Improving Sustainable Energy Access among SC/ST Community in Chamarajanagara District of Karnataka

Ninga Setty H H and Dr. Lasya Gopal

[1] Corresponding Author: Mr. H H Ninga Setty, Field Manager, The Energy and Resources Institute (TERI), 4th Main Road, Domlur 2nd Stage, , Bangalore 560071, E-mail: hhnsetty@teri.res.in

[2] Fellow and Area Convenor, The Energy and Resources Institite (TERI) The Energy and Resources Institute (TERI), 4th Main Road, Domlur 2nd Stage, , Bangalore 560071, E-mail: lasya.gopal@teri.res.in

Abstract:

The main objective of the project was to improve the indoor air quality among SC&ST households in Chamarajanagara district, Karnataka state, through provision of clean energy solutions for cooking and lighting. This intervention was undertaken by The Energy and Resources Institute (TERI) with the support of Ministry of Science and Technology, Government of India. This pilot intervention comprised enhancing energy access, creating awareness and conducting training programmes and imparting technical know-how on the new technologies to village level energy entrepreneurs and end users of cook stoves and off-grid solutions among the SC/ST community. The project was implemented in six villages in Bhogapura Grama Panchayat (GP) in Chamarajanagara district, Karnataka state, as it is one of the backward districts and has a high SC/ST population.

The activities included implementation of 125 integrated domestic energy systems and 300 improved forced draft cook stoves, training of local entrepreneurs / people, stakeholder awareness, user training, establishment of service center, monitoring and assessing the performance of devices and project outcomes etc., assessing the socio-economic status and energy usage of SC/ST households before and post implementation.

The improved cook stove resulted in 43.90% savings in fuel wood, which translates into 366.01 tonnes of savings in fuel wood per annum and 669.79 tonnes of CO_2 reduction among beneficiary households. In addition, several advantages like faster cooking, less smoke, easy fuel processing, reduction in drudgery for women, reduced health risk for women were observed. Use of solar lights resulted in 40% savings in monthly electricity bill, reduced usage in kerosene (upto 3 litres per month) for lighting, indicating a potential to save an average of 4500 litres of kerosene per annum and reduction of 13.5 tonnes of CO_2. Other outcomes included, reduced smoke, relief from eye irritation, and longer duration of light enabled extended study/ work hours. Further, the un-electrified households were able to charge their cell phone batteries. The key learning is that this project provides for a model template for rolling out such programmes in other backward regions/villages in other parts

of the country. This paper describes the methodology, socio-economic profile of the project villages, type of activities carried out and impact of the project.

Key Words: Cook stove, Biomass, kerosene, un-electrified , households

1. Background

Modern energy access for basic lighting and cooking needs is fundamental to human development. In India there is a large gap between demand and supply of appropriate energy services. More than 40% of India's rural households and more than 5% urban households do not have electricity and are primarily dependent on kerosene lamps which can adversely impact human health. Four out of every five rural households and one out of every five urban households primarily use solid biomass fuel like firewood, crop residues and cattle dung as fuel in traditional mud stove/ three stone fire for cooking. Such traditional cooking practice is characterized by low thermal efficiency (10 to 12%) and emits toxic smoke. Women using traditional cook stoves are at increased health problems.

The energy issues create a huge opportunity for dissemination of off-grid lighting technologies that can provide reliable lighting during evenings and clean cooking technologies that can save fuel, reduce smoke in the kitchen and decrease cooking time substantially and minimise drudgery of collecting firewood.

This intervention was undertaken by The Energy and Resources Institute (TERI) with the support of the Department of Science and Technology (DST), Ministry of Science and Technology, Government of India. This pilot intervention comprised enhancing energy access, creating awareness and conducting training programmes and imparting technical know-how on the new technologies to village level energy entrepreneurs and end users of cook stoves and off-grid solutions among the SC/ST community. The project has been implemented in six villages in Bhogapura Grama Panchayat (GP) in Chamarajanagara district, Karnataka as it is one of the backward districts in the State and has a fairly large SC/ST population. The main objective of the project is to improve the indoor air quality among SC&ST households in selected villages of Chamarajanagara district through provision of clean energy solutions for cooking and lighting.

Chamarajanagara district consists of four taluks. The average size of land holding is 1.46 hectares as against the State average of 2.13 hectares. The population of the district is 1020962 (as per 2011 census). SC/ST population (379664) accounts for 37.19 % of the total population in the district, which is more than the State average of 24.1 %. The literacy level in the district is 61.43%, which is lower than the State average (75.36%). Most of the indicators suggest that the district is most backward. About 80% of the households are electrified. The Bhogapura GP has the highest SC/ST population compared to other GPs and was selected for implementing the project. There are 1150 households in the GP, out of them

513 (44.60%) households are SC and ST households. The total population of the GP is 5121, out of which 2486 (48.54%) belong to SC and ST community.

