# DISTRIBUTION OF IMPROVED COOK STOVE - PHASE 12

Document Prepared by EKI Energy Services Limited

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| **Project Title** | Distribution of Improved cook stove - Phase 12 |
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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Project

**Purpose of the Project Activity**

Purpose of the project activity is to facilitate clean cooking practices and reduce health risk due to indoor air pollution[1] along with household drudgery amongst the tribal households (Schedule Tribe) and families living below the poverty level (BPL category[2]) in villages of Maharashtra through dissemination of improved cook stoves. The improved cook stoves through replacement of inefficient traditional cook stove will contribute towards reduction of greenhouse gas emission and by-products of incomplete combustion like black carbon, conservation of fuel wood and thereby preventing forest degradation. Successful operation of the project activity will encourage rural residents to shift from traditional cook stoves usage to the project improved and modern cook stove usage.

The higher efficiency portable, single pot cook stoves distributed and conceived under the project activity has replaced prevailing practice of using traditional cook stoves in rural areas across the state. Independent research reveals that, out of 120 million of the total potential of biomass cook stove in India total number of household using cook stoves is around 14.904 million (WHO, UNDP 2009)[3] only. Study by ESMAP revealed that, improved cook stoves accounted for less than 7 percent of the total biomass stoves used in rural areas. The report also refers to the latest national survey in India highlighting the fact that, only 5 percent of rural households possess an improved cook stove (Zhang et al. 2006). The study portrays Maharashtra amongst one of those few states where, improved cook stoves were distributed under the National Programme of Improved Chulha (NPIC) since 1983-84 and continued thereafter. The distribution was facilitated through Rural Development and Water Conservation Department, Maharashtra Energy Development Agency and Khadi and Village Industries Commission. Even after prolonged period of distribution since 1983, around 85% of households in the villages of Maharashtra still rely on traditional cook stoves.

It is worthwhile to note that firewood and wood chips contributes as major cooking fuel amongst rural households in India. According to the NSSO[4] 61st round survey, a considerable percentage of rural population of Maharashtra relies upon fire wood for cooking and the percentage is substantially much higher amongst the lower MPCE (Monthly Per Capita

[1] Household Cook stoves, Environment, Health and Climate Change – World Bank (Executive summary, page 9-11)
[2] As per the article in The Hindu dated March 20, 2012 anyone with daily consumption expenditure below Rs. 22.42 is categorised under BPL. The article depicts of 24.5% of the total population in Maharashtra under BPL in 2009-10. The article depicts that Scheduled Tribes (47.4%) suffers the highest level of poverty across the country.
[3] Household Cook stoves, Environment, Health and Climate Change – The World Bank
[4] National Sample Survey Office

Expenditure) group. Since, the beneficiary selected under the project belongs to BPL and ST category of population in terms of capacity of expenditure therefore; improved cook stove use will result in substantial fuel wood saving as this section is the major consumer of fuel wood.

| MPCE Groups | Percentage of Population using firewood[5] |
|---|---|
| Rs. 0 – 235/- | 79.2% |
| Rs. 235 – 270/- | 93.8% |
| Rs. 270 – 320/- | 90.0% |
| Rs. 320 – 365/- | 87.2% |
| Rs. 365 – 410/- | 86.2% |
| Rs. 410 – 455/- | 84.2% |
| Rs. 455 - 510/- | 82.8% |

The improved cook stoves distributed are more efficient with thermal efficiency of 29.88%[6] as compared to traditional stoves with thermal efficiency of around 10%[7]. Use of efficient cook stove will result in fuel consumption reduction i.e. non-renewable biomass (since the demand of fire wood is considerably higher than the sustainable potential of fire wood extraction and the wood available through unsustainable extraction is conceived as non-renewable biomass) through minimizing thermal energy losses by facilitating complete combustion and thereby resulting in GHG emission reduction.

**Technology Employed**

The cook stove deployed under the project activity is single pot, portable, metallic, improved biomass cook stoves[8] made of cast iron for combustion of solid biomass. The improved cook stoves are manufactured in accordance to IS 13152, Part-1: 1991, CPRI Design Type I[9] standard. The design ensures complete combustion of biomass. The cook stove is tested for thermal efficiency of 29.88% as per water boiling test protocol specified in IS 13152, Part 1: 1991.

**Measures undertaken**

The Rural Development and Water Conservation (RDWC) Department, Government of Maharashtra is involved in promoting betterment of living standard for the tribal household (ST) and families living Below Poverty Line (BPL) in villages of Maharashtra. The department as a part of its aforesaid programme selects households from amongst the ST and BPL category depending upon level of vulnerability (assessed on basis of 13 parameters: Category and size of usable land, Type of house, Availability of regular usable clothes, Protection of food or food

[5] Redefining poverty lines and survey of BPL families the annual income of Rural BPL is considered to be Rs. 30,000.
[6] Thermal Efficiency Test Report of Improved Cook stove tested at Biomass Cook stove Testing Centre, Dept. of Renewable Energy Sources, Udaipur
[7] Paragraph 6 (Option 2) of approved applicable methodology AMS –II.G., Version 03
[8] MNRE accredited system -http://mnre.gov.in/schemes/decentralized-systems/national-biomass-cookstoves-initiative/
[9] The design of the cook stove is certified by Bureau of Indian Standards relating to its appropriateness to, IS 13152 (Part1). The standard was adopted by Bureau of Indian Standard after the draft finalized by the oil burning Appliances Sectional Committee had been approved by Heavy Mechanical Engineering Division Council.

security, Cleanliness, Ownership of required goods, Heights /Level of literacy, Family working capacity, Source of livelihood goods, Number of children in age group (5 to 14), Type of bankruptcy, reason for staying away from family of Earning member, Choice of help /Yojana)[10] and provide financial assistance to facilitate better and hygienic living standard. The household selected for financial assistance under the programme is provided with an improved cook stove system. The household considered as end users of cook stoves under the project activity are poor enough to afford procurement of cook stoves and are also least interested towards investment as wood is available for free. So, in absence of the cook stove the household would have continued with traditional cooking practice. Since, the project activity is conceived under the program of Govt. of Maharashtra which provides cook stove only to BPL and ST category household so; there is no chance of cook stove to be distributed to non-baseline household. The identification of beneficiaries and distribution of cook stoves comes under the preview of the Rural Development and Water Conservation Department.

The project activity plans to disseminate improved cook stoves over period of time[11] amongst Below Poverty Line (BPL) and Scheduled Tribes (ST) households in rural areas of 14 districts of Konkan, Nashik and Pune divisions in Maharashtra. The project is to consider beneficiaries comprising of 14,720 Nos. of household to which improved cook stoves are to be disseminated under the programme and has signed the end user Tripartite Agreement[12]. The project through conservation of non-renewable biomass will result in greenhouse gas emission reduction of 13,233 tCO2e annually[13].

Vikram Stoves and Fabricators (hereafter referred to as Vikram Stoves) is a MNRE (Ministry of New and Renewable Energy) approved manufacturer and distributor of improved cook stoves having operation network in Maharashtra. The agency is selected by the RDWC Department, Government of Maharashtra for distribution of improved cook stoves amongst identified beneficiaries. With an objective of wide spread dissemination (under limited annual budgetary support provision of the Ministry) of improved cook stoves and facilitate continual usage at beneficiary level; the manufacturer conceived CDM in its revenue model. The revenue was conceived in deciding upon the capital cost as well as to meet up the cost towards imparting awareness and training, periodic maintenance[14] and post lifetime replacement within the crediting period.

[10] Criteria issued by Department of Rural Development, Government of Maharashtra
[11] Each of the cook stoves will be included for the purpose of emission reduction calculation from the day on which it is distributed to the beneficiary and the end user agreement is signed. Thus, in the first monitoring period all the cook stoves may not claim the full credits but for ex-ante determination it is estimated the same operation period for all the cook stoves.
[12] Tripartite Agreement is for transfer the CER right to the Project Participant by each beneficiaries/end users and is signed amongst end user, GKEMPL and Vikram Stoves
[13] The ex-ante estimation of emission reduction is conceived considering that 90% of the cook stove will be in operation and also at desired efficiency. Therefore the number of cook stove conceived for determining the ex-ante estimation of emission reduction is 13,248 instead of 14,720. However, the number of cook stove to be considered for ex post estimation of emission reduction will be determined on the basis of survey result and considering the actual number of cook stove disseminated i.e. 14,720.
[14] "The Indian stove programme: an insider's view – the role of society, politics, economics and education" by Bhaskar Sinha, National Institute of Science, Technology & Development Studies (NISTADS), CSIR, New Delhi outlines that the woman are least interested for maintenance as they do not perceive the usefulness of the stove and revert back to traditional practice when the cook stove becomes non-functional therefore timely operation and maintenance are vital

In the baseline scenario, the absence of the project would have led to underneath options for the purpose of cooking

1. Continuation of use of traditional stoves for the purpose of cooking

2. Use of kerosene for cooking

3. Use of LPG for Cooking

4. Use of biomass based improved cook stove

Use of the traditional cook stove is the most plausible baseline option for the target population.

Kindly refer section 1.13 for further details.

M/s G K Energy Marketers Pvt. Ltd (hereafter referred to as GKEMPL) is authorised as Project Participant by Vikram Stoves and the end users for development of CDM project activity for cook stove dissemination. As a part of the project activity GKEMPL (Project Participant) along with Vikram Stoves will enter into contractual agreement with the beneficiaries by virtue of which, the end user will confirm use of cook stove as well as transfer the CER right to the Project Participant.

## 1.2 Sectoral Scope and Project Type

**The project activity falls under Sectoral Scope 3**: Energy Demand

This project is not grouped project because there is no addition other project activity.

This is non-AFLOU type of project.

## 1.3 Project Eligibility

The project activity involves replacement of the traditional cook stoves by improved cook stoves. The improved cook stoves owing to its higher combustion efficiency of 29.88% in comparison to 10% efficiency of the traditional cook stoves results in efficiency improvement and same do not exceed equivalent of 20 Giga watt hour (GWh) (60 giga watt hour thermal (GWhth))per year. As the cumulative energy saving from the project activity is less than 20 GWh/annum or 60 GWhth/annum and each of the independent sub-systems i.e. Improved cook stoves used in household only for the purpose of cooking results an estimated annual energy savings of 4.073 MWhth or 1.358 MWh which is well smaller than permissible limit of 600 MWh. Hence the project activity is eligible Sectoral scope 3 i.e. energy demand under the scope of the VCS Program.

The tripartite agreement submitted by the PP is between the end party user, Vikram stoves and G K Energy Marketers Private Limited. The agreement clear states that the rights of the VCUs rests with G K energy marketers private limited. The agreement has been signed by all the parties.

Hence as per Section 3.6.1 of the VCS Standard v4.1, the project owner is G K Energy Marketers Private Limited.

## 1.4 Project Design

The project activity plans to disseminate improved cook stoves over period of time amongst Below Poverty Line (BPL) and Scheduled Tribes (ST) households in rural areas of 14 districts of Konkan, Nashik and Pune divisions in Maharashtra. The project is to consider beneficiaries comprising of 14,720 Nos. of household to which improved cook stoves are to be disseminated under the programme and has signed the end user Tripartite Agreement. The project through conservation of non-renewable biomass will result in greenhouse gas emission reduction of 13,233 tCO2e annually[15]

### Eligibility Criteria

Not applicable to this project activity as this is not a grouped project.

