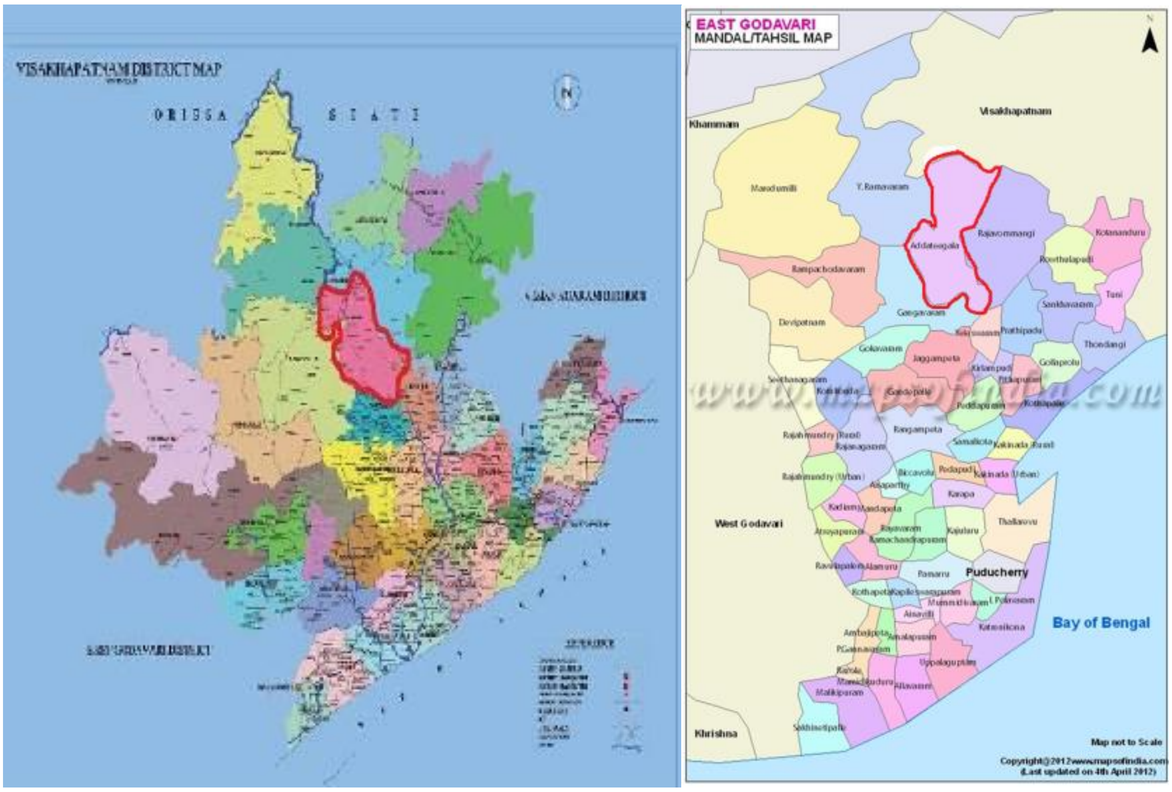

Fig 2: Paderu Mandal in in Visakhapatnam District **Addateegala in East Godavari District**

The East Godavari District[1] is located in the North Coastal part of the state of Andhra Pradesh. The District boundaries are Visakhapatnam, West Godavari, Khammam Districts and Bay of Bengal. East Godavari District lies between 16o 30" to 18o 20" North Latitude and 81o 30" to 82o 36" East Longitude.

Visakhapatnam District[2] is one of the North Eastern Coastal districts of Andhra Pradesh and it lies between 17o - 15' and 18o-32' Northern latitude and 18o - 54' and 83o - 30' in Eastern longitude. It is bounded on the North partly by the Orissa State and partly by Vizianagaram District, on the South by East Godavari District, on the West by Orissa State and on the East by Bay of Bengal.

The coordinates of Mandals are as follows:

State	District	Mandals	Latitude (N)	Longitude (E)
Andhra Pradesh	East Godavari[3]	Addateegala	17^0 34' 04"	81^0 58' 30"
	Visakhapatnam[4]	Paderu	18^0 04' 39"	82^0 39' 38"

A.3. Technologies and/or measures

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The project activity involves two technologies:

i) **SARALA Improved Cook Stoves:** The project activity encompasses the construction of SARALA stoves at the household level. SARALA is a two pan improved cook-stove with a single fuel feeding port for domestic cooking in houses. These stoves are smokeless, compact, durable, and compatible with a wide range of solid biomass. It was developed at ASTRA now Center for Sustainable Technologies, Indian Institute of Science as a consequence to the user response to its earlier version, the ASTRA stove. It uses mud bricks, clay, a cast iron grate and a chimney for construction. A mould of the stove is made for its construction. The features of SARALA are as follows:

- Can burn a variety of biomass fuels
- Smoke-free working environment
- Use of moulds for on-site stove construction with consistent dimensions that provide consistent performance
- Durable with minimal maintenance
- Compact, with low space requirement (Therefore, suitable even for small kitchens)
- Easy to install and operate, no deviation in cooking practice
- Conserves at least 25%-30% of biofuels as compared to open cooking

[1] http://eastgodavari.nic.in/districtprofile/Location.aspx
[2] http://visakhapatnam.nic.in/district-profile.html
[3] Hand book of Statistics, East Godavari District, 2009. Chief Planning Officer, East Godavari District.
[4] Hand book of Statistics, Visakhapatnam District, 2009. Chief Planning Officer, Visakhapatnam District.


Figure 3: Sarala Improved Cook Stove

Bio Sand Filter: The Bio Sand Filter (BSF) is a point of use filtration system, developed from slow sand filters, which remove pathogens and suspended solids from water. At the top of the filter there is a tightly fitted lid, which prevents contamination and unwanted pests from entering the filter. Below is the diffuser plate, which prevents disturbance of the filtration sand layer and protects the bio-layer when water is poured into the filter. Next, is the filtration sand layer. It removes pathogens and suspended solids. Below the sand is a layer of smaller gravels called the separating gravel layer. This prevents filtration sand from entering the drainage gravel layer and clogging the outlet tube. Right below this separating layer is the drainage gravel layer, which supports the separating gravel layer and helps water flow by preventing clogging near the base of the outlet tube.

Filtration process: Pathogens and suspended solids are removed through a combination of biological and physical processes that take place in the bio-layer and within the sand layer. These processes include:

- ✓ **Mechanical trapping.** Suspended solids and pathogens are physically trapped in the spaces between the sand grains.
- ✓ **Predation.** Pathogens are consumed by other microorganisms in the biolayer.
- ✓ **Adsorption.** Pathogens become attached to each other, suspended solids in the water and the sand grains.
- ✓ **Natural death.** Pathogens finish their lift cycle or die because there is not enough food or oxygen for them to survive.

The different processes occur during different points in the filter running process. These can be broken down into segments of the filter running process: the pause period (idle time) and actual run of the filter. During the run, the high water level (hydraulic head) in the inlet reservoir zone pushes the water through the diffuser and filter. The water level in the reservoir decreases as it flows evenly through the sand. The inlet water contains dissolved oxygen, nutrients and contaminants. It provides the oxygen required by the microorganisms in the biofilm. Larger suspended particles and pathogens are trapped in the top of the sand and they partially plug the pore spaces between the sand grains.

The idle time typically accounts for greater than 80% of the daily cycle whereupon various microbial attenuation processes are likely to be significant. In other words, most removal occurs during the point where water is in contact with the biofilm (also referred to as schmutzdecke). When the standing water layer reaches the same height as the outlet tube, the flow stops. This is the level that is high enough to keep the biofilm in the sand layer wet and also allow oxygen from the air to diffuse through the standing water to the bio-layer. The pause period allows time for microorganisms in the bio-layer to consume the pathogens and nutrients in the water. The pause period should be a minimum of 1 hour after the water has stopped flowing up to a maximum of 48 hours.

Removal of Contaminants: The filter removes turbidity. Bio-sand filters exhibit a high reduction in turbidity, slow sand filters show higher removals due to a slower filtration rate. In laboratory studies, the bio-sand filter has been found to have about a 98-99% removal of bacteria. The filter removes *E. coli* due to biofilm formation, which ranges from 97-99.99% depending on the daily charge volume and percent feed water amended with primary effluent to the filter daily.

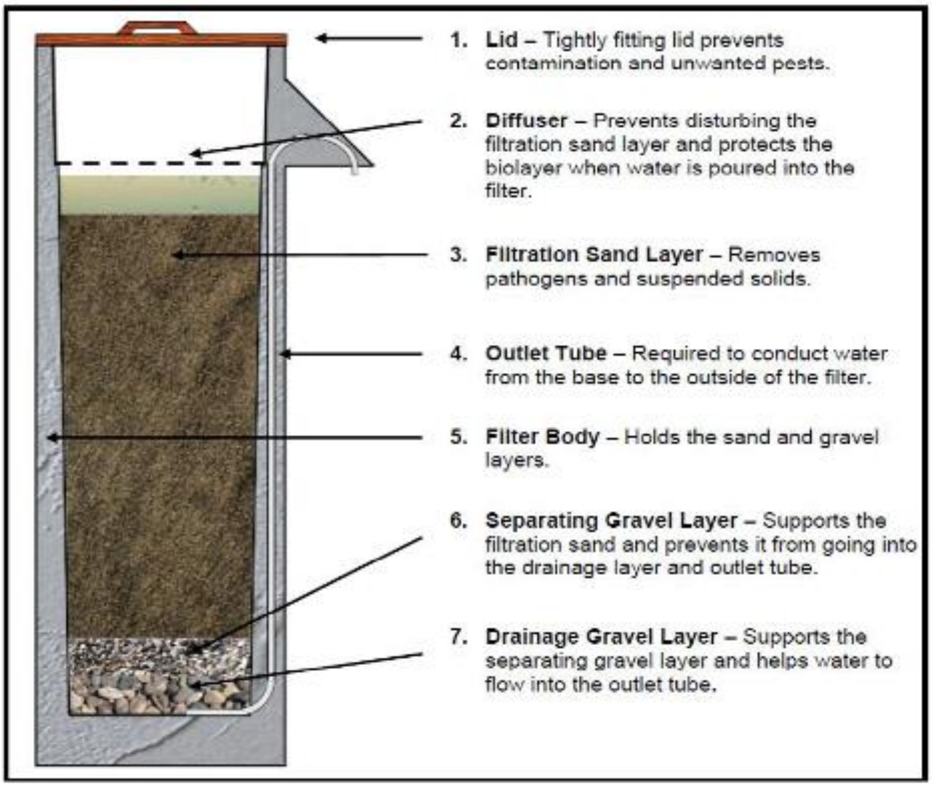

Figure 4: Bio Sand Water Filter

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Party A: India (host)	Private entity A: **Laya Green Ventures Private Limited** Private entity B: **LAYA Resource Centre**	No No

A.5. Public funding of project activity

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There is no public funding involved in the project activity. Please refer to ODA declaration form from the Project Proponent, which is uploaded to the GS Registry.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

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II.G, Energy efficiency measures in thermal applications of non-renewable biomass Version 06.0, Sectoral scope(s): 03

III.AV, Low greenhouse gas emitting safe drinking water production systems, Version 04.0, Sectoral scope(s): 03

B.2. Applicability of methodology

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Applicability of II.G methodology, Version 06

According to Para 2 of the methodology, *the methodology comprises efficiency improvements in thermal applications of non-renewable biomass. Examples of applicable technologies and measures include the introduction of high efficiency biomass fired cook stoves or ovens or dryers to replace the existing devices and/or energy efficiency improvements in existing biomass fired cook stoves or ovens or dryers.*[5]

- The project is implementation of SARALA, a high efficiency biomass fire cook stoves to replace the existing devices of low efficiency having an efficiency of 10%.

According to Para 3 of the methodology, *the methodology is applicable to single pot or multi pot portable or in-situ cook stoves with rated efficiency of at least 20 per cent. The efficiency of the project devices shall be based on certification by a national standards body or an appropriate certifying agent recognized by that body. Alternatively, manufacturer specifications on efficiency based on water boiling test (WBT) may be used. The sampling test of stoves by such certification bodies/agents or manufacturers shall be conducted following a 90/10 precision in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities". However, the following simplified approach may be used, when the efficient cook-stoves are produced by a manufacturer with a good quality management system in place to ensure that the individual equipment produced do not vary beyond the range of acceptance limits (e.g. characteristics such as materials, critical dimensions):*

(a) Conduct a sample test on three cook stoves with three tests conducted for each stove;

(b) If the standard deviation of the nine test results indicated above is very small and 90/10 precision requirement is met (in this case, the value of the t-distribution for 90 per cent confidence shall be used instead of Z value), the efficiency determined is acceptable, otherwise more sample tests would be required until 90/10 precision is met.

- SARALA stove is a multi-pot in-situ cook stove with rated efficiency of above 20%. The stove based on the mould designed by Technology Informatics Design Endeavour (TIDE) and based on studies has been rated at an efficiency of 25-30% through water boiling test[6].
- The efficient cook stoves are being manufactured in-situ through moulds to ensure consistent critical dimensions. Field tests were conducted by LAYA to compare the Specific Fuel Consumption of SARALA stoves (SC_{old}) to traditional stoves (SC_{new}) through controlled cooking test (CCT), which is described in section B.4. Based on the field studies, the SC_{old} and SC_{new} of SARALA stove is 363±86 g/kg and 229±46 g/kg respectively. The results have a precision level of 7% and 6% respectively which is small and is well within the 90/10 precision requirement based on calculations with t-distribution as shown in the enclosed excel sheet and described in section B.4.