2. **Methodology**:

This project involved demonstration cum implementation, training of local people in promotion of cook stoves, off grid solution, testing of cook stoves, user training etc. As a first step, TERI carried out a survey to understand the socio-economic status and energy usage of SC/ST households. The study of cook stoves Four parameters were used to test the performance of four traditional cook stoves and one portable clay cook stove which are commonly used in the project area. The parameters tested included Kitchen Performance Test (KPT), Burning rate, thermal efficiency and emissions. The BIS procedures (Bureau of Indian Standards-IS 13152 part-1:2013) was adopted to study the traditional cook stove.

Results of survey: TERI surveyed the socio economic status and energy usage pattern of the target households through questionnaire in 440 households in six villages of target community. Out of the 440 households surveyed, 13.41% were ST households and the remaining were SC households. About 55.91% of the respondents were illiterate and 44.09% of respondents educated. Overall the educated percentage in the GP was less than the average in Chamarajanagara district which is 61.64%. About 44.55% of respondents are landless, while 50% have less than two acres of land. About 11.82% of the respondents had average annual income less than Rs. 10,000, about 36.36% of respondents earned Rs. 10001 to Rs. 25000, whereas, 38.86% of the respondents had an average annual income of Rs. 25000 to Rs. 50000 and others more than Rs.5000 per annum. The main source of income for about 74.09% of the respondents was labour work.

Energy Usage: About 48.60% of respondents have conventional ovens, 11.78% of respondents have kerosene stoves, 32.34% of respondents have LPG connection and 7.29 % of respondents have portable clay cook stove. The average fuel consumption was 4.6 kgs /day. About 18.43% of the respondents were purchasing fuel wood for Rs 3 to 5/ kg. About 14.31% of respondents were using kerosene stove as secondary device for preparation of coffee/tea, snacks items, etc. About 39.31% of the respondents using LPG for cooking, of which 4.54% of the respondents had two cylinders and the rest had a single cylinder. About 71.10% of respondents expressed that the food taste had changed when compared to cooking using based cook stoves. In case of electrifications About 91.13 % of the households were electrified, of which 50.13% respondents had electricity connection under the Bhagya Jyothi programme and the rest were connected under general schemes.

Performance testing of cook stoves *:* Four traditional cook stoves and one portable clay cook stove as well as five improved cook stoves were tested on Kitchen Performance Tests (KPT), burning rate, thermal efficiency and emission using Bureau of Indian Standards (BIS) procedure. The fuel consumption was less in improved ovens (39.84% per person) and

thermal efficiency was 28.06. In case of improved oven CO2 emission was lesser by 66.82 PPM, CO was 4.28 PPM less and particulate matter was 921 µg/m3 less

Awareness Programme: Six awareness programmes were conducted one each in five villages in Bhogapura Panchayath and 200 people participated. The main purpose was to create awareness among the community including GP members and staff in the villages on project purpose and the importance and benefits of improved cook stoves and solar lighting.

Training for local entrepreneurs and youths: TERI has conducted two training programmes, one for construction, including operation and maintenance of cook stoves and another one for repair and maintenance of solar lighting devices. For the training on cook stoves and solar lighting, TERI identified 15 masons and 40 youth (including women), who have background in SSLC, ITI, Diploma, PUC and degree and trained them in the construction of cook stoves and solar energy respectively.

Dissemination: Five IDES (4 low cost forced draft cook stove and one system with top load forced draft cook stove made up of steel) systems were demonstrated in four villages. In addition standalone system of low cost forced draft cook stove was demonstrated in two villages and one Anganavadi center.