## 1.5 Project Proponent

| | |
|---|---|
| **Organization name** | M/s G K Energy Marketers Pvt. Ltd |
| **Contact person** | Mr. Gopal Kabra |
| **Title** | Authorized Signatory |
| **Address** | Lokmanya Nagar, LBS Road, Flat No.- 350, Building No.- 25,Ground Floor, Pune, Maharashtra – 411030 India |
| **Telephone** | +91-9970450000 |
| **Email** | gopal@energymarketers.in |

## 1.6 Other Entities Involved in the Project

| | |
|---|---|
| **Organization name** | EKI Energy Services Limited |
| **Role in the project** | Project Consultant |
| **Contact person** | Mr. Pankaj Rajpoot |
| **Title** | Assistant Manager- Operations |
| **Address** | Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India |
| **Telephone** | +91- 7828347589 |
| **Email** | pankaj@enkingint.org |

[15] The ex-ante estimation of emission reduction is conceived considering that 90% of the cook stove will be in operation and also at desired efficiency. Therefore, the number of cook stove conceived for determining the ex-ante estimation of emission reduction is 13,248 instead of 14,720. However, the number of cook stove to be considered for ex post estimation of emission reduction will be determined on the basis of survey result and considering the actual number of cook stove disseminated i.e. 14,720.

## 1.7 Ownership

As per VCS Program Definitions version 4, the project ownership is the legal right to control and operate the project activities.

As per CDM Project Design Document section A.1, M/s. G K Energy Marketers Pvt Ltd (hereafter referred to as GKEMPL) is authorised as Project Participant by Vikram Stoves and the end users for development of VCS project activity for securing carbon financing for the cook stove disseminated. As a part of the project activity GKEMPL (Project Participant) along with Vikram Stoves has entered into contractual agreement with each beneficiaries by virtue of which the end user has confirmed use of cook stove as well as transfer the CER right to the Project Participant

Based on above evidences, the project ownership is demonstrated and M/s. G K Energy Marketers Pvt Ltd is authorized project owner.

## 1.8 Project Start Date

The start date of the project activity is 01-October-2012.

The project activity relating to improved cook stove usage by the end user does not require any construction or significant pre-project implementation, nor financial commitment on the part of end user. The real action pertaining to the earliest date of handover of improved cook stoves to beneficiary (also considered as date of onset of GHG emission reductions) under the project activity is considered as the start date as per project start date definition under paragraph 3.7 of the VCS Standard.

The date of supply/ receipt of first lot of improved cookstoves from manufacturer to the regional office of the line department was considered as start date under the CDM registered PDD (evidenced through acknowledgement of the delivery receipt of the line department) as per CDM definition of Start Date. The start date referred to in the registered CDM-PDD was mirrored in the VCS PD. Since the date does not resembles to handover of the cookstoves to beneficiary and does not result in onset of actual emission reduction therefore the same was not considered as start date under VCS mechanism and therefore revised with date of distribution/ handover of improved cookstoves to beneficiary.

## 1.9 Project Crediting Period

The crediting period of the project activity is for 10 years (Fixed).

The length of the first crediting period is 01-October-2012 to 30-September-2022 (both dates inclusive). The improved cookstoves distributions were carried out between 01-October-2012 to 03-December- 2012 amongst 14,720 beneficiaries.

As per errata and clarification, a project is deemed to have met the timelines where Verra confirmed (in writing, to the project proponent or an authorized representative) the project's

eligibility on or before 4-February-2021.The listing process has been completed before 04-February-2021 and hence the errata and clarifications are not applicable

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

The project activity falls under small-scale project category since the annual average GHG emission reductions are less than 300,000 tCO2e.

| Project Scale | |
|---|---|
| Project | √ |
| Large project | |

| Year | Estimated GHG emission reductions or removals ($tCO_2e$) |
|---|---|
| Year 1 (01-October-2012 to 30-Setember-2013) | 13,233 |
| Year 2 (01-October-2013 to 30-Setember-2014) | 13,233 |
| Year 3 (01-October-2014 to 30-Setember-2015) | 13,233 |
| Year 4 (01-October-2015 to 30-Setember-2016) | 13,233 |
| Year 5 (01-October-2016 to 30-Setember-2017) | 13,233 |
| Year 6 (01-October-2017 to 30-Setember-2018) | 13,233 |
| Year 7 (01-October-2018 to 30-Setember-2019) | 13,233 |
| Year 8 (01-October-2019 to 30-Setember-2020) | 13,233 |
| Year 9 (01-October-2020 to 30-Setember-2021) | 13,233 |
| Year 10 (01-October-2021 to 30-Setember-2022) | 13,233 |
| **Total estimated ERs** | 132,330 |
| **Total number of crediting years** | 10 |
| **Average annual ERs** | 13,233 |

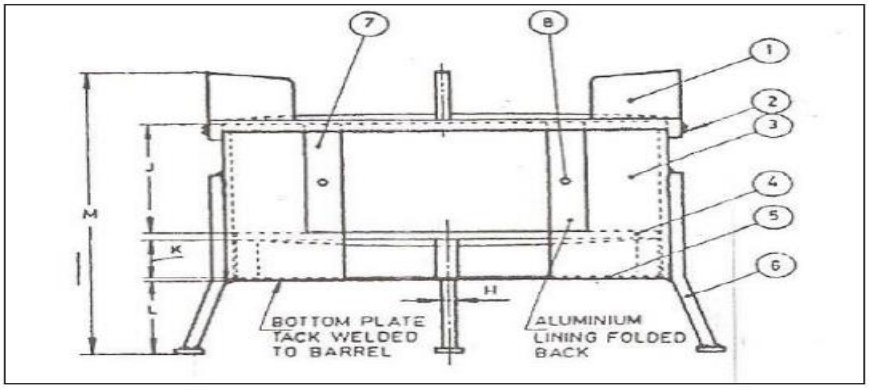
## 1.11 Description of the Project Activity

The improved cook stove conceived under the project activity is MNRE and BIS (Bureau of Indian Standard) approved state of art and environmentally sound technology. The improved

cook stove is manufactured in accordance to IS13152 (Part 1): 1991 (Solid Biomass – Chulha Part 1(Metallic))[16]. This Indian Standard was adopted by the Bureau of Indian Standard after the draft specification was finalized by the Oil Burning Appliances Sectional Committee had been approved by Heavy Mechanical Engineering Division Council. There has been no transfer of technology for the project activity. The standard has been prepared in line with the national approach towards fuel conservation, better environment, mitigating health hazards and loss of forest cover caused by burning of wood as cooking fuel and therefore, can be conceived as an environmentally sound technology for combustion of solid biomass for the purpose of cooking. Moreover, the materials used in manufacturing of the cook stove are of iron and steel which is recyclable after end use and hence, considered to be environmentally safe after lifetime also.

The cook stove distributed under the project activity is a portable, single-pot stove without chimney, natural draft and metal made stove specifically suitable for combustion of solid biomass. The cook stove broadly comprises of a combustion chamber, top plate for holding the utensils, grate for holding fuel during combustion and bottom plate that facilitates ventilation of air. The combustion chamber is cylindrical shaped and made up of mild steel. One side of the chamber of improved cook stove is opened for feeding of fuel. The chamber top plate is die cast and made up of cast iron.

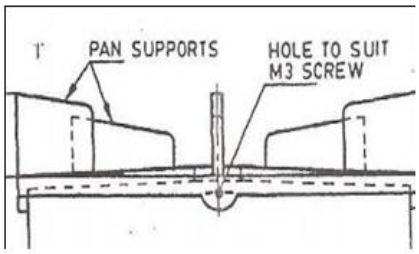
Diagram of Improved Cook stove



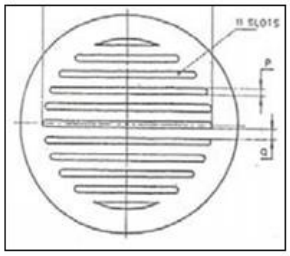

1. Top plate,
2. Screw,
3. Barrel,
4. Grate,
5. Bottom Plate,
6. Legs,
7. Aluminium Lining and

[16] The Standard has been prepared by Indian Standard body in line with the national approach towards fuel conservation and better environment, mitigating Health hazards and drudgery and loss of forest cover caused by burning of wood as cooking fuel (Forward: Indian Standard Solid Bio-Mass, Chulha – Specification Part 1 Portable (Metallic))

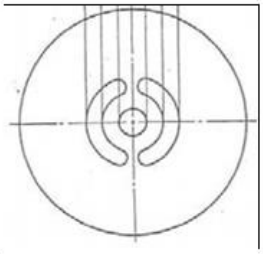
8. Rivet




*Top Plate*



*Grate*



*Bottom Plate*

***Improved Cook stove***

Material used for manufacturing of each component of the cook stoves are:

| Component | Material |
|---|---|
| Top plate | Cast iron |
| Grate | Cast iron |
| Barrel | Mild steel |
| Bottom Plate | Mild steel |
| Lining | Aluminum |
| Perforated Sleeve | Mild steel |
| Handle | Mild steel |
| Pan Support | Mild steel sheet-flat-rod |
| Legs | Mild steel sheet and rod |

**Measures undertaken**

The Rural Development and Water Conservation (RDWC) Department, Government of Maharashtra is involved in promoting betterment of living standard for the tribal household (ST) and families living Below Poverty Line (BPL) in villages of Maharashtra. The department as a part of its aforesaid programme selects households from amongst the ST and BPL category depending upon level of vulnerability (assessed on basis of 13 parameters: Category and size of usable land, Type of house, Availability of regular usable clothes, Protection of food or food security, Cleanliness, Ownership of required goods, Heights /Level of literacy, Family working capacity, Source of livelihood goods, Number of children in age group (5 to 14), Type of bankruptcy, reason for staying away from family of Earning member, Choice of help /Yojana)[17] and provide financial assistance to facilitate better and hygienic living standard. The household selected for financial assistance under the programme is provided with an improved cook stove system. The household considered as end users of cook stoves under the project activity are poor enough to afford procurement of cook stoves and are also least interested towards investment as wood is available for free. So, in absence of the cook stove the household would have continued with traditional cooking practice. Since, the project activity is conceived under the program of Govt. of Maharashtra which provides cook stove only to BPL and ST category household so; there is no chance of cook stove to be distributed to non-baseline household. The identification of beneficiaries and distribution of cook stoves comes under the preview of the Rural Development and Water Conservation Department.

**Life time**

The operational lifetime of the cook stove is 5 years 00 months. As per manufacturer authorization the operational life of improved cookstoves is over seven years, however beyond five years the operational efficiency drops below the rated efficiency and hence was considered as operational life time in the registered PDD.

Decline in the cook stove efficiency as assessed through periodic efficiency testing is being reported and considered as part of emission reduction calculation.

**Replacement of Improved Cookstoves**

Replacement of ICS was scheduled to be carried out

(a) in case of breakage/ dismantle of ICS during the operational period – on receipt of complaint the localised service providers of the project proponent visits the beneficiary with backup cook stoves (ICS) and provides the beneficiary with backup stoves if the service provider fails to address the issues locally. The malfunctioned ICS post collected from beneficiary is thereafter sent to the company workshop in case of possibility of repair. In case the ICS couldn't be repaired beneficiary are to be provided with new ICS.