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[5] Implementation of Greenfield applications is not covered in this methodology.

[6] Jagadish, 2004. The development and dissemination of efficient domestic cook stoves and other devices in Karnataka. Current Science, Vol. 87, No. 7, 10, October 2004. http://eprints.iisc.ernet.in/2388/1/the_development.pdf

2. *Project participants shall be able to show that non-renewable biomass has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.*
   - Based on the FSI, 1989[7], at the level of consumption of forest produce and the productivity of forests, the country needed a minimum of 0.47 ha of forests per capita to meet their needs that include fuel wood. At the national level, based on recorded national are of forests (75.13 Mha), the per capita forest cover is 0.11 ha, below the critical minimum required for sustainable production and extraction of forest produce including fuelwood. Thus non-renewable biomass is being used since 1989 at the national level. The use of non-renewable biomass since 1989 is further justified for Andhra Pradesh. Andhra Pradesh, is a forest scarce state with a critical minimum of 0.1-0.2 hectares per person during 1989. Thus not only at the national level, even at the state level of Andhra Pradesh there has been non-renewable biomass used since 31st December 1989. Andhra Pradesh had forest cover between 0.1-0.2 ha per capita, below the critical minimum required for sustainable production and extraction of forest produce including fuel wood.

Based on Para 3 *for Applicability of the project activity, the aggregate energy savings of a single project activity shall not exceed the equivalent of 60 GWh per year or 180 GWh thermal per year in fuel input.*

- Thermal energy savings per household are calculated by multiplying the annual biomass savings per household from improved cook stove SARALA, with its calorific value:

Energy Savings (GWh)

$$= B_{ysavings}.NCV_{biomass}$$

$$= B_y.(1-\frac{SC_{new}}{SC_{old}}).NCV_{biomass}$$

$$= 3.01\times(1-\frac{229}{363})\times 4.167$$

= 5.0 kWh/household

= 0.005 GWh/household

Where:

B_y = Quantity of biomass used in the absence of the project activity in tonnes = 3.23 t per household (see Section B.4.).

SC_{old} = Specific fuel consumption or fuel consumption rate of the baseline devices i.e. fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively = 363.

SC_{new} = Specific fuel consumption or the fuel consumption rate in year *y* of the devices deployed as part of the project i.e. fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour respectively= 229.

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

The maximum number of eligible households to be disseminated with the stove in this project activity is therefore limited to 180 GWh/0.005 GWh per household = 36,303 households.

The project activity will remain under the limit of small-scale project activity types (annual energy savings below 180 GWh_{th}) during every year of the crediting period, because the maximum number of households that will be disseminated with the stove under the project will be limited to below 36,303.

[7]State of Forest Report, 1989. Forest Survey of India, Ministry of Environment and Forests, Government of India.(Page no 15). Page 19.

Considering the above, AMS II.G. is applicable to the project activity.

Energy Savings		
Activity Data	**Value**	**Source of data**
$B_{y,savings}$ (t/family/yr)	1.19	Calculated based on Sample Survey
$NCV_{biomass}$ (GJ/t)	15	II.G methodology, Version 6.
Energy savings (GJ per appliance/family/yr)	17.85	Calculated
Energy Savings (GWh per app)	0.0050	Calculated
Energy Savings (% of SSC threshold)	0.0028%	Calculated
No. of appliances that can be implemented	36,303	Calculated
Number of appliances to be implemented	**6,000**	
Total Energy savings for 6,000 units (GWh_{th})	**30**	Calculated

<u>Applicablity of III.AV methodology, Version 4</u>

This methodology comprises introduction of low greenhouse gas emitting water purification systems to provide safe drinking water (SDW). Water purification technologies that involve point-of use (POU) or point-of-entry (POE)[8] *treatment systems for residential or institutional applications such as systems installed at a school or a community centre are included. The examples include, but are not limited to water filters (e.g. membrane, activated carbon, ceramic filters), solar energy powered ultraviolet (UV) disinfection devices, solar disinfection techniques, photocatalytic disinfection equipment, pasteurization appliances, chemical disinfection methods (e.g. chlorination), combined treatment approaches (e.g. flocculation plus disinfection). The methodology is also applicable to water kiosks*[9] *that treat water using one or more of the following technologies: chlorination, combined flocculant/disinfection powders and solar disinfection. In case the water kiosk is using solar disinfection, project proponents need to implement measures to prevent recontamination (e.g. disinfecting containers, sealing containers and hygiene trainings).*

- The project involves implementation of zero energy water filters for point of use application through Bio-Sand Filter to provide safe drinking water for residential application.

The methodology is applicable under the following conditions:

(a) *Prior to the implementation of the project activity, a public distribution network supplying SDW to the project boundary does not exist. If during the crediting period SDW is made available through a public distribution network, the emission reductions pertaining to the households/buildings supplied by the public system cannot be claimed from that point onwards. This condition should be checked annually during the crediting period;*

- A survey of 10,919 households was done in the project area of Paderu and Addateegala to understand the type of drinking water distribution system. Based on the survey, the tribal households drink water from various sources are as follows:

[8] Point of Use (POU) devices treat only the water intended for direct consumption, typically at a single tap or limited number of taps, while Point of Entry (POE) treatment devices are typically installed to treat all water entering a single home, business, school, or facility (USEPA, 2006).

[9] Water kiosk is a facility to treat water to be delivered or sold to final consumers in appropriate conditions of sealed storage and/or residual capacity of disinfection, in such a way as to prevent recontamination before the final consumption as drinking water.

Sources of Drinking Water in the tribal region – Project Area

Drinking water source	Number of villages	Number of HHs	Percent of HHs
Bore-well	120	4,808	44%
Stream	139	2,476	23%
Well	88	2,090	19%
Government Tap	35	1,000	9%
Hand Pump	19	262	2%
Spring	21	106	1%
Gravity water	12	70	1%
Open well	16	69	1%
Panchayat Tap	9	30	0.3%
Satyasai water supply	1	8	0.1%
		10,919	**100%**

The project will be implemented only in households without public distribution network supplying water.

Fig 5: Various sources of drinking water in the tribal regions of the project area

- This is further substantiated by published literature, wherein in scheduled tribal regions of India, the sources of drinking water for households are as follows:

Location of source of drinking water	% of households by source
Tap water from treated water	14.6
Tap from untreated water	9.8
Covered well	1.9
Un-covered well	19.1
Hand Pump	39.2
Tubewell/Borewell	7.8
Spring	3.1
River/Canal	2.0
Tank/pond/lake	1.1
Other sources	1.3
Total	100.0

- Further, a research done in rural areas of Andhra Pradesh shows that in the districts of the project area, Visakhapatnam (Northern Coastal Zone) and West Godavari (Godavari Zone), the water supply is predominantly sub-standard and basic in quality[10].

(b) *It shall be demonstrated based on laboratory testing or official notifications (for example notifications from the national authority on health) that the application of the project technology/equipment achieves compliance either with: (i) at a minimum the performance target as per "Evaluating household water treatment options: Health based targets and microbiological performance specifications" (WHO, 2011); or (ii) an applicable national standard or guideline;*

- Based on the manufacturers' manual and other field studies[11], bio-sand filters remove majority of biological contaminations as shown below:

[10] Sub-standard quality is when water used for drinking is of bad smell, bad taste or colour or appearance and basic is when the quantity, quality, accessability and reliability are of minimum service levels.

[11] Biosand Filter Construction Manual, A CAWST Participant Manual, August 2012 Edition. Center for Affordable Water and Sanitation Technology (CAWST).

Table 1: Biosand Filter Treatment Efficiency

	Bacteria	Viruses	Protozoa	Helminths	Turbidity	Iron
Laboratory	Up to 96.5%[1,2]	70 to >99%[3]	>99.9%[4]	Up to 100%[5]	95% <1 NTU[1]	Not available
Field	87.9 to 98.5%[6,7]	Not available	Not available	Up to 100%[5]	85%[7]	90-95%[8]

1 Buzunis (1995)
2 Baumgartner (2006)
3 Elliott et al. (2008)
4 Palmateer et al. (1997)
5 Not researched. However, helminths are too large to pass between the sand, up to 100% removal efficiency is assumed
6 Earwaker (2006)
7 Duke & Baker (2005)
8 Ngai et al. (2004)

- Further, in the project area, water samples from stream and bore-well were collected and filtered through the bio-sand filter. The unfiltered and filtered water were analysed for biological contamination in the laboratory. The Indian National standard "Drinking Water – Specification IS 10500: 1991, has been applied to test the quality of filtered water. The results were as follows:

	Total Bacterial Count (CFU/ml)	Total Coliformis (MPN/100 ml)	E.Coli Count
Indian National standard "Drinking Water – Specification IS 10500: 1991			
	1000	**<10**	**Absent**
Bio-sand Filter			
Stream water (Unfiltered)	2.1×10^3	2400	Present
Stream Water (Filtered by Bio-sand Filter)	$\mathbf{0.92 \times 10^2}$	**4**	**Absent**
Bore Well Water (Unfiltered)	9.0×10^3	11	Absent
Bore Well Water (Filtered by Bio-sand Filter)	$\mathbf{0.8 \times 10^2}$	**8**	**Absent**

(c) In cases where the life span of the water treatment technologies is shorter than the crediting period of the project activity, there shall be documented measures in place to ensure that end users have access to replacement purification systems of comparable quality.

- The life span of bio-sand filter is 25-30 years[12]. The concrete container is heavier and durable. Since the filter will be fixed to the floor, it cannot be knocked over and cracked and hence the filter can last for decades. Because no consumables, such as chemicals, electricity, fuel, moving or exterior parts, are used, the operating costs are negligible.

Applicability of this methodology is foreseen in the following types of situations that shall be reassessed at the beginning of each crediting period:

(a) Case 1: Project activities implemented in rural or urban areas of countries with proportion of rural or urban population using an improved drinking-water source equal to or less than 60 per cent confirmed by one of the three options below:

(i) Proportion of populations using an improved drinking-water source for the most recent year for which data is available from WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and sanitation shall be used for this purpose. Definition of improved and unimproved drinking water source shall be as per the information provided by JMP;

[12] http://www.sapwii.org/technology.html

(ii) Using official data such as publicly available statistical data from a government agency or an independently commissioned study by an international organization or an university;
(iii) Using survey methods (use 90/10 confidence/precision for sampling);

Using survey methods and also from published literature, as mentioned above and repeated below:

- A survey was done in the project area of Paderu and Addatheegala to understand the type of drinking water distribution system. Based on the survey, the tribal households drink water from various sources are as follows:

Sources of Drinking Water in the tribal region – Project Area

Drinking water source	Number of villages	Number of HHs	Percent of HHs
Borewell	120	4808	44%
Stream	139	2,476	23%
Well	88	2,090	19%
Government Tap	35	1,000	9%
Hand Pump	19	262	2%
Spring	21	106	1%
Gravity water	12	70	1%
Open well	16	69	1%
Panchayat Tap	9	30	0.3%
Satyasai water supply	1	8	0.1%
		10,919	**100%**

- This is further substantiated by statistical data from governmental agency[13], wherein in scheduled tribal regions of India, the sources of drinking water for households are as follows:

Location of source of drinking water	% of households by source
Tap water from treated water	14.6
Tap from untreated water	9.8
Covered well	1.9
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Tank/pond/lake	1.1
Other sources	1.3
Total	100.0

- Further, a research done in rural areas of Andhra Pradesh[14], shows that in the districts of the project area, Visakhapatnam (Northern Coastal Zone) and West Godavari (Godavari Zone), the water supply is predominantly sub-standard and basic in quality[10].

[13] Ministry of Tribal Affairs, Government of India, Houses and Household Amenities for Scheduled Tribes, 2011. http://www.tribal.gov.in/WriteReadData/CMS/Documents/201306110241433087395HousesandHouseholdAmenitiesforScheduledTribes.pdf

Thus the project activity falls under Case 1.

B.3. Project boundary

	Source	GHGs	Included?	Justification/Explanation
Baseline scenario	Cooking on traditional stove	CO_2	Yes	Important source of emission
		CH_4	No	Not a major source of emission and not accounted in the methodology
		N_2O	No	Not a major source of emission and not accounted in the methodology
	Fuel wood use to boil drinking water	CO_2	Yes	Avoidance of fuel wood to boil water to drink and thus avoid a major source of emission
		CH_4	No	Not a major source of emission and not accounted in the methodology
		N_2O	No	Not a major source of emission and not accounted in the methodology
Project scenario	Cooking on efficient SARALA stove	CO_2	Yes	Important source of emission from leakage
		CH_4	No	Not a major source of emission and not accounted in the methodology
		N_2O	No	Not a major source of emission and not accounted in the methodology
	Filtration of drinking Water through Bio-sand	CO_2	Yes	Major source of emission from use of fossil fuel and electricity.
		CH_4	No	Not a major source of emission and not accounted in the methodology
		N_2O	No	Not a major source of emission and not accounted in the methodology

B.4. Establishment and description of baseline scenario
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<u>SARALA Stove: II.G, Version 6 methodology</u>

In accordance with Paragraph 12 of the chosen methodology, Type II.G. Energy efficiency measures in thermal applications of non-renewable biomass, Version 06:

It is assumed that in the absence of the project activity, the baseline scenario would be the projected use of fossil fuels to meet similar thermal energy needs as those provided by the project devices.

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.

There are no mandatory national and sectoral policies or regulations for use of improved cook stoves or energy efficiency measures in thermal applications of non-renewable biomass at household level.