TERI has procured off grid solutions from manufacture cum suppliers, who have been certified by MNRE and empaneled by TERI and cook stoves and spare parts of low cost forced draft cook stove from Energy entrepreneurs of TERI for demonstration. A Pre Dispatching Inspection was conducted for 5% of the products which were selected randomly before dispatching to the field by the manufacturers. After demonstration, TERI has identified 125 beneficiaries for installation of IDES. They were selected based on the socio economic survey, preference was given to un-electrified households and economically disadvantaged after concurrence from GP representatives and officers. The devices disseminated included, 125 Integrated Demotic Energy System (IDES consists of a forced draft cook stove, 4.8 W/12V -2 solar lights, 20W/12v solar panel, 20 Ah battery, 5A solar charge controller, mobile charging port and one extra port for power supply for stove) and 300 improved cook stoves (two types, i.e. top loading forced draft cook stove and low cost forced draft cook stove). The IDES solar home lights were installed by suppliers under supervision of TERI staff and the low cost forced draft cook stoves were constructed by local masons. After dissemination of technologies, about 20 user trainings were conducted for groups of 10 to 50 beneficiaries streetwise at the beneficiaries' households

Picture 1: IDES (Cook stove with solar home light distributed at Bhoagapura village

Establishment of Uttam Urja shop: One of energy entrepreneur was identified who has established a shop in Bhogapura. TERI took him to Bangalore and introduced suppliers and manufacturer of solar devices for procurement. He was provided initial stock including cook stoves, solar home lights, spare parts and tools box for repair and services. He was trained to undertake repairs and maintenance and was linked to suppliers and manufacturer of the energy saving devices. This step ensured the beneficiaries have a service and sales point closer to their households.

3. Results / Impact of the project

TERI has conducted impact study of 106 beneficiary households, of which 55 are IDES beneficiaries and 51 are improved cook stoves beneficiaries. Out of 106 beneficiaries, 93.40% of respondents have the improved cook stoves while 6.60% of respondents have dismantled the cook stove due to various reasons. Regarding the frequency of usage of the improved cook stoves, 19.81% of respondents use it as and when required, 14.15% of respondents use it partially, 35.35% of respondents use it regularly and 23.58% of respondents use it as a standby to LPG. After implementation of the Ujjwala Yojana of the Central Government and Anila Bhagya Yojana of the State Government , the usage of improved cook stove has drastically reduced because they have received LPG free of cost, which is easy to use too.

It was observed that 43.90% of fuel wood was saved as compared with conventional oven. With respect to the advantages of using the improved cook stoves, 75.47% of the respondents mentioned they perceived less smoke, 94.34% of respondents mentioned it was easy and appropriate for cooking, 96.23% of respondents mentioned that the fuel processing was easy , 95.28% of the respondents mentioned that fuel feeding was easy. About 78.30% of respondents mentioned that the time taken for cooking was lesser compared to conventional oven.

In case of solar home lights, the average electricity bill paid under general connection was Rs. 148 per month before installation of IDES and after installation the average electricity bill paid is Rs. 88 per month, which is about 40% savings in the electrical bill. Before installation

of IDES, all the respondents were using three liters of kerosene per month as fuel for lighting, and the expenditure for the same was Rs.81 per month. This expenditure has been saved after installation of IDES. In addition, the usage of kerosene light was causing eye irritation, headache and less light than desired. All the respondents used the solar lights regularly. About 53 respondents are using the solar light for more than three hours a day while the remaining use it for less than three hours. Most of the respondents expressed that they had light for longer duration, saved kerosene cost, there was no smoke and eye irritation, and children got more time to study, while the adults could work for more time. The unelectrified household respondents expressed that they were able to charge their cell phones in their houses unlike before when they had to charge it in their neighbours' homes.

Picture 2: Beneficiary using the Improved cook stove at K Mukahalli Village, Chamarajanagara district

4. Conclusion

IDES is well accepted by people, because of the erratic power supply from the grid. There is huge scope for promotion of IDES across Chamarajanagara districts because of the following reasons - 20% of households are un-electrified even among electrified households as they are not getting continuous power from the state grid, there are tribal settlements in forest fringe areas, no proper electricity connection, the tariff for electricity is increasing day by day. Implementation of Anila Bhagya of the State Government and Ujjawala yojana of the Central Government (LPG programmes) is catching up in a big way. However it does not address the issue of how under privileged communities will purchase refill cyliñders as these are less affordable for many families. Supplementing these programmes with biomass based improved cook stoves and IDES interventions will help these communities by alleviating financial burden to some extent and also providing clean energy sources for cooking and lighting as backup measure.

Reference:

1. Statistics of Chamarajanagara district accessed at http://chamrajnagar.nic.in/diststat/dist_stat1.html on 11/08/2016
2. Karnataka at Glance accessed at http://des.kar.nic.in/sites/KAG201516 on 17/9/2017
3. Portable solid biomass cook stove (Chulha)-Specification (First Revision) by BIS 2013, Bureau of Indian Standards accessed on 3/1/2017
4. https://www.census2011.co.in/census/state/karnataka.html accessed on 17/8/2018
5. http://chamrajnagar.nic.in/zp/About%20District.html accessed on 18/8/2017