[17] Criteria issued by Department of Rural Development, Government of Maharashtra

(b) Observed requirement of complex repair- In case the maintenance team of the project proponent during scheduled O&M observes requirement of complex repairs the team may on discretion replace the existing cookstoves with a new one or a backup one. In such case the beneficiary is provided with backup new ICS the same are to be replaced with the repaired one operating at the desired satisfaction level of beneficiary.

(c) Post assessment of operational efficiency in the last year after the elapse of scheduled lifetime of ICS from the date of distribution.

During the current monitoring period of 5 years there has been no instances of replacement of improved cook stoves, therefore no such impact on emission reduction calculation due to increase of cook stoves efficiency.

**Operation and maintenance**

Operation and maintenance of Improved cook stoves are carried out periodically by authorised representative of project proponent (manufacturer of improved cook stoves). The authorized representative of the project proponent during the annual (periodic) maintenance, also motivates and persuades the beneficiaries for continuation of ICS usages for cooking of all meals towards reducing the health impact of the family especially the women and children in case of usage of traditional cook stoves and thereby ensuring the restoration of operation of ICS.

Approach for assessing share of Improved cookstoves users for estimation of emission reduction

1. The number of beneficiaries using Improved cook stoves during a particular monitoring period are assessed based on record of operation and maintenance, maintained by project proponent pertaining to discontinued users.
2. Annual third-party sample survey is being carried out to assess the share of beneficiaries using improved cookstoves. During survey in case beneficiaries were evaluated to be using improved cook stoves for a limited period along with usage of traditional cookstoves the beneficiaries are considered as partial users. Partial users are beneficiaries /household, those who have not discontinued using of ICS but have been using ICS for a limited period and also using traditional cookstoves for the purpose of cooking along with ICS. Since the number of days of operation of partial ICS usage during a particular crediting period is hard to ascertain (uncertainty of estimation), therefore as a conservative approach the beneficiaries /household using ICS partially are considered as discontinued users.

   The survey observed/found most of the beneficiaries to have fully discontinued the usage of traditional cookstoves and have even dismantled the traditional cookstoves.

   Around 5-10% of beneficiaries during a particular crediting period have been assessed to have partially used traditional cookstoves (as deduced from the beneficiary survey) due to customary practice/festival or to manage guests. Considering the perceptive response of the beneficiaries regarding the number of day of functioning of traditional cookstoves, it is conservatively considered that the number of days of use of improved cookstoves for those particular beneficiaries who have used traditional cookstoves as zero/nil. Although such consideration negatively impacts the annualized emission reductions estimate but such consideration is being conservatively considered for the purpose of calculation.

## 1.12 Project Location

The project is located in state Maharashtra, India.

The list of division is given below:

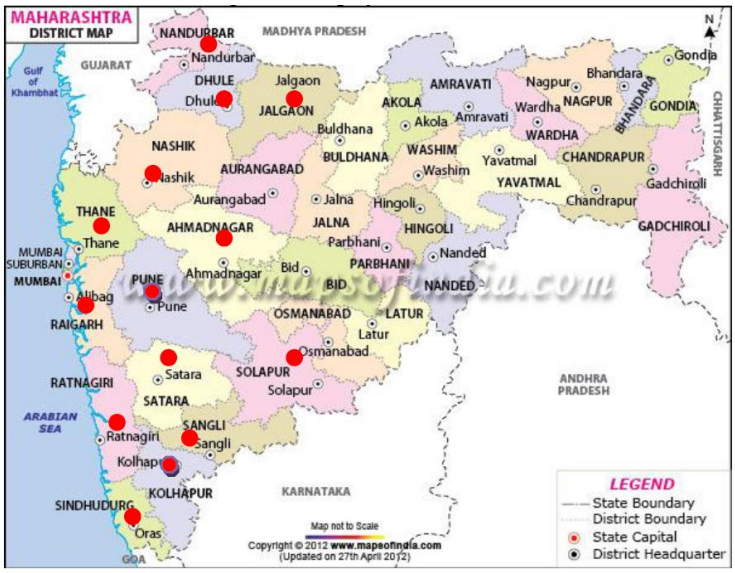
Division: Konkan, Nashik and Pune

Districts: Raigad, Thane, Ratnagiri, Sindhudurg, Nashik, Dhule, Nandurbar, Jalgaon, Ahmednagar, Pune, Sangli, Satara, Solapur and Kolhapur

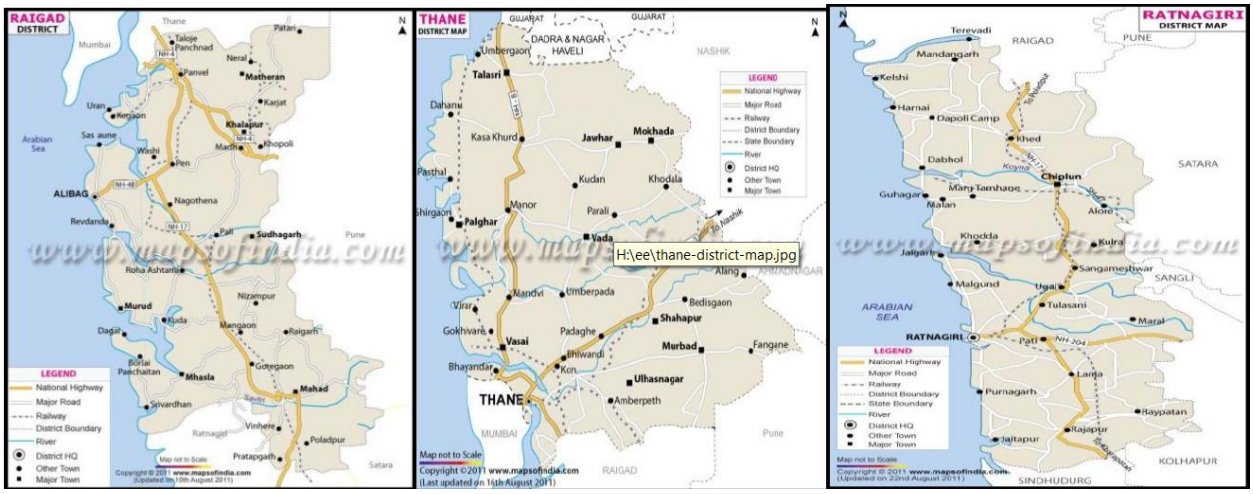
| Division | District | Latitude | Longitude |
|---|---|---|---|
| Konkan | Raigad | 17.51 - 19.80$^{O}$ N | 72.51 -73.40$^{O}$ E |
| | Thane | 18.70 - 20.33$^{O}$ N | 72.75 - 73.80$^{O}$ E |
| | Ratnagiri | 16.30 – 18.00$^{O}$ N | 73.00 – 74.00$^{O}$ E |
| | Sindhudurg | 15.37 - 16.40$^{O}$ N | 73.19 - 74.18$^{O}$ E |
| Nashik | Nashik | 18.33- 20.53$^{O}$ N | 73.16 - 75.16$^{O}$ E |
| | Dhule | 20.63 - 22.01$^{O}$ N | 73.83 - 75.18$^{O}$ E |
| | Nandurbar | 21.00 - 22.03$^{O}$ N | 73.31 - 74.32$^{O}$ E |
| | Jalgaon | 20.00 – 21.00$^{O}$ N | 74.92 - 76.47$^{O}$ E |
| | Ahmednagar | 18.20 - 19.90$^{O}$ N | 73.90 - 75.50$^{O}$ E |
| Pune | Pune | 17.90 –18.52$^{O}$ N | 73.32 - 75.17$^{O}$ E |
| | Sangli | 16.87 17.10$^{O}$ N | 73.43 – 75.00$^{O}$ E |
| | Satara | 17.50 - 18.11$^{O}$ N | 73.33 - 74.54$^{O}$ E |
| | Solapur | 17.10 - 18.32$^{O}$ N | 74.42 - 76.15$^{O}$ E |
| | Kolhapur | 15.00 – 17.00$^{O}$ N | 73.00 – 74.00$^{O}$ E |

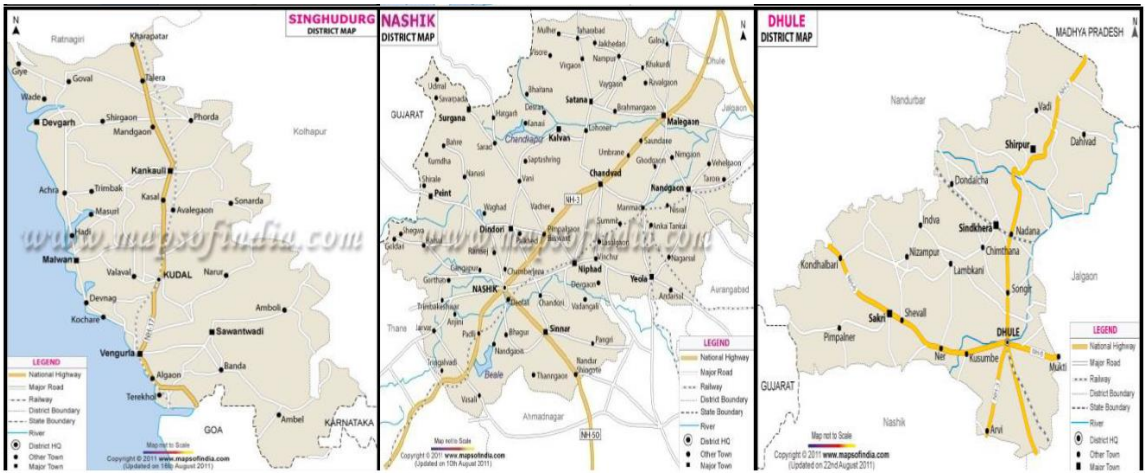
**Map of India**

**Map of Maharashtra**




**Map of Raigad, Thane, Ratnagiri, Sindhudurg, Nashik, Dhule, Nandurbar, Jalgaon, Ahmednagar, Pune, Sangli, Satara, Solapur and Kolhapur**

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DISTRICT MAP
NASHIK
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DHULE
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GUJARAT
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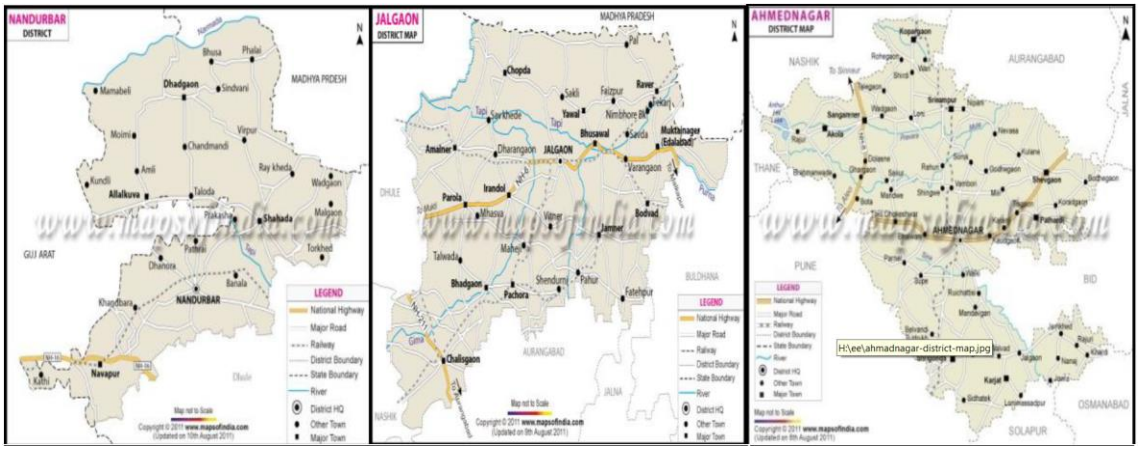
KARNATAKA
LEGEND