[14] T. Sobhasri and G. Sanjeevayya. 2006. Women in Water Management: A Case Study of a Tribal Village in Visakhapatnam District, Andhra Pradesh. Anthropologist, 8(4): 255-257 (2006).

Emission Reduction Calculations

According to Para 13 of the methodology, Emission reductions are calculated as:

$$ER_y = \sum_i ER_{y,i}$$

Where:

i	=	Indices for the situation where more than one type of project device is introduced to replace the pre-project devices[15]
ER_y	=	Emission reductions during year y in t CO_2e
$ER_{y,i}$	=	Emission reductions by project device of type i during year y in t CO_2e

In the project area, only one type of project device SARALA stove is introduced to replace the pre-project devices, the traditional cook stoves. Hence i = 1.

Further for household cook stoves the emission reduction is calculated as follows:

$$ER_{y,i} = \sum_{a=1}^{a=y} B_{y,savings,i,a} \times N_{y,i,a} \times \frac{\mu_{y,i}}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel} - LE_y$$

Where:

a	=	'*a'* is the indices for the age (in years) of the cook stoves that are operating in the year '*y*' of the crediting period. At any year *y* of the crediting period (e.g. *y* = 1, 2, 3…7 or 10) there will be a population of $N_{y,i,a}$ operational devices of the type *i* with age varying from a=1 (the cook stoves installed during the current year *y*) up to the age a=y (the cook stoves installed during the first year of the crediting period). Since the lifetime of cook stoves is often shorter than the length of the crediting period and cook stoves are likely to show significant efficiency losses over time, this aspect needs to be captured through the monitoring plan
$B_{y,savings,i,a}$	=	Quantity of woody biomass that is saved in tonnes per cook stove device of type *i* and age *a* in year *y*
$f_{NRB,y}$	=	Fraction of woody biomass saved by the project activity in year *y* that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (f_{NRB}) values available on the CDM website.[16] The parameter value may be fixed ex ante at the beginning of each crediting period.
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried')

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

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

$EF_{projected\_fossilfuel}$	=	Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO_2/TJ[17]
$N_{y,i,a}$	=	Number of project devices of type *i* and age *a* operating in year *y*, determined as per paragraph 33
$\mu_{y,i}$	=	Number of days of utilization of the project device during the year '*y*'. Its value may be considered as 365 where it can be demonstrated that the pre-project device has been decommissioned and is no longer used, otherwise it shall be determined as per paragraphs 22-24
LE_y	=	Leakage emissions in the year *y*, please refer to the section 4.3 below

Determining $B_{y,savings,i,a}$

$B_{y,savings,i,a}$ for cook stoves is estimated using option 3 of the methodology, the controlled cooking test (CCT), which is as follows:

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

Where:

SC_{old}	=	Specific fuel consumption or fuel consumption rate of the pre-project devices, that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively. Specific fuel consumption or fuel consumption rate are to be determined using the CCT protocol carried out in accordance with national standards (if available) or international standards or guidelines (e.g. the CCT procedures specified by the partnership for clean indoor air (PCIA): <http://www.pciaonline.org/node/1050>). Use weighted average values if more than one type of device is being replaced (taking the amount of woody biomass consumed by each device as the weighting factor)
$SC_{new,i,a=1}$	=	Specific fuel consumption or the fuel consumption rate of the devices of type *i* deployed as part of the project, that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour respectively, for the initial efficiency determined in the year of its installation (a=1). Specific fuel consumption or fuel consumption rate shall be determined using the same CCT protocol used to test the pre-project devices. If more than one project devices are necessary to replace the pre-project device, woody biomass consumption should be calculated per device (taking the amount of woody biomass consumed by each device as the weighting factor)
$\Delta SC_{y,i,a}$	=	Factor to consider the efficiency loss of the project device type *i* due to its aging at the year *y*, as expressed as follows:

[17] This value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. It is assumed that the mix of present and future fuels used would consist of a solid fossil fuel (lowest in the ladder of fuel choices), 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). Thus a 50 per cent weight is assigned to coal as the alternative solid fossil fuel (96 t CO_2/TJ) and a 25 per cent weight is assigned to both liquid and gaseous fuels (71.5 t CO_2/TJ for kerosene and 63.0 t CO_2/TJ for liquefied petroleum gas (LPG).

$$\Delta SC_{y,i,a} = \frac{SC_{new,i,a=1}}{SC_{new,i,a}}$$

where $SC_{new,i,a}$ is the specific fuel consumption of the device '*i*' with age '*a*' determined using the CCT and $SC_{new,i,a=1}$ is the specific fuel consumption of the device at its first year of operation. $\Delta SC_{y,i,a}$ may be determined through sample surveys of project device type *i* for batches of stoves with the same age at each year of the crediting period. Alternatively, the monitoring may determine annually the specific fuel consumption of the devices installed at the first year of the crediting period, and the efficiency loss of this population may be used to correct the initial efficiency of the population of devises installed later on. As an example, the loss rate of year 2016 for the project device of type *i* installed in 2015 can be considered the same as that of year 2014 for the project device of the same type installed in 2013. In this way, the monitoring at any year y during the crediting period will consist of the determination of the specific fuel consumption for the devices installed during the current year (the initial value $SC_{new,i,a=1}$ for the population commissioned during this year), and the values of $SC_{new,i,a}$ and of $\Delta SC_{y,i,a}$ for oldest population (i.e. the devices from the first year that have now reached the age a=y)

$B_{old,i}$ is determined using option (a) wherein, it is estimated as the average annual consumption of woody biomass per device (tonnes/year). This may be derived from historical data or a sample survey of local usage.

Laya registered a Gold Standard Community-Focused Micro Scale Scheme for implementation of SARALA stoves during 2012 entitled "LAYA PADERU ENERGY EFFICIENT WOODSTOVES PROJECT" (GS997).

The improved cook stove being implemented is the SARALA stove because of the demand from other families in the region. A sample survey of Kitchen test was done to study the fuel wood use by traditional cookstoves and the SARALA stoves. The same study has been considered for this PDD too, as it is the same tribal region of Paderu and neighbouring tribal district of Addatheegala, with similar socio-economic conditions.

The purpose of the survey was to define clusters or groups with homogeneous emission reduction characteristics and to quantify the emission reduction which is achieved by the implementation of SARALA Improved Cook Stoves.

The KS, followed by KT surveys, observations and analysis were undertaken by staff of LAYA and the Technical Team of Fair Climate Network (FCN). The questionnaires for household surveys, demographic surveys, fuelwood usage were designed according to the requirement of the methodology and field tested. Based on the field tests, the questionnaires was modified and finalized for the survey.

Sample Selection and Survey: The survey was carried out in Paderu and Pedabayalu Mandals in Paderu division, Vishakhapatnam district, Andhra Pradesh, India, among the tribal people who use fuel wood collected from the nearby forests. Women, the main stakeholder were interviewed to collect household level information.

A simple random technique was employed to select the households from the data available in LAYA NGO. Here none of the households has telephone connections because they are all located in remote villages in hilly regions and far from the main telephone exchanges. Also they are too poor to have telephonic connections at homes. The homes only contain the basic minimum for a living. All the interviews were conducted face to face in the houses, which were part of the survey. A kitchen Survey (KS) was carried out in 116 randomly selected households in the project area. For the Kitchen Survey and Kitchen Test, 116 beneficiary households were selected, wherein SARALA improved cook-stove were constructed. The study was conducted in the project area from 4 representative villages of Boddaput, Donela and Jamadala from Paderu Mandal and Urrugunda from Pedabayalu Mandal (Table 1).

Table 1: Details of the project area in which the Kitchen Survey and Tests was conducted

Mandal	Villages				
	Boddaput	Donela	Jamadala	Urrugunda	Total
Paderu	48	16		34	98
Pedabayalu			18		18
Total	48	16	18	34	116

The households were selected for their willingness and enthusiasm to cooperate for the tests. It was also based on the time frame, wherein qualitative and quantitative tests could be conducted during the chosen time. The survey was done jointly by the staff of the NGO – LAYA Resource Centre, Fair Climate Network (FCN) Technical Team and village level volunteers. The households were visited and interviewed by trained project staff from 12/11/2010 to 06/12/2010. The interview team consisted of 75 data collectors, 3 supervisors who were also involved in data collection and 1 coordinator. For the interviews, the "Questionnaire for Kitchen Survey" was designed, field tested and then finalized. It was compiled and translated into the local language Telugu for the data collectors/village volunteers so that they would be able to use them at the time of interview. Collected data was entered by LAYA staff into Microsoft Excel. The results of Kitchen Survey resulted in the following recommendations for delineation of the clusters.

Clustering: The questionnaire was well designed to enquire about the use of different biomass for cooking during all seasons throughout the year. All households stated to use ONLY wood. It is not a practice among the tribals in this region to use agricultural residues, dung and/or agricultural residues or a combination of these fuel types. None of the fossil fuels i.e. Kerosene, LPG, Coal, etc. are also used for cooking. Thus 100% of all households use only wood throughout the year in all seasons for cooking and heating water. With the introduction of the improved SARALA cook-stove, they will continue to use only wood and there will be no shift in type of fuelwood use. Culturally, the tribes live amidst forests, using wood for cooking. The reason for not using agricultural residue is that the tribes predominantly practice Podu or shifting cultivation far off on the hill tops. On an average, each family has one hectare of land on all hill slopes for the purpose of shifting cultivation. The method of shifting cultivation includes four stages. In the first stage the tribal farmer select the field on the hill slope or on the hill top, where there is good growth of trees and bushes. Later, the area is cleared off the bushes, cutting off trees and undergrowth and left on the field for about ten to fifteen days to dry up. It is burnt and the ash remains on the field. During monsoon, in the month of May or June the tribal farmers prepare the podu plots for cultivation and sow the seeds in the field without adding any additional manure except the ash which remains in it. Generally the tribal farmers grow mixed crops like millets, pulses and oil seeds in podu plots without weeding. The tribal farmers get very low yields from the crops which they raise in the podu plots. Podu plots are cultivated for one or two years and then it left fallow for another two or three years. Then a new plot shall be selected on the hill slope of forested zone. The rotation of podu plots is a common feature, in the methods of shifting cultivation. Some of the tribal families take up settled cultivation also, simultaneously in addition to podu cultivation. Thus crop residues are used as fodder, manure and burnt on field. It is not at all used as fuelwood. Thus only one cluster is demarcated covering fuel consumption patterns of the project population. The cluster is defined as a household using wood for cooking.

The survey was done on days, wherein normal cooking was done for the family members. Days of festival, cooking for guests, etc. have not been included. The survey also does not include the special days wherein extra meals would be cooked for festivals and guests. Space heating is done separately. The stove is not used for space heating and hence there will not be large variation in fuel wood use between seasons for space heating. Thus no adjustment factor has been applied for seasonal and weekend variations. The adjustment factor would need to consider the reduction of fuel wood use in summer. We do not expect a large variation in fuel wood consumption, as SARALA will continue to be used for cooking and water heating for bathing and is not used for space heating. Also we will have to take into consideration the extra fuelwood that will be used during festivals and guests at home. Nearly there are 47 festival days[18] in a year during which, the fuelwood consumption would be more. Thus considering these issues, no adjustment factor has been applied.

Based on the KS,
(a) Fuel Type: The primary fuel is woody biomass. No other secondary fuel is used by the tribal communities.
(b) All cooking during the tests were done with woody biomass. Since no other secondary fuel is being used by the tribal people throughout the year, the fraction of secondary fuels is zero and kept so throughout the project period.
(c) There are no fuel and stove-type mixing in the project area.

There are no other emissions directly or indirectly being resulted due to wood fuel combustion which will be avoided or introduced by the project activity. The Kitchen Tests was targeted at the people who are Tribal Communities who use fuel wood for cooking food, heating water for bath which is collected from the forests with traditional stoves. The survey revealed that no clustering was required since the project is implemented in a homogeneous environment where there is no deviation in the pattern of using the stoves as well as collection of fuel wood from forests.

Based on the Kitchen test, the fuel wood use on traditional stoves are as follows:

Fuelwood Use (t/Household/yr)	
Mean	**3.23**
Standard Error	0.11
Standard Deviation	1.19
Confidence Level (90.0%)	0.18
Precision Level	**6%**

Thus, an annual consumption of 3.23 t/family/yr has been considered as B_{old} for emission reduction calculations in the PDD.

To determine $B_{y,savings}$ considering Option 3 of the methodology, Controlled Cooking Test (CCT) will be done. According to the methodology, the approach used to determine $B_{y,savings,i,a}$ requires annual sampling of project device to determine efficiency of each batch of project devices. Alternatively, the result of a sampling of the first batch may be used as a proxy to subsequent batches (e.g. the efficiency in year 4 for the batch installed in year 1 could be used for the efficiency in year 5 for the batch installed in year 2):

[18] http://festivals.tajonline.com/

Based on CCT conducted for SARALA stoves constructed in the project area for year of construction, the following results were obtained:

Table 2: Specific Fuel Consumption (g/kg) of traditional and SARALA stoves

	Traditional Stove	SARALA Stove
Number of stoves tested	15	15
N	45	45
DI	44	44
t-distribution	1.86	1.86
Confidence Level	0.9	0.9
Precision	0.1	0.1
Mean (g/kg)	**363**	**229**
Standard Deviation	86.17	46.40
Standard Error	12.84	6.91
Precision level	7%	6%

Biomass Savings ($B_{y, savings}$)		
Parameters	**Value**	**Source of data**
$B_{old,i}$	3.23	Field Studies
SC_{old} (Fuel consumption per quantity of food cooked g/kg)	363	CCT
SC_{new} (Fuel consumption per quantity of food cooked (g/kg)	229	CCT
$B_{y,savings,i,a} = B_{old,i} \times (1 - \frac{SC_{new,i,a=1} \times \Delta SC_{y,i,a}}{SC_{old}})$ for year of installation[19]	$3.23 \times (1 - \frac{229}{363}) = 1.19$	Calculated

ΔSC_y will be determined after project implementation which is the factor to consider the efficiency loss of the project device type *i* due to its aging at the year *y*, as expressed as follows:

$$\Delta SC_{y,i,a} = \frac{SC_{new,i,a=1}}{SC_{new,i,a}}$$

where $SC_{new,i,a}$ is the specific fuel consumption of the device '*i*' with age '*a*' determined using the CCT and $SC_{new,i,a=1}$ is the specific fuel consumption of the device at its first year of operation.