NANDURBAR
DISTRICT
JALGAON
DISTRICT MAP
AHMEDNAGAR
DISTRICT MAP
MADHYA PRADESH
AURANGABAD
PUNE
SOLAPUR
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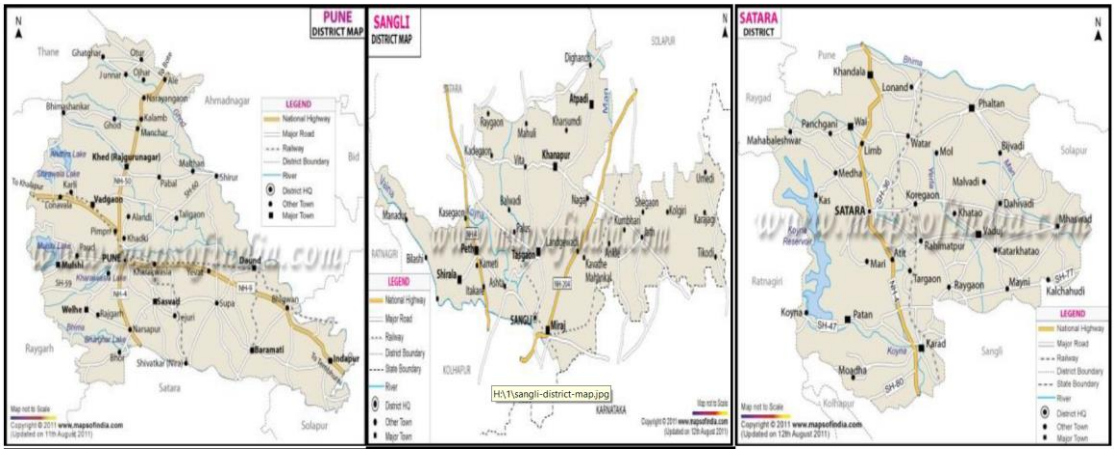
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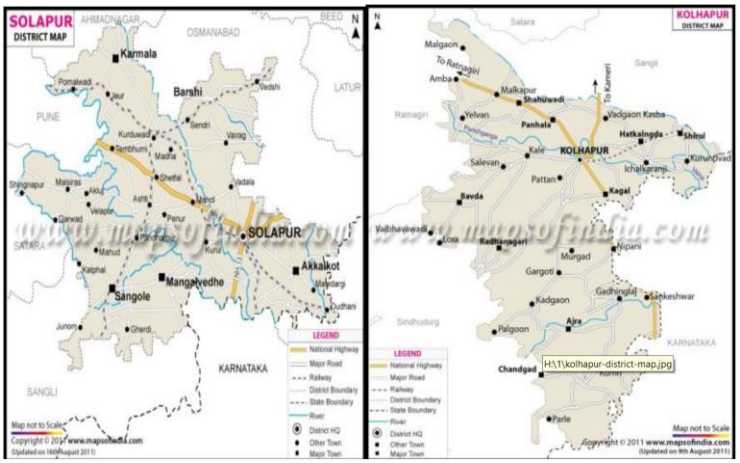



| District- Raigad | | | District- Thane | | |
|---|---|---|---|---|---|
| **Sr.** | **Name of the Village** | **Taluka** | **Sr.** | **Name of the Village** | **Taluka** |
| 1 | Adivali | Karjat | 1 | Adivali | Kalyan |
| 2 | Ambherpada | Karjat | 2 | Ambivali Tarf Chon | Kalyan |
| 3 | Ambiwadi T. Kothal Khalati | Karjat | 3 | Ambivali Tarf Vasundri | Kalyan |
| 4 | Ambiwali Bk. | Karjat | 4 | Anakhar | Kalyan |
| 5 | Ambot | Karjat | 5 | Ane | Kalyan |
| 6 | Anjap | Karjat | 6 | Antade | Kalyan |
| 7 | Antrat T. Need | Karjat | 7 | Antarli | Kalyan |
| 8 | Antrat T. Waredi | Karjat | 8 | Apati Tarf Barhe | Kalyan |
| 9 | Ardhe | Karjat | 9 | Apati Tarf Chon | Kalyan |
| 10 | Arvand | Karjat | 10 | Arele | Kalyan |
| 11 | Asal | Karjat | 11 | Asade | Kalyan |
| 12 | Ase | Karjat | 12 | Bapsai | Kalyan |
| 13 | Ashane | Karjat | 13 | Bere | Kalyan |
| 14 | Avalas | Karjat | 14 | Bhisod | Kalyan |
| 15 | Awasare | Karjat | 15 | Bhopar | Kalyan |
| 16 | Baliware | Karjat | | | |
| 17 | Bamnoli | Karjat | | | |
| 18 | Bandhiwali | Karjat | | | |

| District -Ratnagiri | | | District - Sindhudurg | | |
|---|---|---|---|---|---|
| **Sr.** | **Name of the Village** | **Taluka** | **Sr.** | **Name of the Village** | **Taluka** |
| 1 | Dorle | Ratnagiri | 1 | Durganagar | Kudal |
| 2 | Dugave | Ratnagiri | 2 | Gandhigram | Kudal |
| 3 | Gadnaral | Ratnagiri | 3 | Gandhinagar | Kudal |
| 4 | Ganapatipule | Ratnagiri | 4 | Gaondhad | Kudal |
| 5 | Ganeshgule | Ratnagiri | 5 | Gaorai | Kudal |
| 6 | Gaonkhadi | Ratnagiri | 6 | Gavalgaon | Kudal |
| 7 | Gavade Ambere | Ratnagiri | 7 | Ghadigaon | Kudal |
| 8 | Ghavaliwadi | Ratnagiri | 8 | Ghatakarnagar | Kudal |
| 9 | Golap | Ratnagiri | 9 | Ghavanale | Kudal |
| 10 | Harchiri | Ratnagiri | 10 | Ghotage | Kudal |

| | | | | | |
|---|---|---|---|---|---|
| 11 | Hatis | Ratnagiri | 11 | Girgaon | Kudal |
| 12 | Hatkhamba | Ratnagiri | 12 | Gondhalpur | Kudal |
| | | | 13 | Gondhayale | Kudal |
| | | | 14 | Gothos | Kudal |
| | | | 15 | Goveri | Kudal |

| **District -Nashik** | | | **District-Dhule** | | |
|---|---|---|---|---|---|
| **Sr.** | **Name of the Village** | **Taluka** | **Sr.** | **Name of the Village** | **Taluka** |
| 1 | Amdongra | Peint | 1 | Ajang | Dhule |
| 2 | Amlon | Peint | 2 | Ajnale | Dhule |
| 3 | Abasa | Peint | 3 | Aklad | Dhule |
| 4 | Abheti | Peint | 4 | Ambode | Dhule |
| 5 | Adgaon | Peint | 5 | Amdad | Dhule |
| 6 | Ambapani | Peint | 6 | Anakwadi | Dhule |
| 7 | Ambapur | Peint | 7 | Anchade | Dhule |
| 8 | Ambe | Peint | 8 | Anchade Tanda | Dhule |
| | | | 9 | Arni | Dhule |
| | | | 10 | Arvi | Dhule |
| | | | 11 | Babhulwadi | Dhule |
| | | | 12 | Babre | Dhule |
| | | | 13 | Balapur | Dhule |
| | | | 14 | Balhane | Dhule |

| **District- Nandurbar** | | | **District- Ahmednagar** | | |
|---|---|---|---|---|---|
| **Sr.** | **Name of the Village** | **Taluka** | **Sr.** | **Name of the Village** | **Taluka** |
| 1 | Adachhi | Nandurbar | 1 | Aghi | Jamkhed |
| 2 | Ajepur | Nandurbar | 2 | Anandwadi | Jamkhed |
| 3 | Akhatwade | Nandurbar | 3 | Apti | Jamkhed |
| 4 | Akrale | Nandurbar | 4 | Arangaon | Jamkhed |
| 5 | Ambapur | Nandurbar | 5 | Balgavhan | Jamkhed |
| 6 | Amlatne | Nandurbar | 6 | Bandhkhadak | Jamkhed |
| 7 | Arale | Nandurbar | 7 | Batewadi | Jamkhed |
| 8 | Arditara | Nandurbar | 8 | Bavi | Jamkhed |
| 9 | Asane | Nandurbar | 9 | Bhavarwadi | Jamkhed |
| 10 | Ashte | Nandurbar | 10 | Bhutvada | Jamkhed |
| | | | 11 | Borle | Jamkhed |
| | | | 12 | Chobhewadi | Jamkhed |
| | | | 13 | Chondhi | Jamkhed |
| | | | 14 | Chumbhali | Jamkhed |
| | | | 15 | Daradwadi | Jamkhed |

| **District- Jalgaon** | | | **District- Pune** | | |
|---|---|---|---|---|---|
| **Sr.** | **Name of the Village** | **Taluka** | **Sr.** | **Name of the Village** | **Taluka** |
| 1 | Amadgaon | Bodvad | 1 | Shenavadi | Velhe |
| 2 | Bhankhede Pr. Varangaon | Bodvad | 2 | Shirkoli | Velhe |

| | | | | | |
|---|---|---|---|---|---|
| 3 | Bodwad | Bodvad | 3 | Singapur | Velhe |
| 4 | Borgaon | Bodvad | 4 | Sonde Haroji | Velhe |
| 5 | Chikhali Bk. | Bodvad | 5 | Sonde Karla | Velhe |
| | | | 6 | Sonde Mathana | Velhe |
| | | | 7 | Sonde Sarfal | Velhe |
| | | | 8 | Surawad | Velhe |
| | | | 9 | Tekpole | Velhe |
| | | | 10 | Thangaon | Velhe |
| | | | 11 | Vadgaon | Velhe |
| | | | 12 | Vadghar | Velhe |
| | | | 13 | Vajeghar Bk. | Velhe |
| | | | 14 | Vajeghar Kh | Velhe |
| | | | 15 | Vanjale | Velhe |
| | | | 16 | Vanjalwadi | Velhe |
| | | | 17 | Varasgaon | Velhe |
| | | | 18 | Varoti Bk | Velhe |
| | | | 19 | Varoti Kh. | Velhe |
| | | | 20 | Velhe Bk. | Velhe |
| | | | 21 | Velhe Bk. Ghera | Velhe |
| | | | 22 | Velhe Kh. Ghera | Velhe |
| | | | 23 | Vihir | Velhe |
| | | | 24 | Vinzar | Velhe |
| | | | 25 | Wangani | Velhe |
| | | | 26 | Wanganichi Wadi | Velhe |

| **District- Sangli** | | | **District- Satara** | | |
|---|---|---|---|---|---|
| **Sr.** | **Name of the Village** | **Taluka** | **Sr.** | **Name of the Village** | **Taluka** |
| 1 | Ambewadi | Atpadi | 1 | Achali | Mahabaleshwar |
| 2 | Atpadi | Atpadi | 2 | Adhal | Mahabaleshwar |
| 3 | Autewadi | Atpadi | 3 | Ahire | Mahabaleshwar |
| 4 | Awalai | Atpadi | 4 | Akalpe | Mahabaleshwar |
| 5 | Balewadi | Atpadi | 5 | Ambral | Mahabaleshwar |
| 6 | Banpuri | Atpadi | 6 | Amshi | Mahabaleshwar |
| 7 | Bhingewadi | Atpadi | 7 | Araw | Mahabaleshwar |
| 8 | Bombewadi | Atpadi | 8 | Avakali | Mahabaleshwar |
| 9 | Chinchale | Atpadi | 9 | Awalan | Mahabaleshwar |
| 10 | Deshamukhwadi | Atpadi | 10 | Bhekavali | Mahabaleshwar |
| 11 | Dhavadwadi | Atpadi | 11 | Bhilar | Mahabaleshwar |
| 12 | Dighanchi | Atpadi | 12 | Bhose | Mahabaleshwar |
| | | | 13 | Birmani | Mahabaleshwar |
| | | | 14 | Birwadi | Mahabaleshwar |
| | | | 15 | Chakdev | Mahabaleshwar |
| | | | 16 | Chaturbet | Mahabaleshwar |
| | | | 17 | Chikhali | Mahabaleshwar |
| | | | 18 | Dabhe dabhekar | Mahabaleshwar |

| District- Sangli | | | District- Satara | | |
|---|---|---|---|---|---|
| Sr. | Name of the Village | Taluka | Sr. | Name of the Village | Taluka |
| | | | 19 | Dabhe mohan | Mahabaleshwar |
| | | | 20 | Dandeghar | Mahabaleshwar |
| | | | 21 | Danvali | Mahabaleshwar |
| | | | 22 | Dare | Mahabaleshwar |
| | | | 23 | Dare tamb | Mahabaleshwar |
| | | | 24 | Devali | Mahabaleshwar |
| | | | 25 | Devasare | Mahabaleshwar |
| | | | 26 | Dhangarwadi | Mahabaleshwar |
| | | | 27 | Dhardev | Mahabaleshwar |
| | | | 28 | Dhawali | Mahabaleshwar |
| | | | 29 | Dodani | Mahabaleshwar |
| | | | 30 | Dudhgaon | Mahabaleshwar |
| | | | 31 | Dudhoshi | Mahabaleshwar |
| | | | 32 | Gadhavali | Mahabaleshwar |
| | | | 33 | Gavadhoshi | Mahabaleshwar |
| | | | 34 | Ghavari | Mahabaleshwar |
| | | | 35 | Ghonaspur | Mahabaleshwar |
| | | | 36 | Godavali | Mahabaleshwar |

| District-Solapur | | | District-Kolhapur | | |
|---|---|---|---|---|---|
| Sr. | Name of the Village | Taluka | Sr. | Name of the Village | Taluka |
| 1 | Akole | Mangalvedhe | 1 | Bololi | Karvir |
| 2 | Andhalgaon | Mangalvedhe | 2 | Chafodi | Karvir |
| 3 | Arali | Mangalvedhe | 3 | Chikhali | Karvir |
| 4 | Asabewadi | Mangalvedhe | 4 | Chinchawade Tarf Kale | Karvir |
| 5 | Bathan | Mangalvedhe | 5 | Chinchwad | Karvir |
| 6 | Bavachi | Mangalvedhe | 6 | Chuye | Karvir |
| 7 | Bhalewadi | Mangalvedhe | 7 | Dewale | Karvir |
| 8 | Bhalwani | Mangalvedhe | 8 | Dhangarwadi | Karvir |
| 9 | Bhose | Mangalvedhe | 9 | Dhondewadi | Karvir |
| 10 | Borale | Mangalvedhe | 10 | Dindnevli | Karvir |
| 11 | Bramhapuri | Mangalvedhe | 11 | Donwade | Karvir |
| 12 | Chikhalgi | Mangalvedhe | 12 | Donwadi | Karvir |
| | | | 13 | Durgulwadi | Karvir |
| | | | 14 | Gadegoundwadi | Karvir |
| | | | 15 | Ganeshwadi | Karvir |
| | | | 16 | Garjan | Karvir |
| | | | 17 | Ghanawade | Karvir |
| | | | 18 | Ghungurwadi | Karvir |
| | | | 19 | Girgaon | Karvir |
| | | | 20 | Haladi | Karvir |
| | | | 21 | Halsavade | Karvir |
| | | | 22 | Hanbarwadi | Karvir |
| | | | 23 | Hanmantwadi | Karvir |
| | | | 24 | Hasur | Karvir |

| District-Solapur | | | District-Kolhapur | | |
|---|---|---|---|---|---|
| Sr. | Name of the Village | Taluka | Sr. | Name of the Village | Taluka |
| | | | 25 | Hirawade Dumala | Karvir |
| | | | 26 | Hirawade Khalasa | Karvir |
| | | | 27 | Ispurli | Karvir |

## 1.13 Conditions Prior to Project Initiation

In accordance to the Paragraph 4 of the chosen methodology, AMS - II.G; "Energy Efficiency measures in thermal applications of non-renewable biomass", EB 60, Version 03: baseline of the project activity is "the use of fossil fuels for meeting similar thermal energy needs". In absence of the project activity the beneficiaries could have opted for the underneath options for the purpose of cooking

1. Continuation of use of traditional stoves for the purpose of cooking
2. Use of kerosene for cooking
3. Use of LPG for Cooking
4. Use of biomass based improved cook stove

Use of all the above options for purpose of cooking is permitted as per the regulation of the host country. However, use of few of the fuel options stated above faces barriers as their use in the rural areas are concerned and are depicted below.

As per the study by "National Institute of Science, Technology & Development Studies (NISTADS), CSIR, New Delhi" it is highlighted that poor rural household could not afford and also not willing to opt for the improved cook stoves since wood are available for free. The household that opts for the improved stoves only opts for subsidy hence the use of biomass based cook stoves in not a pertinent or plausible scenario. The percentages of population relying on different fuel type in rural areas of Maharashtra for the purpose of cooking are as follows[18] –

| | Firewood | LPG | Kerosene | No cooking arrangement | Others |
|---|---|---|---|---|---|
| Percentage of population | 78% | 15% | 1% | 3% | 2% |

From above figures it is quite evident that, the percentages of population depending on firewood in the rural areas are quite high in the state. Publication titled "Household Energy and the Environment"[19] depicts that, although nationally there has been a decrease in the share of traditional fuels, as biomass is being increasingly substituted by commercial fuels, the shift to commercial fuels has been negligible in rural areas. The energy consumption in rural areas is guided by the availability and accessibility of local biomass resources; the competing uses for biomass; availability of commercial energy sources; the cost of commercial fuels such as LPG and kerosene (NCAER 1985); absence of an effective supply

[18] TERI Energy Data Directory & Yearbook 2010
[19] Preeti Malhotra, http://www.hedon.info/BP42_EnvironmentalImplicationsOfTheEnergyLadderInRuralIndia

especially in the rural areas (TERI 1998); and inadequate production and refining capacity of LPG (Ravindranath and Ramakrishna 1997). Over and above the above barriers the issues of affordability of commercial fuel is quite a bigger issue amongst the populations conceived under the project activity and hence the use of commercial fuel is not usual scenario amongst the BPL and ST population. Therefore, use of LPG or Kerosene is not the plausible baseline option.

From above it can be concluded that the use of biomass in the traditional cook stove is the most plausible baseline option for the target population.

The methodology identifies the baseline and suggests for baseline emission factor therefore, the same is considered as precedence and assessment of alternatives is not carried out for the purpose of determination of baseline and emission factor. According to Paragraph 5 of the applicable methodology, default emission factor of 81.6 tCO2e/TJ is considered for estimation of emission reduction. Emission reductions would be calculated as:

$ER_y = B_{y,savings} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projectedfossilfuel}$

Where:

| | |
|---|---|
| $ER_y$ | Emission reductions during the year y in $tCO_2e$ |
| $B_{y,savings}$ | Quantity of woody biomass that is saved in tonnes |
| $f_{NRB,y}$ | Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass |
| $NCV_{biomass}$ | Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne) |
| $EF_{projectedfossilfuel}$ | I Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 tCO2/TJ[3] |

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

Where,

| | |
|---|---|
| $B_{y,savings}$ | Quantity of woody biomass that is saved in tonnes |
| $B_{old}$ | Quantity of woody biomass used in the absence of the project activity in tonnes |
| $\eta_{old}$ | A default value of 0.10 may be optionally used if the replaced system is a three stone fire, or a conventional system with no improved combustion air supply or flue gas ventilation system, i.e. without a grate or a chimney. |
| $\eta_{new}$ | Efficiency of the system being deployed as part of the project activity (fraction), as determined using the Water Boiling Test (WBT) protocol. |

**Determination of Bold:**

According to Paragraph 7 of the chosen methodology; Bold is determined by using the Option (a) "Calculated as the product of the number of systems multiplied by the estimated average annual consumption of woody biomass per appliance (tonnes/year). This can be derived from historical data or a survey of local usage."

According to the Wood Fuel Trade in India – Food and Agricultural Organisation of the United Nation, July 2001; per capita per day biomass consumption is 1.52 kg and per household per day fuel wood consumption is 5.60 kg. Annual consumption per household per day is therefore estimated at 2.044 tonnes.

Further, following the TERI Energy Data Directory and Yearbook 2010; per capita per month consumption of fire wood in Maharashtra is 25.51 kg[20]. With average population size of 4.8 person/ household[21] (the population size of 4.8 persons per household is obtained from the secondary literature publication that indicates the average number of personnel per household in rural areas of Maharashtra as 4.8); annual consumption of firewood is estimated at 1.469 tonnes.

Being the annual household fuel consumption data estimated on the basis of the TERI Energy Data Directory is most conservative the value of 1.469 tonnes/household/year is considered. Therefore,

$B_{old}$ = 1.469 tonnes/ household/ year.

**Determination of $\eta_{old}$**

Since, the project is replacing traditional cooking system[22] with no improved combustion air supply or flue gas ventilation system therefore, efficiency of the system being replaced is chosen as per Alternative 2 of Option 2 of Paragraph 6 as default value of 0.10.

**Determination of $\eta_{new}$**

Efficiency of the system being deployed in the project activity is chosen as 29.88%[23] following the Performance Test of Improved Cook stove done by Department of Renewable Energy Sources, Maharana Pratap University of Agriculture & Technology.

$\eta_{new}$ = 29.88%

**$f_{NRB, y}$ is determined as follows:**

According to Paragraph 8 of the chosen methodology, "Project participants shall determine the shares of renewable and non-renewable woody biomass in Bold (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 $f_{NRB,y}$".