$\Delta SC_{y,i,a}$ will be determined through sample surveys of project device type *i* for batches of stoves with the same age at each year of the crediting period or alternatively, the monitoring will determine annually the specific fuel consumption of the devices installed at the first year of the crediting period, and the efficiency loss of this population may be used to correct the initial efficiency of the population of devises installed later on. As an example, the loss rate of year 2016 for the project device of type *i* installed in 2015 can be considered the same as that of year 2014 for the project device of the same type installed in 2013. In this way, the monitoring at any year y during the crediting period will consist of the determination of the specific fuel consumption for the devices installed during the current year (the initial value $SC_{new,i,a=1}$ for the population commissioned during this year), and the values of $SC_{new,i,a}$ and of $\Delta SC_{y,i,a}$ for oldest population (i.e. the devices from the first year that have now reached the age a=y)

[19] ΔSC_y is zero for year of installation.

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

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:
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.*

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:

$$f_{NRB,y} = \frac{NRB}{NRB + DRB}$$

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[20]. 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. According to the study, the total fuel wood consumption for Andhra Pradesh state is 24.293 Mt. Fuel wood productions from forests and from trees outside Forests account for 0.002 Mt and 1.024 Mt respectively. Therefore the DRB component of total fuel wood production is 1.026 Mt. Accordingly; the NRB component of fuel wood consumption is 23.267 Mt. This accounts for an f_{NRB} of 0.95. The following table summarizes the calculations for f_{NRB} based on FSI, 2011.

Table 3: f_{NRB} calculations for Andhra Pradesh State in which the project will be implemented

f_{NRB} Calculations for Andhra Pradesh State based on Forest Survey of India, 2011		
Parameter	**Value**	**Source of Data**
Fuel wood Consumption (tonnes)	2,42,93,000	State of Forest Report, Forest Survey of India, Ministry of Environment and Forests, Government of India, 2011
Fuel wood production from Forest (tonnes)	2,000	
Fuel wood production from trees outside Forests (tonnes)	10,24,000	
Non-Renewable Biomass (NRB) (tonnes)	2,32,67,000	(Consumption) minus (Production from forests and outside forests)(24293000-(2000+1024000)
Demonstably Renewable Biomass (DRB) (tonnes)	10,26,000	Production from forests and from trees outside forests (2000+1024000)
$f_{NRB,y} = \frac{NRB}{NRB + DRB}$	**0.95**	Based on formula given in I.E. Version 6 methodology

The fraction of non-renewable woody biomass used in the absence of the project activity **is 0.95.**

[20] FSI, 2011. Chapter 7: Socio-economic contribution of forests: Production and consumption of forest resources in India. State of Forest Report. Forest Survey of India, Ministry of Environment and Forests, Government of India. Page numbers 72, 73 and 76.

According to the methodology, *the Non-renewable woody biomass (NRB) is the quantity of woody biomass used in the absence of the project activity (B_y) minus 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 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.*

To demonstrate the non-renewability of woody biomass, the supporting indicators that exist are as follows:

- *Increase in time spent for gathering fuel-wood by users:* The baseline household survey conducted in 2013 in the project area showed that 90% of the respondents spend more time to collect fuel-wood now compared to that 20 years back. This is due to depletion of biomass stocks in wastelands and forests. They need to trek longer distances to collect fuel-wood compared to that 20 years back resulting in increased time spent. This corroborates with a study done in Chittoor district. A Participatory Rural Appraisal (PRA) was conducted wherein the communities identified declining fuelwood availability as a dynamic and a very important problem. They defined the problem in terms of their perception of the availability of fuelwood in the forest and elaborated on the problem using indicators such as longer time taken and distance travelled to collect fuel wood[21].
- *Increasing trends in fuel wood price indicating scarcity;* Yearly consumer expenditure survey among Indian households is carried out by the National Sample Survey Organisation (NSSO) for rural areas at the state level. Information on energy sources used both for cooking and lighting is collected as part of the survey. It can be seen that there is an increase in price beyond the yearly inflation rate, indicating scarcity (Fig 5). Respondents were also asked to recall the price of a headload of firewood in 20 years ago and the cost of the same today. The present price of each headload of firewood is around Rs 100. Communities recalled that 20 years ago fuelwood was available in abundance near to their villages and there was no need to buy from outside. The baseline survey also revealed that they travel long distances compared to 20 years ago (Appendix 4 of the PDD).

[21] Yadama, *et al*., Community Driven Modelling of Social-Ecological Systems: Lessons from Andhra Pradesh, India. George Warren Brown School of Social Work, Washington University of St. Louis and Foundation for Ecological Security, India. (Page no 9).

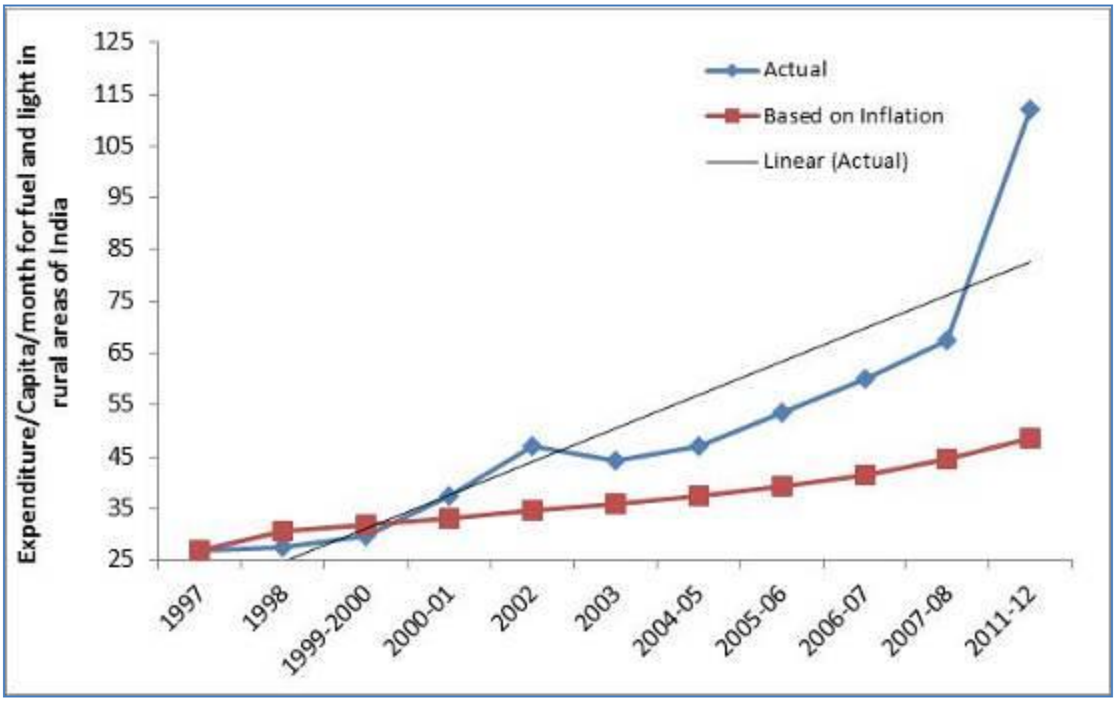

Fig 5: Relative escalation of prices (average yearly inflation rate in India vis-á-vis the actual prices) towards fuel and light spent by rural population in Andhra Pradesh[22]

Use of non-renewable biomass since 31st December 1989.

Andhra Pradesh, the state in which the project will be implemented, is a forest scarce state with less than a critical minimum of 0.1 hectares per person during 1989. Though forest cover has stopped declining further, its quality however is still declining in terms of lowered growing stock and annual incremental rates depicting a lowered volume of the forest's stock and of the productivity of India's forest covered areas. Between the years 1989-1997, there has been a decrease of 10% change in the crown cover in Andhra Pradesh. Thus not only at the national level, even at the state level of Andhra Pradesh there has been non-renewable biomass used since 31st December 1989[23]. Based on the FSI, 1989 (Fig 6)[24], at the level of consumption of forest produce and the productivity of forests, the country needed a minimum of 0.47 ha of forests per capita to meet their needs which includes fuel wood. Andhra Pradesh had forest cover of 0.05 –

[22] http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=442&type=NSSO (1997) (Page no 19)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=448&type=NSSO (1998) (Page no 22)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=454&type=NSSO (1999-2000) (Page no 52)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=476&type=NSSO (2000-01) (Page no 22)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=484&type=NSSO (2002) (Page no 23)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=490&type=NSSO (2003) (Page no 24)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=509_P1&type=NSSO (2004-05) (Page no A-201)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=523&type=NSSO (2005-06) (Page no A-8)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=527&type=nsso (2006-07) (Page no A-8)
http://mospi.nic.in/Mospi_New/upload/530_final.pdf (2007-08) (Page no A-8)
http://mospi.nic.in/Mospi_New/upload/KI-68th-HCE.pdf (Page no A-19)

[23] Population pressure and deforestation in India. S.C. Gulati and Suresh Sharma. Population Research Centre, Institute of Economic Growth, University Enclave, Delhi.(Page no 10 and 11)

[24] State of Forest Report, 1989. Forest Survey of India, Ministry of Environment and Forests, Government of India.(Page no 15)

0.1 ha per capita, below the critical minimum required for sustainable production and extraction of forest produce including fuel wood.

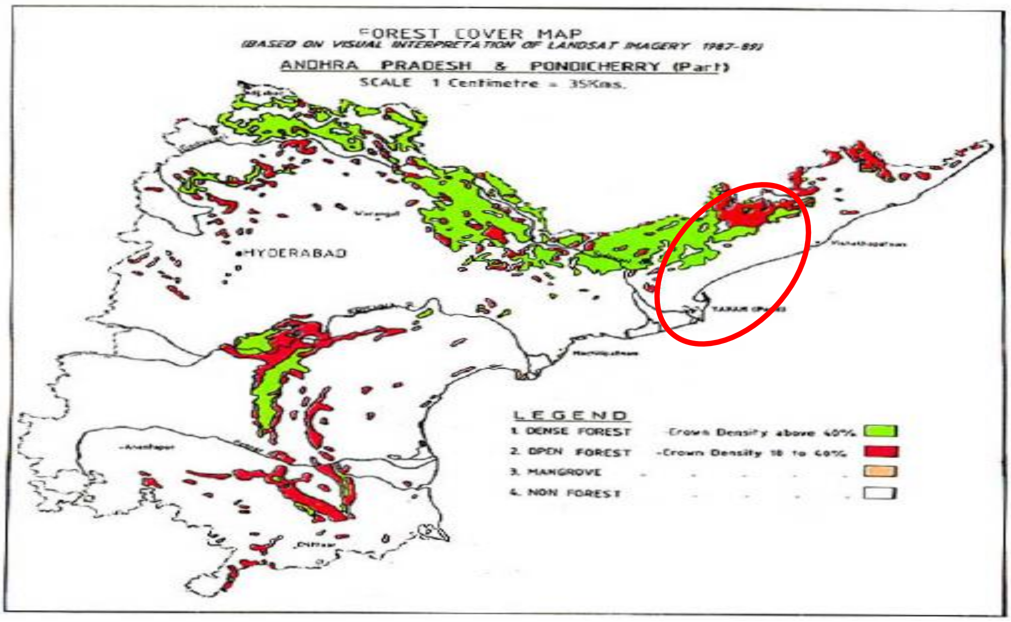

Figure 6: Forest Map of Andhra Pradesh for 1989 showing the project area.

Thus non-renewable biomass is being used since 1989.

As mandated in the methodology, two conditions; increase in time spent for gathering fuel wood by users and increasing trends in fuel wood price indicating scarcity clearly proves non-renewable woody biomass use in the project area.

The variables, parameters, data source to determine the baseline emission for the project activity is as follows:

Emission Reductions from Energy Efficiency measures in thermal applications of non-renewable biomass (II.G)		
Parameters	**Value**	**Source of data**
Quantity of woody biomass that is saved in tonnes ($B_{y,savings}$)	**1.19**	Calculated based on Field Studies
$f_{NRB,y}$	**0.95**	Fraction of biomass that is non-renewable, FSI 2011.
$NCV_{biomass}$ (TJ/tonne)	0.015	Net Calorific Value of wood (Methodology II G)
$EF_{projected\_fossilfuel}$ (tCO_2/TJ)	81.6	Emission factor for kerosene(Methodology II G)
ERy (tCO_2/yr/household)	**1.38**	**Emission Reduction/year**
ERs generated for 6000 Household	**8,280**	**tCO_2**

Bio-sand Filter: III.AV, Version 4 methodology

According to Para 10 and 11 of the methodology, for a simplified and standardized approach it is assumed that fossil fuel or non-renewable biomass (NRB) is used to boil water as means of water purification in the absence of the project activity. The emissions are calculated based on the energy demand for boiling water, and in case of displacement of NRB the baseline emissions are corrected for the fraction of the biomass that can be demonstrated to be non-renewable. Only purified water consumed for drinking purposes can be used in the baseline calculation.

The baseline emissions are calculated as follows:

$$BE_y = QPW_y \times SEC \times f_{NRB,y} \times EF_{projected\_fossilfuel} \times 10^{-9}$$

Where:

BE_y	=	Baseline emissions during the year *y* in (t CO_2e)
QPW_y	=	Quantity of purified water in year *y* (litres)
SEC	=	Specific energy consumption required to boil one litre of water (kJ/L)
$f_{NRB,y}$	=	Fraction of non-renewable biomass
$EF_{projected\_fossilfuel}$	=	Emission factor as per AMS-I.E procedures when NRB is displaced or the emission factor of the fossil fuel substituted (t CO_2/TJ)

Specific energy consumption required to boil one litre of water is to be calculated as follows:

$$SEC = \left[WH \times (T_f - T_i) + 0.01 \times WHE\right] / n_{wb}$$

Where:

WH	=	Specific heat of water (kJ/L ^oC). Use a default value of 4.186 kJ/L ^oC
T_f	=	Final temperature (^oC). Use a default value of 100 °C[25]
T_i	=	Initial temperature of water (°C). Use annual average ambient temperature;[26] or use a default value of 20 °C
WHE	=	Latent heat of water evaporation (kJ/L). Use a default value of 2260 kJ/L.
n_{wb}	=	Efficiency of the water boiling systems being replaced.

Determine (QPW_y).

QPW_y is the quantity of purified water in year *y* (litres). The quantity of purified water is the total amount of water treated by the project activity in year *y*. According to the methodology, it should be directly monitored; alternatively, it should be based on: (a) the population serviced by the project equipment, estimated using surveys; and (b) an average volume of drinking water per person per day estimated using surveys or official data or peer reviewed literature or local expert opinion (a value of 5.5 litres per person per day[27] shall not be exceeded). For Case 2, total project population needs to be adjusted for the fraction of the population serviced by the project equipment at households/buildings for which it can be demonstrated through documentation or survey that the practice of water purification would have been water boiling.

[25] Boiling point of water at standard conditions.

[26] Ambient temperature data must be from globally accepted data sources, for example data published by the National Aeronautics and Space Administration (NASA) or the National Renewable Energy Laboratory (NREL). Data can be used only if they are for a location that can be demonstrated to be representative of the project location.

[27] Based on WHO recommendations (Domestic Water Quantity, Service Level and Health, Table 2: Volumes of water required for hydration, WHO 2003).

The average volume of drinking water per person per day is based on official data. The Union Ministry of Works and Housing, has fixed minimum norms for various basic human needs. For drinking water, the minimum quantity is fixed at 5 litres/person/day[28]. The drinking water requirements per family/year is as follows, which is derived from the average family size from sample survey of the project area.

Drinking water required/person/day (Litres)	5	Official data
Average family size (numbers)	4.56	Based on sample survey
Quantity of purified water in year QPWy (litres/HH/yr)	**8315.65**	**5 x 4.56 x 365 Total drinking water/HH/yr**

Calculation of Specific Energy Consumption required boiled per liter of water SEC (kJ/L)		
Parameters	**Value**	**Source of Data**
Specific heat of water (kJ/L C) - WH	4.186	Methodology III.AV
Final Temperature (C) - T_f	100	Methodology III.AV
Initial Temperature of water (C) - T_i	20	Methodology III.AV
Latent heat of water evaporation (kJ/L)WHE	2260	Methodology III.AV
Efficiency of the water boiling systems being replaced n_{wb}	0.1	Methodology III.AV
Specific Energy Consumption required boiled water SEC (kJ/L)	**3574.8**	$SEC = [WH \times (T_f - T_i) + 0.01 \times WHE] / n_{wb}$ **Calculated**

Parameters	Value	Source of Data
Quantity of purified water in year QPW_y (litres/yr/HH)	**8315.65**	Calculated from Official Data
Specific Energy Consumption required boiled per liter of water SEC (kJ/L)	3574.8	Calculated
$f_{NRB,y}$	0.95	Calculated
$EF_{projected\_fossilfuel}$ (tCO_2/TJ)	81.6	Methodology

B.5. Demonstration of additionality

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The project activity by LAYA is implementation of SARALA stoves and Bio-sand water filters, with the primary aim of achieving energy savings, thus reducing carbon dioxide emissions. The energy efficiency project activities aim to achieve thermal energy savings at a scale of no more than 180 gigawatt $hours_{th}$ per year (see section B.2) for cook stoves and not more than 60,000 tCO_2 for Bio-sand water filters. The additionality is demonstrated based on Guidelines on the demonstration of additionality of Small-scale Project Activities, Version 09.0, Annex 27, EB 68.

According to Para 2 of the guidelines, documentation of barriers, as per paragraph 1 of the guidelines, is not required for the positive list of technologies and project activity types that are defined as automatically additional for project sizes up to and including the small-scale CDM thresholds (e.g. installed capacity up to 15 MW).

[28] http://www.nih.ernet.in/rbis/india_information/drinking.htm

Further, according to Para 2c of the guidelines, the positive list comprises of Project activities solely composed of isolated units where the users of the technology/measure are households or communities or Small and Medium Enterprises (SMEs) and where the size[29] of each unit is no larger than 5% of the small-scale CDM thresholds.

SARALA Stove: II.G, Version 6 methodology

The implementation of SARALA stoves project activity falls under the category– Type II, Energy Efficiency Project Activity wherein the threshold is 180 GWh_{th}.

The project activity is implementation of isolated units SARALA improved cook stoves in 6,000 households. The project activity falls under Type II project activity, methodology II.G, which is an energy efficiency improvement activity that reduces energy consumption on the supply side. The project activity will achieve energy savings of 30 GWh_{th} (0.005 GWh/household x 6,000 households) which is less than 180 GWh thermal (60 GWh_e x 3 = 180 GWh_{th}).

The project activity fulfils the condition (c) of Para 2 for inclusion under positive list as follows:

- The project activity involves implementation of SARALA improved cook stoves, which are isolated units in 6,000 households.
- The users of each of the SARALA stoves are tribal households.
- The independent SARALA unit per family in the project activity has an annual thermal energy savings of 0.005 GWh_{th} or 5 MWh_{th} (kindly see section B.2. for rating each of the unit) and thus smaller than 9,000 MWh_{th} (3,000 MWh_e x 3 = 9,000 MW_{th}). Thus it is no larger than 5% of the small-scale CDM thresholds.

Bio-sand Filter: III.AV, Version 4 methodology

The implementation of Bio-sand water filters falls under the category– Type III, Emission Reduction Activity wherein the threshold is 60,000 tCO_2.

The project activity is implementation of isolated units of Bio-sand water filters in 12,000 households. The project activity falls under Type III: other project activity not included in Type I or Type II, methodology III.AV, that result in GHG emission reductions not exceeding 60 kt CO_2e per year in any year of the crediting period.

The project activity fulfils the condition (c) of Para 2 for inclusion under positive list as follows:

- The project activity involves implementation of Bio-sand water filters, which are isolated units in 12,000 households.
- The users of each of the bio-sand filters are Adivasi or tribal households.
- The independent Bio-sand filter unit per family in the project activity has an annual emission reduction of 2.30 tCO_2/HH/yr. (kindly see section B.2. for calculations) and thus smaller than 3,000 tCO_2. Thus it is no larger than 5% of the small-scale CDM thresholds.

Thus Para 2, condition (c) of the “Guidelines on the demonstration of additionality of Small-scale Project Activities, Version 09.0, Annex 27, EB 68” is satisfied by the project activity for both SARALA improved cook stoves and Bio-sand water filters.

[29] That is the size of each unit under 750 kW installed capacity or under 3000 MWh of energy savings per year or 3000 tonnes of emission reductions per year.

Thus, based on Guidelines on the demonstration of additionality of Small-scale Project Activities, Version 09.0, Annex 27, EB 68 the project activity proves to be additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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SARALA Improved Cook stoves, Methodology II.G., Version 06.

The methodology does not provide for estimation of baseline and project emissions separately. The methodology involves calculations of emission reductions directly as follows:

$$ER_y = \sum_i ER_{y,i}$$

Where:

i	=	Indices for the situation where more than one type of project device is introduced to replace the pre-project devices[30]
ER_y	=	Emission reductions during year *y* in t CO_2e
$ER_{y,i}$	=	Emission reductions by project device of type *i* during year *y* in t CO_2e

Since the project is for household cook stoves, the emission reduction would be calculated using the formula

$$ER_{y,i} = \sum_{a=1}^{a=y} B_{y,savings,i,a} \times N_{y,i,a} \times \frac{\mu_{y,i}}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel} - LE_y$$

Where:

a	=	'*a*' is the indices for the age (in years) of the cook stoves that are operating in the year '*y*' of the crediting period. At any year *y* of the crediting period (e.g. *y* = 1, 2, 3…7 or 10) there will be a population of $N_{y,i,a}$ operational devices of the type *i* with age varying from a=1 (the cook stoves installed during the current year *y*) up to the age a=y (the cook stoves installed during the first year of the crediting period). Since the lifetime of cook stoves is often shorter than the length of the crediting period and cook stoves are likely to show significant efficiency losses over time, this aspect needs to be captured through the monitoring plan
$B_{y,savings,i,a}$	=	Quantity of woody biomass that is saved in tonnes per cook stove device of type *i* and age *a* in year *y*
$B_{y,savings,i}$	=	Quantity of woody biomass that is saved in tonnes per oven or drier of type *i* in year *y*
$f_{NRB,y}$	=	Fraction of woody biomass saved by the project activity in year *y* that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM

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

website.[31] The parameter value may be fixed ex ante at the beginning of each crediting period.

$NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, based on the gross weight of the wood that is 'air-dried')

$EF_{projected\_fossilfuel}$ = Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO_2/TJ[32]

$N_{y,i,a}$ = Number of project devices of type *i* and age *a* operating in year *y*, determined as per paragraph 33

$\mu_{y,i}$ = Number of days of utilization of the project device during the year '*y*'. Its value may be considered as 365 where it can be demonstrated that the pre-project device has been decommissioned and is no longer used, otherwise it shall be determined as per paragraphs 22−24

LE_y = Leakage emissions in the year *y*, please refer to the section 4.3 below

$B_{y,savings,i,a}$ for cook stoves will be estimated using option 3 of the methodology, controlled cooking test (CCT), which is as follows:

$$B_{y,savings,i,a} = B_{old,i} \times (1 - \frac{SC_{new,i,a=1} \times \Delta SC_{y,i,a}}{SC_{old}})$$

Where:

SC_{old} = Specific fuel consumption or fuel consumption rate of the pre-project devices, that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour, respectively. Specific fuel consumption or fuel consumption rate are to be determined using the CCT protocol carried out in accordance with national standards (if available) or international standards or guidelines (e.g. the CCT procedures specified by the partnership for clean indoor air (PCIA): <http://www.pciaonline.org/node/1050>). Use weighted average values if more than one type of device is being replaced (taking the amount of woody biomass consumed by each device as the weighting factor)

$SC_{new,i,a=1}$ = Specific fuel consumption or the fuel consumption rate of the devices of type *i* deployed as part of the project, that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour respectively, for the initial efficiency determined in the year of its installation (a=1). Specific fuel consumption or fuel consumption rate shall be determined using the same CCT protocol used to test the pre-project devices. If more than one project devices are necessary to replace the pre-project device, woody biomass consumption should be calculated per device (taking the amount of woody biomass consumed by each device

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

[32] This value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. It is assumed that the mix of present and future fuels used would consist of a solid fossil fuel (lowest in the ladder of fuel choices), 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). Thus a 50 per cent weight is assigned to coal as the alternative solid fossil fuel (96 t CO_2/TJ) and a 25 per cent weight is assigned to both liquid and gaseous fuels (71.5 t CO_2/TJ for kerosene and 63.0 t CO_2/TJ for liquefied petroleum gas (LPG).

as the weighting factor)

$\Delta SC_{y,i,a}$ = Factor to consider the efficiency loss of the project device type *i* due to its aging at the year *y*, as expressed as follows:

$$\Delta SC_{y,i,a} = \frac{SC_{new,i,a=1}}{SC_{new,i,a}}$$

where $SC_{new,i,a}$ is the specific fuel consumption of the device '*i*' with age '*a*' determined using the CCT and $SC_{new,i,a=1}$ is the specific fuel consumption of the device at its first year of operation. $\Delta SC_{y,i,a}$ may be determined through sample surveys of project device type *i* for batches of stoves with the same age at each year of the crediting period. Alternatively, the monitoring may determine annually the specific fuel consumption of the devices installed at the first year of the crediting period, and the efficiency loss of this population may be used to correct the initial efficiency of the population of devises installed later on. As an example, the loss rate of year 2016 for the project device of type *i* installed in 2015 can be considered the same as that of year 2014 for the project device of the same type installed in 2013. In this way, the monitoring at any year y during the crediting period will consist of the determination of the specific fuel consumption for the devices installed during the current year (the initial value $SC_{new,i,a=1}$ for the population commissioned during this year), and the values of $SC_{new,i,a}$ and of $\Delta SC_{y,i,a}$ for oldest population (i.e. the devices from the first year that have now reached the age a=y)

$B_{old,i}$ has been estimated as the average annual consumption of woody biomass per device (tonnes/year) derived from a sample survey of local usage, which is explained in section B.4.