[20] Ref: TERI Energy Data Directory and Year book 2010

[21] Ref: Pg.No. -3 of A Report on "Morbidity & Health Care Based on Data Collected in Central, State & Pooled Samples of 60th Round of National Sample Survey Jan - Jun2004"

[22] Traditional cookstove is being used among all households prior to the project activity as per the baseline survey.

23 Thermal Efficiency Test Report of Improved Cook stove tested at Biomass Cook stove Testing Centre, Dept. of Renewable Energy Sources, Udaipur

The fraction of woody biomass saved due to the project activity that can be established as non-renewable is estimated as –

$f_{NRB,y}$ = NRB/ (NRB+DRB)

Where,

NRB: Non Renewable Biomass (NRB) is the quantity of woody biomass used in the absence of the project activity (Bold) minus the DRB component.

According to the Paragraph 9 of the applicable methodology; Demonstrably Renewable woody Biomass (DRB) is justified by satisfying the condition no. (1) in following manner –

The wood extracted from forest land in a sustainable quantity is considered as renewable. The wood extracted from forest land in a sustainable quantity is considered as renewable. Further, to demonstrate the woody biomass is renewable the following conditions as per paragraph 9, are satisfied.

1. Land Area Remain a Forest: The forest area (also termed as recorded forest area and represents the total area of land as per the Government records) in Maharashtra across the last five years is as follows –

| Study Period | Total area under forest (sq.km) | Reporting Year (Economic Survey Report ) |
|---|---|---|
| 2010-11 | 61,939 | 2011-12 |
| 2009-10 | 61,939 | 2010-11 |
| 2008-09 | 61,939 | 2009-10 |
| 2007-08 | 61,939 | 2008-09 |
| 2006-07 | 61,939 | 2007-08 |

The table above represents the total area of land under forest in Maharashtra and confirms that, the land under forest continued to remain under forest.

Therefore, it is evident from above information that, the land area under forest continued to remain under forest.

2. 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).Sustainable management practices like afforestation, reforestation, preservation and conservation of forest land is undertaken in the country as a part of the National Forest Policy, 1988 by Ministry of Environment & Forests, Govt. Of India. The National Mission for Green India is one of the eight Missions of National Action Plan on Climate Change; that calls for forest conservation policy as policy decision to be implemented by the state government.
   In order to prevent illicit cutting of trees and following the request of the government of India, the Maharashtra State had taken an important and pioneering decision regarding

forest management with the active participation of the rural people[24]. The Joint Forest Management/Forest Protection Committee has selected forest land including degraded and barren forest land and similar other land in rural areas for sustainable management.

3. Any national or regional forestry and nature conservation regulations are complied with. According to the Circular No. FLD/1000/CR 243/F-3 of Government of Maharashtra, the forest land under the state of Maharashtra is abided by Forest Conservation Act 1980. The Forest (Conservation) Act, 1980 and amended in 1988[25] was enacted with a view to check further deforestation which ultimately results in ecological imbalance; and therefore, the provisions made therein for the conservation of Forests and for matters connected therewith, must apply to all forests irrespective of the nature of ownership or classification thereof. This definition of forest covers all statutorily recognized forests, whether designated as reserved, protected or otherwise for the purpose of section 2 (i) of the Forest (Conservation) Act. The Forest Conservation Act vide paragraph 2 also impose restriction on the de-reservation of forests or use of forest land for non-forest purpose.

Since, the woody biomass originating from land area under forest fulfils the specified conditions the same is considered to be renewable.

**Fuel Wood Demand**

The demand of fuel wood in context of Maharashtra is estimated from percentage share of the rural population relying on fire wood and average per-capita fuel wood consumption. The demand of fire wood in the state is estimated as follows:

| Particulars | Data | Unit | Reference |
|---|---|---|---|
| Rural Population | 55,778,000.00 | Nos. | Economic Survey of Maharashtra 2010-11 (Pg.No.-3) |
| Percentage of households reliant on biomass for cooking | 78.00 | % | Teri Energy Data Directory & Yearbook 2010(Pg. No. 294) Although study by NSSO depicts higher percentage of dependency of the rural population in lower strata of MCPE group the conservative figure is used for the purpose of calculation |
| Population Dependent on the Fuel Wood | 43,506,840.00 | Nos. | Calculated |
| Per capita fuel wood consumption for cooking | 25.51 | kg/ month | Teri Energy Data Directory & Yearbook 2010(Pg. No.-293) |
| Fuel Wood requirement | 13,318,313.86 | tonne /year | Calculated |

[24] http://www.iifm.ac.in/databank/jfm/mahfdres.html
[25] http://www.moef.nic.in/legis/forest/forest2.html

**Supply of Fire Wood**

Forest is the major source of fire wood supply followed by Tree outside Forest. The amount of fire wood that can be sustainably extracted from the forest and Tree outside Forest land is estimated from the area under different forest type and sustainable rate of extraction from forest and plantation. The same method is applied for estimation of sustainable extraction potential from Tree outside Forest.

As a conservative approach, the land under open forest and scrub are also included.

| **Sustainable Fuel wood Extraction From Forest Area** | | | | |
|---|---|---|---|---|
| **Particulars** | **Data** | **Unit** | **Reference** | **Remarks** |
| Very Dense Forest | 8,736 | sq. km. | Pg. No. -173, Ch -9.16. of India State of Forest Report 2011 -FSI | Land with forest cover havingcanopy density above 70% |
| Medium DenseForest | 20,815 | sq. km. | Pg. No. -173, Ch -9.16. of India State of Forest Report 2011 -FSI | All Lands with forest cover having a canopy density of40%- 70% |
| Open Forest | 21,095 | sq. km. | Pg. No. -173, Ch -9.16. of India State of Forest Report 2011 -FSI | Land with forest cover havingdensity between 10-40% |
| Scrub | 4,157 | sq. km. | Pg. No. -173, Ch -9.16. of India State of Forest Report 2011 -FSI | Degraded forest land with canopy cover less than 10% |
| Total area underforest | 54,803 | sq. km. | | Calculated |

| **Forest Cover In Different Forest Type** | | | | |
|---|---|---|---|---|
| Tropical dry deciduousforest | 57.40% | Pg. No. -174, Ch -9.16. of India Stateof Forest Report 2011 –FSI | | FSI Report Title: India State of Forest Report 2011 By: Forest Survey ofIndia Link: www.fsi.nic.in Report No: 12th Data Period: October2008 - March 2009 |
| Tropical moist deciduousforest | 29.85% | Pg. No. -174, Ch -9.16. of India Stateof Forest Report 2011 –FSI | | |
| Tropical semi evergreen | 7.72% | Pg. No. -174, Ch -9.16. of India Stateof Forest Report 2011 –FSI | | |
| Tropical thorn forest | 1.02% | Pg. No. -174, Ch -9.16. of India Stateof Forest Report 2011 –FSI | | |
| Sub-tropical broad leavedhill forest | 1.54% | Pg. No. -174, Ch -9.16. of India Stateof Forest Report 2011 –FSI | | |
| Littoral and Swamp | 0.09% | Pg. No. -174, Ch -9.16. of India Stateof Forest Report 2011 –FSI | | |
| Tropical dry deciduous forest | | 31,457 | sq. km. | Calculated |
| Tropical moist deciduous forest | | 16,359 | sq. km. | Calculated |
| Tropical semi evergreen | | 4,231 | sq. km. | Calculated |
| Tropical thorn forest | | 559 | sq. km. | Calculated |
| Sub-tropical broad leaved hill forest | | 844 | sq. km. | Calculated |
| Littoral and Swamp | | 49 | sq. km. | Calculated |

| | | | |
|---|---|---|---|
| **Sustainable Rate Of Extraction From Forests And Plantation** | | | |
| Tropical dry deciduous forest | 0.22 | tonne /ha/yr | Pg. No. 254 of Forestry for sustainable biomass production and carbon sequestration in India- N. H. Ravindranath (Centre for Ecological Sciences, IISc, Bangalore), P. Sudha (Centre for Ecological Sciences, IISc, Bangalore), Sandhya Rao (Dept. of Civil Engineering IIT Delhi) |
| Tropical moist deciduous forest | 0.27 | tonne/ha/yr | |
| Tropical semi evergreen | 0.39 | tonne /ha/yr | |
| Tropical thorn forest | 0.24 | tonne/ha/yr | |
| Sub-tropical broad leaved hillforest | 0.36 | tonne /ha/yr | |
| Littoral and Swamp | 0.36 | tonne /ha/yr | |

| | | | |
|---|---|---|---|
| **Renewable Biomass Extraction From Forest Area** | | | |
| Tropical dry deciduous forest | 692,052 | tonne /year | Calculated |
| Tropical moist deciduous forest | 441,684 | tonne /year | Calculated |
| Tropical semi evergreen | 165,000 | tonne /year | Calculated |
| Tropical thorn forest | 13,415 | tonne /year | Calculated |
| Sub-tropical broad leaved hill forest | 30,382 | tonne /year | Calculated |
| Littoral and Swamp | 1,775 | tonne /year | Calculated |
| **Total Renewable Biomass Extractionfrom Forest** | 1,344,308 | tonne /year | Calculated |

| | | | |
|---|---|---|---|
| **Sustainable Extraction from Plantation and ToF** | | | |
| Plantation /TreeOutside Forest | 1,304 | sq. km | India State of Forest Report 2011 - FSI (Calculated considering the area under Plantation/ToF as 2.38%) |
| Sustainable Extraction rate from plantation | 2.00 | tonne /ha/yr | Pg. No. 254 of Forestry for sustainable biomass production and carbon sequestration in India - N. H. Ravindranath (Centre for Ecological Sciences, IISc, Bangalore), P. Sudha (Centre for Ecological Sciences, IISc, Bangalore), Sandhya Rao (Dept. of Civil Engineering IIT Delhi) |

Estimation of $f_{NRB}$

| | | |
|---|---|---|
| Total Renewable Biomass Extraction from Plantation/ ToF | 260,862.28 | tonne /year |
| Total Sustainable biomass available | 1,605,170.28 | tonne /year |
| Fuel Wood requirement | 13,318,313.86 | tonne /year |
| NRB | 11,713,143.58 | tonne /year |
| **$f_{NRB}$** | **87.90%** | |

Following the Paragraph 10 of the applicable methodology, the $f_{NRB}$ estimation is estimated as above andalso two supporting indicators are established through the following –

- Survey results, national or local statistics, studies, maps or other sources of information, such asremote-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

**1. Depletion of Carbon Stock**

According to the India State of Forest Report by Forest Survey of India, Ministry of Environment & Forests, Govt. of India there has been a conversion of the dense and moderately dense forest, to open forest due to felling, pruning or thinning of trees in the forest areas. An increase in the area of open forest is related to diversion of very dense and moderate dense forest to open forest. As per the Government of India Sustainable Forest Management Policy Land converted to open forest are taken up for plantation activity or promote natural or artificial regeneration. In this context it is also worthwhile to note that, the department of forest is undertaking initiatives towards plantation activity.