Leakage

The potential source of leakage for the project activity is due to the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources. $B_{y,savings,i,a}$ will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

<u>Bio-sand Water Filter; Methodology III.AV, Version 04</u>

The baseline emissions will be calculated as follows:

$$BE_y = QPW_y \times SEC \times f_{NRB,y} \times EF_{projected\_fossilfuel} \times 10^{-9}$$

Where:

BE_y = Baseline emissions during the year *y* in (t CO_2e)

QPW_y = Quantity of purified water in year *y* (litres). The quantity of purified water is the total amount of water treated by the project activity in year *y*. It is based on: (a) the population serviced by the project equipment, estimated using surveys; and (b) an average volume of drinking water per person per day estimated using official data.

SEC = Specific energy consumption required to boil one litre of water (kJ/L)

$f_{NRB,y}$	=	Fraction of woody biomass used in the absence of the project activity in year *y* that can be established as non-renewable as per the relevant provisions of “AMS-I.E: Switch from Non-Renewable Biomass for Thermal Applications by the User”.
$EF_{projected\_fossilfuel}$	=	Emission factor as per AMS-I.E procedures when NRB is displaced or the emission factor of the fossil fuel substituted (t CO_2/TJ)

Specific energy consumption required to boil one litre of water is to be calculated as follows:

$$SEC = \left[WH \times \left(T_f - T_i\right) + 0.01 \times WHE\right] / n_{wb}$$

Where:

WH	=	Specific heat of water (kJ/L ^oC). Use a default value of 4.186 kJ/L ^oC
T_f	=	Final temperature (^oC). Use a default value of 100 °C[33]
T_i	=	Initial temperature of water (°C). Use annual average ambient temperature;[34] or use a default value of 20 °C
WHE	=	Latent heat of water evaporation (kJ/L). Use a default value of 2260 kJ/L. The latent heat required to boil one litre of water for five minutes is assumed to be equivalent to latent heat for the evaporation of 1% of the water volume (WHO recommends a minimum duration of five minutes of water boiling)[35]
n_{wb}	=	Efficiency of the water boiling systems being replaced. Use one of the options below: 0.10 default value is used as the replaced system or the system that would have been used is a three stone fire or a conventional system for woody biomass lacking improved combustion air supply mechanism and flue gas ventilation system that is without a grate as well as a chimney.

Leakage

According to the methodology, where relevant leakage relating to the non-renewable woody biomass shall be assessed as per the relevant procedures of AMS-I.E.

According to I.E. Version 5 (latest version) 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:

- 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_y is adjusted to account for the quantified leakage. Alternatively, B_y is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

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33 Boiling point of water at standard conditions.

34 Ambient temperature data must be from globally accepted data sources, for example data published by the National Aeronautics and Space Administration (NASA) or the National Renewable Energy Laboratory (NREL). Data can be used only if they are for a location that can be demonstrated to be representative of the project location.

35 WHO guidelines for emergency treatment of drinking water at point of the use <http://www.searo.who.int/LinkFiles/List_of_Guidelines_for_Health_Emergency_Emergency_treatment_of_drinking_water.pdf>.

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

There are no equipment currently being utilized that is transferred from outside the boundary to the project boundary for leakage to be considered. The bio-sand filters will be constructed in-situ at the household level.

B_y will be adjusted to account for leakage. B_y will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required and will not be done.

Project activity emissions

If the operation of the project water purification system involves consumption of fossil fuels and/or electricity, project emissions[36] include:

- CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";
- CO_2 emissions from electricity consumption by the project activity using the latest version of the tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

The project activity does not involve consumption of fossil fuels and/or electricity. Hence project emissions are not applicable.

B.6.2. Data and parameters fixed ex ante

<u>For II.G. Version 06 methodology</u>

Data / Parameter	$B_{old,i}$
Unit	tonnes per year per device - t/yr/device or t/hh/yr (as one SARALA stove will be implemented in one household)
Description	Annual quantity of woody biomass that would be used in the absence of the project activity to generate thermal energy equivalent to that provided by the project device type
Source of data	Based on sample survey of local usage
Value(s) applied	3.23
Choice of data or Measurement methods and procedures	The value is based on sample survey conducted in the project area for fuel wood use on traditional cook stoves.
Purpose of data	To estimate Emission Reductions
Additional comment	This parameter is fixed for the entire crediting period

36 Calculations of the project emissions may also be limited to the quantity of purified water used for the baseline calculations as per paragraph 11.

Data / Parameter	$f_{NRB,y}$
Unit	-
Description	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass
Source of data	Assessment of Non Renewable Biomass based on data provided by Forest Survey of India, 2011, Ministry of Environment and Forests, Govt of India.
Value(s) applied	0.95
Choice of data or Measurement methods and procedures	Based on data from State of Forest Report, 2011. Forest Survey of India, Ministry of Environment and Forests, Government of India. The data gives the consumption of fuel wood and production of fuel wood from forests and from trees outside forests. This data is assessed at the state level. Thus the f_{NRB} for Andhra Pradesh is applied for the project activity.
Purpose of data	To estimate Emission Reductions
Additional comment	This parameter is fixed for the entire crediting period

Data / Parameter	$NCV_{biomass}$
Unit	TJ/tonne
Description	Net Calorific Value of Biomass
Source of data	AMS-II.G., Version 6 methodology
Value(s) applied	0.015
Choice of data or Measurement methods and procedures	-
Purpose of data	To estimate Emission Reductions
Additional comment	This parameter is fixed for the entire crediting period

Data / Parameter	$EF_{projected\_fossilfuel}$
Unit	tCO_2/TJ
Description	Emission Factor for fossil fuel. Emission factor for substitution of non-renewable woody biomass by similar consumers.
Source of data	AMS-II.G., Version 6 methodology
Value(s) applied	81.6
Choice of data or Measurement methods and procedures	Based on the methodology, this value represents the emission factor of the substitution fuels likely to be used by similar users on a weighted average basis. It is assumed that the mix of present and future fuels would consist of a solid, liquid and gaseous fossil fuel.
Purpose of data	To estimate Emission Reductions
Additional 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**
Unit	tonnes / year
Description	Diversion of non-renewable biomass saved under the project activity by non-project households
Source of data	Based on the methodology B_y will be multiplied by a net to gross adjustment factor of 0.95 to account for leakages.
Value(s) applied	Biomass (t) - 3.23 x 0.95 = 3.07 t/yr. The biomass diversion is 3.23 – 3.07 = 0.16 t/device /yr Leakage for 6,000 units (tCO_2) 8,280 – 7,860 = 420 tCO_2/yr
Choice of data or Measurement methods and procedures	According to II.G, Version 6, B_y can be multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required. 3.23 x 0.95 = 3.07 t/yr. Thus the diversion is 3.23 – 3.07 = 0.16 t/device /yr or per family In terms of leakage of emissions, 8,280 – 7,860 = 420 tCO_2/yr for 6,000 units.
Purpose of data	This parameter is fixed for the entire crediting period. Surveys will not be conducted to determine leakage
Additional comment	

<u>For II.AV, Version 04 methodology</u>

Data / Parameter	SEC
Unit	kJ/L
Description	Specific energy consumption required to boil one litre of water
Source of data	Calculated
Value(s) applied	**3574.8**
Choice of data or Measurement methods and procedures	As specified in III.AV, Ver 04, specific energy consumption required to boil one litre of water was calculated as follows: $SEC = [WH \times (T_f - T_i) + 0.01 \times WHE] / n_{wb}$ Where: WH = Specific heat of water (kJ/L °C). Default value of 4.186 kJ/L °C T_f = Final temperature (°C). Default value of 100 °C[37] T_i = Initial temperature of water (°C). Default value of 20 °C WHE = Latent heat of water evaporation (kJ/L). Default value of 2260 kJ/L. n_{wb} = Efficiency of the water boiling systems being replaced. (0.1)
Purpose of data	To calculate baseline emissions
Additional comment	When the water filters are being implemented in houses will existing SARALA stoves (under GS997: Laya Paderu Energy Efficient Woodstoves Project) n_{wb} will be considered as 0.2 and accordingly SEC will be calculated.

Data / Parameter	$f_{NRB,y}$
Unit	-
Description	Fraction of woody biomass used in the absence of the project activity in year y that can be established as non-renewable biomass.
Source of data	Assessment of Non Renewable Biomass based on data provided by Forest Survey of India, 2011, Ministry of Environment and Forests, Govt of India.
Value(s) applied	0.95
Choice of data or Measurement methods and procedures	Based on data from State of Forest Report, 2011. Forest Survey of India, Ministry of Environment and Forests, Government of India. The data gives the consumption of fuel wood and production of fuel wood from forests and from trees outside forests. This data is assessed at the state level. Thus the f_{NRB} for Andhra Pradesh is applied for the project activity.
Purpose of data	To estimate Emission Reductions
Additional comment	This parameter is fixed for the entire crediting period

[37] Boiling point of water at standard conditions.

Data / Parameter	$EF_{projected\_fossilfuel}$
Unit	tCO_2/TJ
Description	Emission Factor for fossil fuel. Emission factor for substitution of non-renewable woody biomass by similar consumers.
Source of data	As mentioned in AMS-III.AV., Version 4 methodology, based on AMS I.E methodology, Version 5.
Value(s) applied	81.6
Choice of data or Measurement methods and procedures	Based on the methodology, this value represents the emission factor of the substitution fuels likely to be used by similar users on a weighted average basis. It is assumed that the mix of present and future fuels would consist of a solid, liquid and gaseous fossil fuel.
Purpose of data	To estimate Emission Reductions
Additional comment	This parameter is fixed for the entire crediting period

B.6.3. Ex ante calculation of emission reductions

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SARALA Stoves; AMS II.G., Version 06 methodology

$$ER_{y,i} = \sum_{a=1}^{a=y} B_{y,savings,i,a} \times N_{y,i,a} \times \frac{\mu_{y,i}}{365} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected\_fossilfuel} - LE_y$$

$$ER = 1.19 \times 6000 \times \frac{365}{365} \times 0.95 \times 0.015 \times 81.6 - LE_y$$

LE here is calculated by multiplying $B_{y,old}$ by 0.95. The $B_{y,savings}$ after consideration leakage is 0.13 t/hh/yr. Hence the Emission reduction after consideration of leakage is as follows.

$$ER_{afterconsideringleakage} = 1.13 \times 6000 \times \frac{365}{365} \times 0.95 \times 0.015 \times 81.6 = 7860$$

$LE_y = ER_y - ER_{afterconsideringleakage}$

LE = 8,280 – 7,860 = 420 tCO_2

$$ER = 1.19 \times 6000 \times \frac{365}{365} \times 0.95 \times 0.015 \times 81.6 - 420 = 7,860$$

ER_y after considering leakage = 8,280 – 420 = 7,860 tCO_2.

Emission Reductions from Energy Efficiency measures in thermal applications of non-renewable biomass (II.G)		
Biomass Savings ($B_{y, savings}$)		
Parameters	**Value**	**Source of data**
B_y	3.23	Field Studies
SC_{old}	363	CCT
SC_{new}	229	CCT

$B_{y,savings}$	**1.19**	**Calculated**

Parameters	Value	Source of data
Quantity of woody biomass that is saved in tonnes (By,savings)	1.19	Based on field studies
Total Number of appliances(N_y)	6,000	
μ_y	365	Methodology II G
$f_{NRB,y}$	0.950	Fraction of biomass that is non-renewable
$NCV_{biomass}$ (TJ/tonne)	0.015	Net Calorific Value of wood
$EF_{projected\_fossilfuel}$ (tCO2/TJ)	81.6	Emission factor for kerosene
ER_y (tCO_2/yr/household)	1.38	Emission Reduction/year
ERs generated for 6,000 Household	**8,280**	tCO_2

AFTER CONSIDERING LEAKAGE		
Biomass Savings ($B_{y, savings}$)		
Parameters	**Value**	**Source of data**
By	3.23	Field Studies
By after considering leakage	3.07	
SC_{old}	363	CCT
SC_{new}	229	CCT
$B_{y,savings}$	**1.13**	**Calculated**

Parameters	Value	Source of data
Quantity of woody biomass that is saved in tonnes ($B_{y,savings}$)	**1.13**	
Total Number of applicances (N_y)	**6,000**	
μ_y	365	
f_{NRBy}	**0.950**	Fraction of biomass that is non-renewable
NCVbiomass (TJ/tonne)	0.015	Net Calorific Value of wood
EFprojected_fossilfuel (tCO2/TJ for kerosene)	81.6	Emission factor for kerosene
ER_y (tCO_2/yr/household)	**1.31**	**Emission Reduction/year**
VERs generated/Household	**7,860**	**tCO_2**

<u>Bio-sand Filter; AMS III.V., Version 04 methodology</u>

The Baseline emissions are calculated as follows:

$$BE_y = QPW_y \times SEC \times f_{NRB,y} \times EF_{projected\_fossilfuel} \times 10^{-9}$$

Estimation of QPW_y

Quantity of purified water in year QPW_y (litres/yr)	**8315.65**	5 x 4.56 x 365 days
Drinking water required/person/day (Litres)	5	Official Data
Average family size (numbers)	4.56	From sample survey

Estimation of SEC

Parameters	Value	Source of Data
Specific Energy Consumption required boiled water SEC (kJ/L)	**3574.8**	Calculated
Specific heat of water (kJ/L C) – WH	4.186	Methodology III.AV
Final Temperature (C) - T_f	100	Methodology III.AV
Initial Temperature of water (C) - T_i	20	Methodology III.AV
Latent heat of water evaporation (kJ/L)WHE	2260	Methodology III.AV
Efficiency of the water boiling systems being replaced[38] (n_{wb})	0.1	Methodology III.AV

Calculation of Baseline Emissions

Emission Reductions from safe drinking water production systems (Methodology AMS III.AV)		
Parameters	**Value**	**Source of Data**
Quantity of purified water in year QPW_y (litres/yr)	**8315.65**	Calculated from Official Data
Specific Energy Consumption required boiled per liter of water SEC (kJ/L)	3574.8	Calculated
$f_{NRB,y}$	0.95	Calculated
$EF_{projected\_fossilfuel}$ (tCO_2/TJ)	81.6	Methodology
Baseline Emissions BE_y (tCO_2)/HH/yr	**2.30**	Calculated
Number of water filters	**12,000**	
Baseline Emissions BEy (tCO_2) for 12,000 units	**27,600**	

BE_y /HH = 8315.65 x 3574.8 x 0.95 x 81.6 x 10^{-9} = 2.30 tCO_2

BE_y for 12,000 HH = 12,000 x 2.30 = 27,600 tCO_2

[38] When the water filters are being implemented in houses with existing SARALA stoves (under GS997: Laya Paderu Energy Efficient Woodstoves Project) n_{wb} will be considered as 0.2 and accordingly SEC will be calculated.

B.6.4. Summary of ex ante estimates of emission reductions

For SARALA stoves; AMS II.G. Version 06

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2015	2,251	0	114	2,137
2016	6,391	0	324	6,067
2017	8,280	0	420	7,860
2018	8,280	0	420	7,860
2019	8,280	0	420	7,860
2020	8,280	0	420	7,860
2021	8,280	0	420	7,860
Total	**50,042**	**0**	**2,538**	**47,504**
Total number of crediting years				**7**
Annual average over the crediting period	**7,149**	**0**	**363**	**6,786**

Implementation of SARALA Stoves will be over 2 years period wherein every month 250 stoves will be constructed totalling 6,000 units, starting from January 2015.

For Bio-sand Filter; AMS III.AV, Version 04

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2015	3,752	0	0	3,752
2016	10,652	0	0	10,652
2017	17,552	0	0	17,552
2018	24,452	0	0	24,452
2019	27,600	0	0	27,600
2020	27,600	0	0	27,600
2021	27,600	0	0	27,600
Total	**1,39,210**	**0**	**0**	**1,39,210**
Total number of crediting years				**7**
Annual average over the crediting period	**19,887**	**-**	**-**	**19,887**

About 250 bio-sand filters will be constructed monthly for 4 years totalling 12,000 units in 4 years starting from January 2015.

Total Estimation of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2015	6,003	-	114	5,889
2016	17,043	-	324	16,719
2017	25,832	-	420	25,412
2018	32,732	-	420	32,312
2019	35,880	-	420	35,460
2020	35,880	-	420	35,460
2021	35,880	-	420	35,460
Total	**1,89,250**	**-**	**2,538**	**1,86,712**
Total number of crediting years	**7**			
Annual average over the crediting period	**27,036**	**-**	**363**	**26,673**

Credits for improved cook stoves will be claimed for 7 years only and for 21 years for the improved water filters.

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$N_{y,i,a}$
Unit	-
Description	Number of project devices of type *i* and age *a* that are operating in year *y*
Source of data	Based on monitoring database maintained by LAYA
Value(s) applied	Year 1 – 3,000 stoves; Year 2 – 6,000 stoves
Measurement methods and procedures	As per Para 33 of the methodology, the installation date and recipient/location of each device will be tracked individually on the monitoring database maintained by LAYA for the project activity. Each unit will have a unique identification number which will be maintained in the database.
Monitoring frequency	At least once every two years (biennial)
QA/QC procedures	This can be triangulated with the end user agreement signed between LAYA and the end user.
Purpose of data	To estimate emission reduction from the date of commissioning of each device.
Additional comment	

Data / Parameter	$SC_{new,i,a}$
Unit	t fuel/unit output
Description	Specific fuel consumption or fuel consumption rate in year *y* of the device(s) of type *i* deployed as part of the project that is fuel consumption per quantity of item/s processed (e.g. food cooked) or fuel consumption per hour respectively with the age *a*
Source of data	Based on field studies conducted annually
Value(s) applied	
Measurement methods and procedures	As per paragraphs 18 and 34(c) of the methodology, CCT protocol of PCIA will be followed to determine the specific fuel consumption of 3 stoves.
Monitoring frequency	Annually
QA/QC procedures	The sample survey will be conducted on three cook stoves with three tests conducted for each stove. If the standard deviation of the nine test results is very small and 90/10 precision requirement is met (in this case, the value of the t-distribution for 90 per cent confidence shall be used instead of Z value), the efficiency determined is acceptable, otherwise more sample tests would be done until 90/10 precision is met.
Purpose of data	To estimate emission reductions for the project activity
Additional comment	

Data / Parameter	$\Delta SC_{y,i,a}$
Unit	-
Description	Factor to consider the efficiency loss of the project device type *i* due to its aging at the year *y*
Source of data	
Value(s) applied	The factor to consider the efficiency loss of the project device type *i* due to its aging at the year *y*, as expressed as follows will be done: $\Delta SC_{y,i,a} = \frac{SC_{new,i,a=1}}{SC_{new,i,a}}$ where $SC_{new,i,a}$ is the specific fuel consumption of the device '*i*' with age '*a*' determined using the CCT and $SC_{new,i,a=1}$ is the specific fuel consumption of the device at its first year of operation.
Measurement methods and procedures	$\Delta SC_{y,i,a}$ will be determined through sample surveys of project device type *i* for batches of stoves with the same age at each year of the crediting period. The monitoring will determine annually the specific fuel consumption of the devices installed at the first year of the crediting period, and the efficiency loss of this population will be used to correct the initial efficiency of the population of devises installed later on. In this way, the monitoring at any year y during the crediting period will consist of the determination of the specific fuel consumption for the devices installed during the current year (the initial value $SC_{new,i,a=1}$ for the population commissioned during this year), and the values of $SC_{new,i,a}$ and of $\Delta SC_{y,i,a}$ for oldest population (i.e. the devices from the first year that have now reached the age a=y)
Monitoring frequency	Annually
QA/QC procedures	The sample survey will be conducted on three cook stoves with three tests conducted for each stove. If the standard deviation of the nine test results is very small and 90/10 precision requirement is met (in this case, the value of the t-distribution for 90 per cent confidence shall be used instead of Z value), the efficiency determined is acceptable, otherwise more sample tests would be done until 90/10 precision is met.
Purpose of data	To estimate emission reductions for the project activity
Additional comment	

Data / Parameter	$U_{y,i}$
Unit	Days
Description	Number of days of utilization of the project device during the year y.
Source of data	Monitoring Database of LAYA
Value(s) applied	365
Measurement methods and procedures	The traditional cook stove will be demolished and the SARALA stove will be constructed in its place. As and when the stoves are decommissioned and no longer in use it will be reported and accounted for non-usage. If any repairs are done, the days not used will be deducted and ER will not be calculated for those days. If traditional stoves are also used along with the SARALA stoves, it will be recorded for its usage and biomass excluded from B_y for emission reduction calculations. Annual stratified sample surveys will be conducted through questionnaire surveys to determine the frequency of usage of both the project devices and baseline devices and to capture the cooking habits and stove usage of households in the region.
Monitoring frequency	Yearly once
QA/QC procedures	
Purpose of data	To estimate emission reductions
Additional comment	

III.AV

Data / Parameter	**Operational Bio-sand Filters**
Unit	Numbers
Description	The bio-sand filters are operational or are replaced by an equivalent in service appliance
Source of data	Biennially conducted stratified sample survey
Value(s) applied	12,000
Measurement methods and procedures	Physical check of appliances.
Monitoring frequency	Checking of all appliances or a representative sample thereof, at least once every two years (biennial) to ensure that they are still operating or are replaced by an equivalent in service appliance as per the relevant sampling requirements of AMS-I.E.
QA/QC procedures	
Purpose of data	To estimate baseline emissions
Additional comment	

Data / Parameter	**Quantity of purified water in year y**
Unit	Lts
Description	Quantity of water purified by the Bio-sand Filters during the crediting period
Source of data	Derived from the capacity of the equipment established by manufacturers' specifications and the number of functional project appliances, which would be determined by biennial sample survey.
Value(s) applied	5 litres/person/day and 8,315.65 litres/HH/yr @ 4.56 persons/family
Measurement methods and procedures	Derived from the capacity of the equipment established by manufacturers' specifications and the number of functional project appliances, which would be determined by biennial sample survey.
Monitoring frequency	NA
QA/QC procedures	
Purpose of data	To determine the baseline emission reductions
Additional comment	

Data / Parameter	**Annual check if a Safe Drinking Water public distribution network is installed**
Unit	-
Description	Annually a check of all the houses will be done to see if there has been safe drinking water supply to the house where the bio-sand filters have been installed.
Source of data	Annual survey of the households
Value(s) applied	12,000
Measurement methods and procedures	Annually a check of all the houses will be done to see if there has been safe drinking water supply to the house where the bio-sand filters have been installed.
Monitoring frequency	Annually
QA/QC procedures	In addition, even if the safe drinking water system has been connected to the household, a test will be done to see if it is supplying clean drinking water and if does not provide clean water, then it will be continued.
Purpose of data	To estimate the emission reduction for only those houses that is using the bio-sand filter.
Additional comment	

Data / Parameter	**Safe drinking water quality**
Unit	CFU/ml for total bacterial count; MPN/100 ml for total coliformis and absent for E.Coli Count
Description	The safe drinking water quality should be within the specifications given by the Indian National Standard Drinking Water specifications, which are given below.
Source of data	Laboratory Tests of water from the bio-sand filters
Value(s) applied	**Based on Indian National standard "Drinking Water – Specification IS 10500: 1991** Total Bacterial Count (CFU/ml): **<1000** Total Coliformis (MPN/100 ml): **<10** E.Coli Count: **Absent**
Measurement methods and procedures	Laboratory tests
Monitoring frequency	Annually
QA/QC procedures	
Purpose of data	To ensure that the purifiers are supplying good quality drinking water
Additional comment	

B.7.2. Sampling plan

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The sampling plan for the project activity contains information relating to: (A) sampling design; (B) data to be collected; and (C) implementation plan.

(A) Sampling design

Objectives and reliability requirements: The objective of the sampling effort, time frame and estimated parameter value is as follows:

Table 4: The objective, time frame and reliability requirements of parameters for sampling surveys

Objective	**Time Frame**	**Samples**	**Confidence/precision levels**
$SC_{new,i,a}$ Specific fuel consumption or fuel consumption rate in year *y* of the device(s) of type *i* deployed as part of the project that is fuel consumption per quantity of item/s processed	Survey Annually	Conduct a sample test on three cook stoves with three tests conducted for each stove; If the standard deviation of the nine test results indicated above is very small and 90/10 precision requirement is met (in this case, the value of the t-distribution for 90	90/10

		per cent confidence shall be used instead of Z value), the efficiency determined is acceptable, otherwise more sample tests would be required until 90/10 precision is met.	

Annual check if a Safe Drinking Water public distribution network is installed	Survey Annually	Village level and family level connections to SDW network	-

Safe drinking water quality	Survey Annually	One sample each from filtered drinking water for the 2 more contaminated sources – Bore-well and Stream.	Within the prescribed limits of the national standard or guidelines

Objective	**Time Frame**	**Estimated Parameter**	**Sample size to get Confidence/precision levels**
SARALA Stoves			
$N_{y,i,a}$ Number of project devices of type *i* and age *a* that are operating in year *y*	Sample biennially	Number of stove installed till date limited to 6,000	95/10
$U_{y,I}$ Number of days of utilization of the project device during the year y.	Survey Annually	365 Days	90/10
Bio-Sand Filters			
Operational Bio-sand Filters	Survey biennially	Number of bio-sand filter installed till date limited to 12,000	95/10

Target population: The target population are the tribal families of Paderu and Addatheegala Mandals in which the SARALA stoves and Bio-sand Filters will be implemented.

Sampling method: The sampling method would be stratified random sampling, where the first stratification will be based on the Mandals. Thus Addatheegala and Paderu Mandals will be the first strata. Further stratification will be considered based on occupancy and demographic differences if any. From each Mandal, villages will be selected randomly and families will be selected randomly from these villages for further sampling. A simple random sample is a subset of a population chosen randomly, such that each family of the population has the same probability of being selected. The sample-based estimate of mean is an unbiased estimate of the population parameter. It will also be easy to implement as the sampling frame (household details for which the project is being implemented) will be collected and stored in the monitoring database.

(iv) Sample Size: The sample size will be determined using the following equation

$$n \geq \frac{1.645^2 NV}{(N-1)\times 0.1^2 + 1.645^2 V} \quad \text{and} \quad V = \frac{SD^2}{\overline{p}^2} = \frac{overall.\text{var}iance}{\overline{p}^2} \quad \text{and } \overline{p} \text{ is the overall proportion}$$

n	Sample size
N	Total number of households
1.645	Represents the 90% confidence required
0.1	Represents the 10% relative precision

Assuming a response rate of only 80%, the number of households will be scaled up to n/0.8 households.

To then decide on the number of households in the sample that come from each Mandal the proportional allocation will be used, where the proportions of units from the different Mandals in the sample are the same as the proportions in the population.

During initial years after implementation, the number of households for sample survey will be calculated based on the number of bio-sand filter units that would be constructed. The value of N will be the number of bio-sand filter units or the number of households provided with bio-sand filter units for the monitoring period. If the sample size calculation returns a value of less than 30 samples, a minimum sample size of 30 will be chosen.