The table below represent the area under different forest cover:

| | | | | All area in $km^2$ |
|---|---|---|---|---|
| **Year** | **Very Dense** | **Moderately Dense** | **Open Forest** | **Total** |
| 2011 | 8,736 | 20,815 | 21,095 | 50,646 |
| 2009 | 8,739 | 20,834 | 21,077 | 50,650 |
| 2005 | 8,747 | 20,847 | 21,067 | 50,661 |

In accordance to the **Population Pressure and Deforestation in India- Population Research Centre, Institute of Economic Growth – Delhi;** the forest's growing stock reflects the quality of forest cover in terms of crown densities. The study exhibits the depletion in the forest stock in 1997 over 1989.Considering the dense forest growing stock is 67.6cubic metre/hectare and open forest growing stock as 28.5cubic metre/hectare; the volume of the growing stock in 1989 is estimated to be 227,592,000 cubic metres which is lowered to 223,516,000 cubic metres in 1997. The reduction in the volume of growing stock is estimated at 2% from 1997 in compared to 1989.

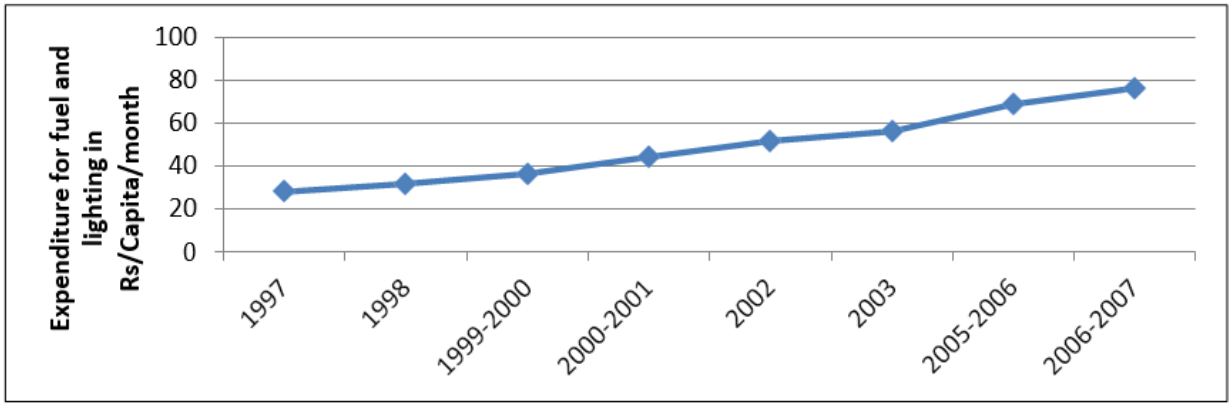
| **State** | **Volume of growing stockin 1989 (cubic metres)** | **Volume of growing stock in 1997 (cubic metres)** | **Percentage change in volume of growing stock** |
|---|---|---|---|
| Maharashtra | 227,592,000 | 223,516,000 | -2% |

**2. Increase in fuel wood price trend**

As per the consumer expenditure survey carried out by National Sample Survey Organisation in 2004; it has been portrayed that 54% of the total consumption expenditure for cooking and lighting in rural areas pertains to fuel wood consumption. The expenditure across the year is presented as follows:

| **Year** | **1997** | **1998** | **1999-2000** | **2000-2001** | **2002** | **2003** | **2005-2006** | **2006-2007** |
|---|---|---|---|---|---|---|---|---|
| Average Monthly Per Capit | 27.97 | 31.79 | 36.45 | 44.14 | 51.70 | 56.20 | 68.77 | 76.20 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| a Expenditure (Rs.) | | | | | | | | |




Since expenditure on fuel wood comprises of 43% of the total expenditure on fuel and lighting (considering 2004-05 data) it can be assumed that the cost of fire wood will increase in line with the increase in expenditure on fuel and light. Moreover the fact is also established from the mean annual increase in the price of the different energy products use for cooking and lighting and is as follows:

The trend in depletion of the carbon stock and rise of the fuel wood price is mainly due to increased demand and supply gap and unsustainable extraction or felling thereof. With the increase in demand of fire wood owing to population pressure and –limited and decreased potential for supply gap of fuel wood due depletion of carbon stocks (forest cover) the price is increasing. As the total biomass availability is unable to cater the demand of unsustainable extraction and pilferage is on the way towards depletion of the forest cover. The depletion of the carbon stock is due to the unsustainable extraction of biomass from the forest land and not due to any national policy. The national policy is aimed towards increasing of the forest area as the total area of forest at present is lower than the projected and required forest area as stipulated by the Govt. of India. Therefore, depletion of carbon stock or rise of the fuel wood price is not due to any national and Sectoral regulations but due to the stiffening of the gap between the demand and supply of fire wood in the region.

Please refer to section B 2 of PDD of the UNFCCC registered CDM project with Ref No. 8807 through the web link

Web-link:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

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

There has been no policy regulation or legal enforcement that promotes deforestation of forest degradation in host country as well as in the region. National forest policy 1988, Government of India, Ministry of Environment and Forest, points out the requirement of forest conservation in the light of forest depletion in the country. Revenue and Forest Department,

Government of Maharashtra vide circular no. FLD/1000/CR 243/F-3 16-December-2004, paragraph 3 has directed to prevent further deforestation in line with section 2 of the Forest Conservation Act 1980. The National mission for Green India, one of the eight Missions on National Action plan on Climate Change has also pointed out use of efficient biomass stoves as a measure towards preventing forest degradation.

The trend in depletion of the carbon stock and rise of the fuel wood price is mainly due to increased demand and supply gap and unsustainable extraction or felling thereof. With the increase in demand of fire wood owing to population pressure and –limited and decreased potential for supply gap of fuel wood due depletion of carbon stocks (forest cover) the price is increasing. As the total biomass availability is unable to cater the demand of unsustainable extraction and pilferage is on the way towards depletion of the forest cover. The depletion of the carbon stock is due to the unsustainable extraction of biomass from the forest land and not due to any national policy. The national policy is aimed towards increasing of the forest area as the total area of forest at present is lower than the projected and required forest area as stipulated by the Govt. of India. Therefore, depletion of carbon stock or rise of the fuel wood price is not due to any national and Sectoral regulations but due to the stiffening of the gap between the demand and supply of fire wood in the region.

The design of the cook stove is certified by Bureau of Indian Standards relating to its appropriateness to, IS 13152 (Part1). The standard was adopted by Bureau of Indian Standard after the draft finalized by the oil burning Appliances Sectional Committee had been approved by Heavy Mechanical Engineering Division Council.

The Project has received necessary approvals for development and commissioning for cook stove project from the state Nodal agencies and is in compliance to the local laws and regulations.

## 1.15 Participation under Other GHG Programs

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

Project has been registered with UNFCCC under Clean Development Mechanism program, Registration reference number is 8807.

### 1.15.2 Projects Rejected by Other GHG Programs

The Project is not rejected by any other GHG programs.

## 1.16 Other Forms of Credit

### 1.16.1 Emissions Trading Programs and Other Binding Limits

India is Non-annex1 country and there is no compliance with an emission trading program or to meet binding limits on GHG emissions for this project activity. The project is registered

under CDM with registration ID 8807. Project Proponent has submitted undertaking that they will not claim same GHG emission reductions of the project from CDM and VCS. PP would not use net GHG emission reductions by the projects for compliance with emission trading program to meet binding limits on GHG emissions. PP has also submitted an undertaking stating that they will not take REC benefits for the same Emission Reductions.

### 1.16.2 Other Forms of Environmental Credit

Project has been registered with UNFCCC under Clean Development Mechanism program. Registration reference number is 8807. Project Proponent has submitted undertaking for not availing other forms of environmental credit for the same crediting period under consideration. Project Participant is not taking REC benefits for the same emission reductions.

## 1.17 Additional Information Relevant to the Project

### Leakage Management

Not applicable to this project activity.

### Commercially Sensitive Information

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

### Sustainable Development

The project contribution towards sustainable development is established in line with the sustainable development indicator framed by the host country DNA:

**Social benefits:**

- Reduces drudgery of women and children of rural areas (due to reduced fuel wood use) by reducing time spent and distance travelled for fuel wood collection. Reduction in firewood requirement would help in spending more time in productive activities such as education, employment etc[26]
- Improves overall health (particularly diseases related to respiratory system) of women and children by reducing smoke in the kitchen[27].

**Environmental benefits:**

- Improves the local environment by reducing rate of forest degradation /deforestation in the project area. Conservation of forest will not only reduce non- renewable biomass demand and also reduce soil erosion and loss of biodiversity as a consequence of deforestation[28].

[26] Wood Fuel Trade in India – Food and Agricultural Organisation of United Nation
[27] Clean Household Energy for all: WHO and Health in the green Economy – WHO
[28] Wood Fuel Trade in India, Regional Wood Energy Development Programme in Asia – Food and Agricultural Organisation of United Nations (pg. 58)

- Reduces emission of black carbon to the atmosphere[29].
- Reduces Green-house gas emissions[30].

**Economic benefits:**

- Employment opportunities for local communities involved in monitoring, training of users, undertaking periodic maintenance and post life time replacement.
- Reduces the expenditure involved in the pre project scenario for purchase of fuel wood.

**Technological benefits:**

- Introduction of new technology to the rural communities.
- Knowledge transfer to trainers including technicians for pertaining training to users, maintenance of system.
- Demonstration of a successful project at household level will create replication potential in other states and countries.

In view of the above, the project proponent considers that, the project activity profoundly contributes towards sustainable development of the region as well as of the nation.

### Further Information

There are no information or incidents that will have bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

# 2 SAFEGUARDS

## 2.1 No Net Harm

According to the Ministry of Environment and Forests (MoEF), Government of India, under the Environment Impact Assessment Notification vide S.O.1533(E), dated 14/09/2006;the project activity of utilization of Improved Cook stove for cooking in rural households does not require environmental impact assessment study to be carried out.

## 2.2 Local Stakeholder Consultation

Please refer to sections E 1 and E 2 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

[29] Household Cook stoves, Environment, Health and Climate Change – World Bank (page 13-14)
[30] Household Cook stoves, Environment, Health and Climate Change – World Bank (page 13-14)

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 2.3 Environmental Impact

Please refer to D 1 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 2.4 Public Comments

The commenting period for the Project Activity was from 22-March-2021 to 21-April-2021. No comments have been received during this period.

## 2.5 AFOLU-Specific Safeguards

Not Applicable

# 3 APPLICATION OF METHODOLOGY

## 3.1 Title and Reference of Methodology

Consolidated baseline methodology for "Energy efficiency measures in thermal applications of non-renewable biomass"; AMS II-G, Version 03.0.0 Sectoral Scope: 03, EB 68.

## 3.2 Applicability of Methodology

The project activity involves replacement of the traditional cook stoves by improved cook stoves. The improved cook stoves owing to its higher combustion efficiency of 29.88% in comparison to 10%[31] efficiency of the traditional cook stoves results in efficiency improvement and same do not exceed equivalent of 20 Giga watt hour (GWh) (60 giga watt hour thermal (GWhth))per year.. As the cumulative energy saving from the project activity is less than 20 GWh/annum or 60 GWhth/annum and each of the independent sub-systems i.e. Improved cook stoves used in household only for the purpose of cooking results an estimated annual energy savings of 4.073 MWhth or 1.358 MWh (detailed calculation presented in section B.5. of the PDD) which is well smaller than permissible limit of 600 MWh. Therefore, the project is considered appropriate to be developed under micro small-scale guidelines. The applicability

[31] Traditional cookstove is being used among all households in the baseline as per the survey, thus thermal efficiency is considered 10% for traditional stove according to the methodology.

criteria of the chosen methodology AMS-II. G (Version 03) is satisfied by the project activity in following manner:

**Criteria 1**
This category comprises appliances involving the efficiency improvements in the thermal applications of non-renewable biomass. Examples of these technologies and measures include the introduction of high efficiency[32] biomass fired cook stoves[33] or ovens or dryers and/or improvement of energy efficiency of existing biomass fired cook stoves or ovens or dryers.