The sample villages 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.

Sampling frame: The sampling frame to be used is the complete listing of all the tribal households for which SARALA stoves and Bio-sand filters will be constructed under the project activity in Paderu and Addatheegala Mandals of Andhra Pradesh State. Each of the household will have a unique identify number with all the required details of the family. The details will be drawn from the monitoring solution for the project activity identifies or describes the sampling frame to be used.

Data to be collected

Field measurements: The variables that will be measured and the appropriate times and frequency of measurements are given in Table 4. None of the parameters are subjected to seasonal fluctuations. Thus the measurements will be conducted at the frequency mentioned and scaled up to the whole year.

Quality assurance/Quality control: The QA/QC procedure will be to achieve good quality data through field measurements. The household level questionnaire will be designed and field tested before administering the actual questionnaire survey. The questionnaire will be translated into local language for easy understanding of households and village level volunteers. The village level volunteers will be trained to administer the questionnaire at the household level. The households will be trained to collect and fill in the questionnaire. The village level volunteers will be trained to conduct and supervise data collection at the household level. This will reduce non-response from the households. Oversampling will be done to replace non-respondents, if any.

The data collected will be entered by the field staff, which will be checked and verified further for any typographic mistakes. A valuator will further cross-check each entry with the physical form for any typographic mistakes or to clarify any sort of confusion in the data. The field staff, the data entry staff and the valuators will be literate to collect good quality data. Outliers if any will be defined and excluded and/or replaced.

Analysis: The data entry will be done in Microsoft excel sheet. The data will be cross checked with the filled in questionnaire by Valuators as QA/QC procedure. The data will be analyzed for the mean annual value of the parameter.

Implementation

The implementation of sampling effort will be done by the NGO in consultation with CDM Team of Fair Climate Network (FCN). The FCN has the skill and resources to implement the sampling procedure. The team is experienced with rural energy CDM projects implemented for the rural poor for more than 5 years. The FCN team will train the village level volunteers to conduct the survey along with the randomly selected households. The village level volunteers will also be literate and would already be involved in monitoring of biogas units at the village level for their operation and maintenance. The collected data will be analysed by the FCN for inclusion in the monitoring report.

B.7.3. Other elements of monitoring plan

>>

The operational and Management Structure for the project activity to monitor emission reduction and any leakage generated by the project activity is as follows:

1. Maintenance of Records.

The Project Co-ordinator will be responsible to maintain and make available accurate records. The Project Coordinator will collate a composite record as follows:

All records will comprise the following data:

- Date of Construction of SARALA Stoves and Bio-sand Filters
- Start date of use
- Location of stove and filter Construction
- Unique Identification Number of the beneficiary
- Name and telephone number:
    - Unique Identification Number: Ration Card/ID Card
    - Details of the domestic end users
- Address of the beneficiary

The project co-ordinator will maintain database of the constructed units at an online monitoring database http://ver.laya.org.in/.

2. Strategy for Monitoring

1. A team of stove builders and bio-sand filter builders from the community will be identified. They will be trained by group of master trainers from the community. Women will be trained to SARALA stoves, while youth will be trained to construct bio-sand filters.

2. The team will be assigned the task of building the stoves and the filters. The material cost and cost of construction will be through VER forward funding. They will claim a small fee from the community as incentive. This will ensure ownership of the new energy efficient implements.
3. The team of stove and filter builders will be under the direct supervision of a field coordinators based at LAYA, Paderu and Addatheegala who will report to the Project Coordinator based at LAYA Resource Centre. Visakhapatnam. The Project Coordinator will essentially supervise the implementation, monitoring and documentation of the stoves and filters being built. They will also be in-charge of sampling surveys for monitoring parameters required to estimate emission reductions. They will co-ordinate with the FCN Technical team to conduct surveys and field studies.
4. The building of stoves and filters is expected to be completed in 2 year. An end user agreement will be signed with the beneficiary family after satisfactory use of the stove and filter for a period of 7 days.
5. After the stoves and filters are built, a team will be selected from the trained builders to form the maintenance team. They will be required to collect data as to the functioning of the built stoves and filters. They will be responsible for the maintenance of the stoves and filters. Strategically the selection of this team will also be based in various regions so that they may be accessible to the community easily.
6. The project coordinator and field coordinator will together be responsible for collection of data and processing of data every year to determine the status of the stoves, filters and its operation.

Quality Assurance and Quality Control

The FCN Technical Team will be appointed to accomplish or reinforce some or all of the monitoring tasks. This will be done in relation to specific cross-checks, for example between material purchase, financial accounts, and also through End User agreements signed with the beneficiaries. Identification of stoves will be facilitated to prevent double counting.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

01/01/2015

C.1.2. Expected operational lifetime of project activity

>>

10 years – SARALA stoves

25 years – Bio-sand Filters

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>

Renewable Crediting Period

C.2.2. Start date of crediting period

>>

01/01/2015

C.2.3. Length of crediting period

>>

7 years, 0 months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

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. Hence, it is not required by the host party[39] documentation on the analysis of the environmental impacts of the project activity.

D.2. Environmental impact assessment

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Not Applicable as is not mandated by the Government of India.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

A Local Stakeholder's meeting was held on 30th and 31st October 2013 at the following venue:

Date: 30th October 2013	**Date: 31st October 2013**
Location: Addateegala Mandal, East Godavari District	**Location:** Paderu Mandal, Visakhapatnam District
Time: 11-00 AM to 02-00 PM	**Time: 11-00 AM to 02-00 PM**

The following primary stakeholders were invited for the meeting.

Local Communities: The local communities invited for the stakeholder's meeting are farmers, representatives of tribal farmer association, members of Self-Help Group (SHG) groups, Herbal Medicine Practitioners, representative of community development organizations. The invitees included both men and women from the project area, without any bias of caste, creed or ethnicity. LAYA works for the tribal communities for socially just and humanized society where the marginalized communities find a space for survival with dignity without any discrimination of caste, creed or ethnicity.

Local Policy Makers, Representative of Local authority and Official Representatives: The invitees among local policy makers included Ward Members, Sarpanchs, Tasildars, Gram Panchayat members; government official representatives from Departments of Agriculture, Education, Forest, Medical, Animal Husbandry, Banking, Police and Mandal Development; and Revenue officers. They were invited to seek their opinion on the project activity and sustainable development of the project activity.

Local NGOs: The invitees of local NGO's include those working in Addateegala and Paderu Mandals. The local NGOs include SAKSHI, WOMEN, ORCC, Adivasimithra, Girigina Deepaka, Covel Foundation, Girigana Vikasa, THP net and Fair Climate Network (FCN) members. FCN is a network of grass root NGO's working on CDM projects for rural communities.

GS NGOs: There are 8 GS NGOs in India. All of them were sent invitations for the meeting. Also international Gold Standard NGOs' supporters were invited to comment on the project activity. FCN, a GS NGO supporter attended the meeting.

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39 http://moef.nic.in/legis/eia/so1533.pdf

Official Representative of DNA: The official representative of the DNA for India, Ministry of Environment and Forests (MoEF) were intimated of the meeting and invited.

The Gold Standard Regional Manager for India was also notified of the meeting and invited to attend the meeting.

In addition, advertisement in the local newspaper, posters and banners were put up for the general public to attend the meeting.

Invitees who were not able to attend the meeting were asked to send in their written feedback or comments on the project, based on the non-technical summary of the project provided to them. Telephonic feedback were also taken from a few participants.

E.2. Summary of comments received
>>

Compilation of the responses from the evaluation forms for the project activity from Addateegala Mandal is as follows:

Questions	**Responses**	**No. of Stakeholders**
What is your impression of the meeting?	We had no idea about Sarala woodstoves and Bio Sand Woodstoves, we were happy to be at this meeting and learn about this new technology that will be useful to the community	18
	This project will facilitate development of people	4
	Happy to be at this meeting, the technologies are useful to the community	12
	I learned a lot after travelling a great distance to be at this meeting	2
	This meeting was useful to inform us about this project before its start	3
	This is project will facilitate less usage of wood and save money, and better health, faster cooking	19
	This project will facilitate better health and environment for the community	9
	I like this project	11
What did you like in the project?	The project will benefit women to cook faster and more efficiently and the project will help people's health through clean drinking water	20
	This project will facilitate clean drinking water, better health of women, reduce effort of women, reduced wood usage, less air pollution, reduced cost	17
	I learned about new technologies at this meeting	1
	This project will reduce pollution in the atmosphere, and improve health	11
	This project will help facilitate employment of local volunteers	3
	I like the Bio-sand filter as we can drink water directly	12

	without it being boiled	
	I like the Sarala woodstove and its ability to cook efficiently	9
	This project will facilitate conservation of forest	1
	I appreciate the Idea of this project that should have been done by government	1
	I like this meeting	1
	I wish this project would reach out to all in my village	1
What do you not like about the project?	I wish the water doesn't ever get bad, after the filter is left without being refilled for 3 days	3
	Wish this project had been started earlier	3
	This project would have good if extended to other regions as well and done by government	7
	No Comments	65

Compilation of the responses from the evaluation forms for the project activity from Paderu Mandal is as follows:

Questions	Responses	No. of Stakeholders
What is your impression of the meeting?	This project is good for environment and employment	6
	This project reduces carbon emissions and improves health	9
	I am happy to be at this meeting. I learned a lot about both these technologies	21
	I am glad this project is focused on health	3
	Well presented with audio-visuals	2
What did you like in the project?	I like the technologies of both Surakasha Sand Filters and Sarala Woodstoves, feel it is necessary for the local region	11
	The technologies of both Surakasha Sand Filters and Sarala Woodstoves is good and useful for community	7
	These technologies will conserve forest and project against diseases	6
	I appreciate this project because it focuses on the poor and sustainable development	4
	Sarala Woodstoves facilitate faster cooking, smoke free kitchen	6
What do you not like about the project?	No Comment	32
	Technologies should reach community as soon as possible	1
	Bio-sand Filter cannot be turned off, once water is poured	1
	Not happy with the ceramic water filter alternative	1

Stakeholder comment	Was comment taken into account (Yes/ No)?	Explanation (Why? How?)
What is the cost of Bio-sand Filter and SARALA Stove?	Clarification	The cost of construction of Bio-sand Filter is Rs.2100 and Rs. 800 for SARALA Stoves. The cost is

		towards construction materials - bricks, sand, cement, gravel, aluminum separator and lid.
What is the cost to the family?	Clarification	The transportation costs of Rs.300 and Rs.100 for the water filter and Sarala Stove respectively.
How do you calculate the emission reduction for the project activity?	Clarification	This is based on reduction in fuel wood consumption for cooking and boiling water for drinking water and fraction of sustainable wood present in the region. This is converted to carbon-dioxide equivalent.
Why is biogas not considered as an option?	Clarification	In the tribal region, stall feeding is not practiced and cattle is taken for grazing. Due to this practice, availability of cow dung will be an issue.
When will these technologies be given to the households and which are the villages?	Clarification	By mid-2014, we will start the project activity. These will be villages in Addateegala and Paderu Mandals and will be to households who are using traditional cook stoves presently before the start of the project activity.
Who will be training for construction of water filters and Sarala stoves?	Clarification	The local people, especially women will be trained for construction of Sarala stoves and the youth for water filters.
How will the material be filled in for the water filter	Clarification	The constructed water filter and material for filling in will be transported to the house and filled in there.
Do we have to clean the water filter periodically	Clarification	No, it is not required. Only the top separator has to be cleaned once in 2-3 days. If there is any problem, the village volunteer can be contacted for repair, who will be trained.
How often can the water be poured for filtration?	Clarification	A gap of 2 hours has to be given between each pour of filtration for the bio-layer to be effective.
The project takes 2 years for implementation. Can the process not be hastened by providing ready ceramic filters?	Yes, Comment taken into account	Yes, we can also include steel ceramic filters. We will work on the costs, the feasibility and implications.

The questions from the stakeholders were clarifications regarding project implementation, construction and maintenance. All the clarifications requested by the communities were provided during the stakeholder's meeting. There were no negative comments that need to be mitigated.

E.3. Report on consideration of comments received

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Due to long-term implementation, a primary stakeholder also suggested implementation of steel ceramic filters. The stakeholder's suggestion is taken into account. The cost of implementation and maintenance will be worked out. The filtered water from ceramic filters will be tested to national standards before deciding to implement the project. Based on its suitability for the various sources of water, it will be decided for implementation.

SECTION F. Approval and authorization

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This is a GS VER project. Hence according to the GS 2.2 guidelines, Host Country Approval is not required for the project activity. But during the Local Stakeholder's meeting, the Indian DNA has been informed about the project activity.

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Appendix 1: Contact information of project participants

Organization name	**LAYA**
Street/P.O. Box	Plot No. 110,
Building	Near Senora Beach Resorts, Yendada
City	Visakhapatnam
State/Region	Andhra Pradesh
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Website	www.laya.org.in
Contact person	Nafisa Goga D'Souza
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Middle name	Goga
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Organization name	**LAYA GREEN VENTURES PRIVATE LIMITED.**
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Middle name	Goga
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Department	
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Personal e-mail	nafisa.dsouza@gmail.com

Appendix 2: Affirmation regarding public funding

There is no public funding for the project activity

Appendix 3: Applicability of selected methodology

It is discussed in the relevant sections

Appendix 4: Further background information on ex ante calculation of emission reductions

It is discussed in the relevant sections

Appendix 5: Further background information on monitoring plan

It is discussed in the relevant sections

Appendix 6: Summary of post registration changes

This is the pre-registration submission.

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
Decision Class: Regulatory		

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