**Justification**: The project activity involves dissemination of higher efficiency biomass fired cook stoves use as household appliances (29.88% as tested from MNRE approved centre) for cooking purpose[34]. This will contribute in reduction of non-renewable biomass consumption which would have been otherwise consumed by less efficient cook stoves. Since, it is an introduction of high efficiency cook stove the above condition is justified.

**Criteria 2**:
Project participants are able to show that non-renewable biomass has been used since 31 December 1989, using survey methods or referring to published literature, official reports or statistics.

**Justification**: Use of non-renewable biomass is established through demonstration of gap between the demand of fire wood and silviculturally permissible production of biomass from forest and tree outside forest. The fact is established using published literature referring to the following studies:

**Food and Agricultural Organisation of United Nation[35] - Regional Wood Energy Development Programme in Asia:**

The literature highlights gap in demand and supply of fuel wood across the country as well as across the state of Maharashtra. In accordance to the study, fuel wood consumption in real terms is much higher than the recorded production of about 30%; thus, leaving a wide gap leading towards unsustainable extraction of fire wood. Moreover, on account of population pressure, demand for firewood has outstripped natural regeneration and planting, so much so that in some areas there is food to eat but not enough wood is available to cook it (Mathur, 1987)". The report also highlight the statistics from Forest Survey of India (FSI1988:46) which estimated a gap of 130 million tonne between the demand and internal production of firewood in the country in 1987. The study also highlight demand for fuel-wood across Maharashtra in

[32] The efficiency of the project systems as certified by a national standards body or an appropriate certifying agent recognized by it. Alternatively manufacturers' specifications may be used.
[33] Single pot or multi pot portable or in-situ cook stoves with specified efficiency of at least 20%
[34] Ref: Thermal Efficiency Test Report of Improved Cook stove tested at Biomass Cook stove Testing Centre, Dept. of Renewable Energy Sources, Udaipur

[35] Regional Wood Energy Development Programme In Asia GCP/RAS/154/NET, RWEDP Report No 57, The Wood Fuel Scenario and Policy issues in India. Published by the FAO Regional Wood Energy Development Programme in Asia, Bangkok, Thailand

1980 around 17 million cu.m.as against the production of 1.5 million cu. m. from the recorded forest (Pethiya & Luthra, 1991). The quoted demand supply gap of fire wood is also highlighted in the finding of the National Council for Applied Economic Research (NCAER).

**State of Forest Report 1987, MoEF, Govt. of India:**
The report highlights gap between the demand and production of fire wood as major cause of deforestation. The reported consumption and production across the country within silviculturally permissible limit across the following years is indicated as follows

| Year | Consumption in million tonnes | Recorded Production in million tonnes |
|---|---|---|
| 1953-54 | 86.3 | 6.49 |
| 1960-61 | 99.6 | 8.15 |
| 1965-66 | 109.3 | 9.16 |
| 1970-71 | 117.9 | 11.62 |
| 1975-76 | 133.1 | 19m. from forest and 30 m. from tree outside fore |

In accordance the gap between demand and production is met through pilferage leading to continuous depletion of forest land.

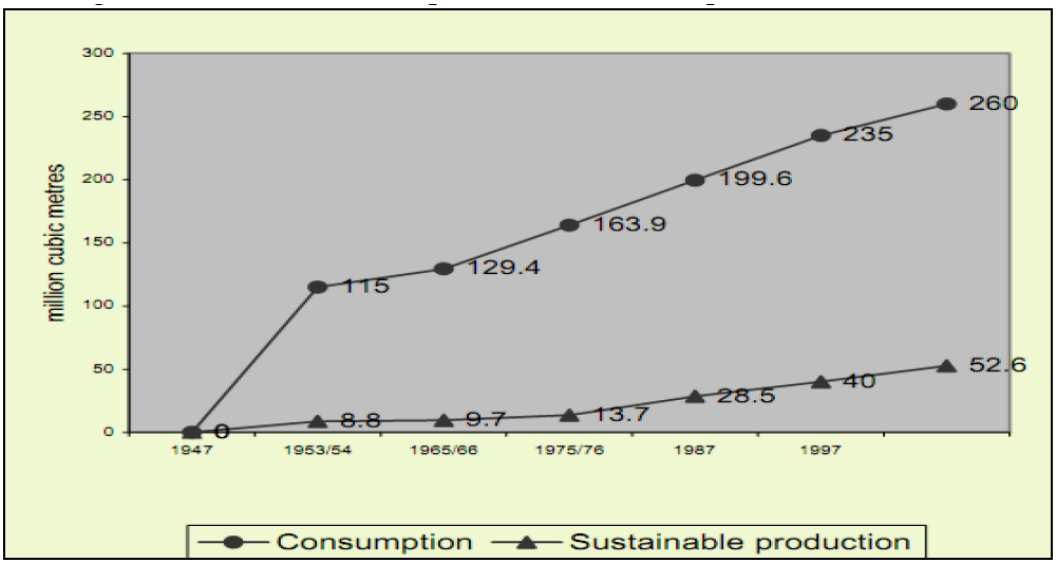
**Wood Fuel Trade in India: Food and Agricultural Organisation of United Nation:**

The report outlines demand- supply gap which has referred the expert committee report of MoEF dated 30.01.1998 as below –

| | | | *In million cubic metre* |
|---|---|---|---|
| **Year** | **Consumption** | **Sustainable Production** | **Gap** |
| 1953-54 | 115.0 | 8.8 | 106.2 |
| 1965-66 | 163.9 | 13.7 | 150.2 |
| 1975-76 | 199.6 | 28.5 | 171.4 |
| 1987-88 | 235.0 | 40.0 | 195.0 |

**Rural energy data sources and estimations in India - TERI**
The report refers to gap between consumption and recorded production of fuel-wood has however, increasing, indicating seriousness of the fuel-wood scarcity in India.

**Fuel wood consumption and sustainable production since 1947**




**Conclusion:**

Therefore, it is established from the above studies that, a staggering gap exists between the demand and potential for sustainably extractable fuel wood from forest land. While the first three studies refer to the fuel wood supply scenario and the gap that were precedent before 1989; the study by TERI highlight the widening of gap between the demand and supply of biomass after 1989. The widening of the gap has been for both reasons - due to the increased population pressure as well as the conversion of dense forest to medium dense, scrub and open type forest land due to unsustainable extraction even after the government's initiative towards promotion of afforestation. Thus, it can therefore be concluded that, the gap exists from and before 1989 and continued thereafter, forcing the population in using biomass extracted in un-sustainable manner which is identified as non-renewable component.

## 3.3 Project Boundary

According to the Paragraph 3 of approved methodology AMS-II.G., "The project boundary is the physical, geographical site of the efficient systems using biomass".

The project boundary is therefore, encompasses physical, geographical sites of all 14,190 individual households possessing efficient cook stove in 14 districts of Konkan, Nashik and Pune Divisions in Maharashtra. Based on the methodology, GHG included for the baseline and project scenario, leakage for the project activity is $CO_2$.

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline | Emission combustion fuel wood traditional stove from of in cook | $CO_2$ | Yes | This is the major Green-house gas emitting from combustion of fuel wood in the baseline scenario. |
| | | CH4 | No | Not Applicable as per the applicable methodology |

| Source | | Gas | Included? | Justification/Explanation |
|---|---|---|---|---|
| | | $N_2O$ | No | Not Applicable as per the applicable methodology |
| Project | Emission from consumption of fuel wood in efficient cook stoves | $CO_2$ | No | Not Applicable as per the applicable methodology |
| | | $CH_4$ | No | Not Applicable as per the applicable methodology |
| | | $N_2O$ | No | Not Applicable as per the applicable methodology |
| Leakage Emissions | Leakage related to the use/ diversion of non-renewable woody biomass saved under the project activity by non – project households/users | $CO_2$ | Yes | Baseline fuel wood consumption is multiplied by a net to gross adjustment factor of 0.95 to account for leakages. |
| | | CH4 | No | Not Applicable as per the applicable methodology |
| | | $N_2O$ | No | Not Applicable as per the applicable methodology |
| | Leakage related to if equipment utilised under the project activity is transferred from outside the boundary | $CO_2$ | No | Not Applicable as per the applicable methodology |
| | | CH4 | No | Not Applicable as per the applicable methodology |
| | | $N_2O$ | No | Not Applicable as per the applicable methodology |

## 3.4 Baseline Scenario

Please refer to section B 4 of PDD of the UNFCCC registered CDM project reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 3.5 Additionality

Please refer to section B 5 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 3.6 Methodology Deviations

Not Applicable, as there are no methodological deviations for this project activity.

# 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 4.1 Baseline Emissions

Please refer to section B 6.1 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 4.2 Project Emissions

Please refer to section B 6.1 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 4.3 Leakage

Please refer to section B 6.1 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 4.4 Net GHG Emission Reductions and Removals

Please refer to section B 6.4 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

| Year | Estimated baseline emissions or removals ($tCO_2e$) | Estimated project emissions or removals ($tCO_2e$) | Estimated leakage emissions ($tCO_2e$) | Estimated net GHG emission reductions or removals ($tCO_2e$) |
|---|---|---|---|---|
| Year 1 (01-October-2012 to 30-Setember-2013) | 13,930 | 0 | 697 | 13,233 |
| Year 2 (01-October-2013 to 30-Setember-2014) | 13,930 | 0 | 697 | 13,233 |
| Year 3 (01-October-2014 to 30-Setember-2015) | 13,930 | 0 | 697 | 13,233 |
| Year 4 (01-October-2015 to 30-Setember-2016) | 13,930 | 0 | 697 | 13,233 |
| Year 5 (01-October-2016 to 30-Setember-2017) | 13,930 | 0 | 697 | 13,233 |
| Year 6 (01-October-2017 to 30-Setember-2018) | 13,930 | 0 | 697 | 13,233 |
| Year 7 (01-October-2018 to 30-Setember-2019) | 13,930 | 0 | 697 | 13,233 |
| Year 8 (01-October-2019 to 30-Setember-2020) | 13,930 | 0 | 697 | 13,233 |
| Year 9 (01-October-2020 to 30-Setember-2021) | 13,930 | 0 | 697 | 13,233 |
| Year 10 (01-October-2021 to 30-Setember-2022) | 13,930 | 0 | 697 | 13,233 |
| **Total** | 139,300 | 0 | 6,970 | 132,330 |

# 5 MONITORING

## 5.1 Data and Parameters Available at Validation

Please refer to section B 6.2 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 5.2 Data and Parameters Monitored

Please refer to section B.7.1 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view

## 5.3 Monitoring Plan

Please refer to section B.7.3 of PDD of the UNFCCC registered CDM project with reference no. 8807.

The web link of the same is given below:

https://cdm.unfccc.int/Projects/DB/RWTUV1355662359.34/view