

**POPULARISATION OF NON-CONVENTIONAL ENERGY SOURCES
AMONG IMK MEMBERS OF VENKITAPURAM AREA**

By

BHANU REKHA R.

**A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND
HIGHER EDUCATION FOR WOMEN - DEEMED UNIVERSITY, COIMBATORE - 641 043**

**IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE IN HOME SCIENCE EXTENSION EDUCATION**

APRIL - 1998

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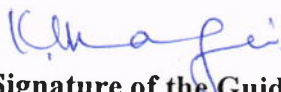
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APRIL 1998

Certified as Bonafide Research work



Signature of the Head of the Department



Signature of the Guide

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Introduction

INTRODUCTION

"Science and its application alone could redeem India from her manifold and pressing problems like food, shelter, population, health etc".

- Jawaharlal Nehru

Energy is one of the resources that determine the level of the country's economic development, self-sufficiency and the quality of life it can offer its people. Energy is any society's fundamental need. It aims at human welfare covering household, agriculture, transport and industrial complexes. Like other natural resources, energy resources are also renewable and non-renewable. Renewable resources of energy are mostly biomass based and are available in unlimited amount in nature since these can be renewed over a relatively short period of time. On the other hand non-renewable energy resources are available in limited amount and develop over a much longer period. As a result of unlimited use, they are likely to be exhausted one day. Earth is in trouble and so are we. The trouble is largely our own fault. We use energy too thoughtlessly, too wastefully and with too little imagination. The world's leading experts now agree that burning fossil fuels - coal, oil and gas, results in scarred landscaped oil spills, polluted waterways, acid rain and smog, which kills forests, chokes cities and shortens people's lives (Kohli and Tewari, 1997).

India is, at present, reeling under a severe power crisis. There will be an energy shortage of about seven to 16 per cent within the next five years. The projected growth in demand for energy from 1996 - 97 to 2009 - 10 is twice today's requirement.

The present installed power capacity of India is 80, 000 MW. Meeting our projected demand of 1, 72, 000 MW in 2010 A.D. means an annual addition of 6, 500 MV. In the present levels of exploitation, India's limited coal reserves, will last only 30 years. By 2000 A.D. India will be down to the last of its crude oil. India, which supports one sixth of the worlds total population has barely one per cent of the world's conventional energy resources with which to fulfil their needs. But India also has renewable sources such as solar, wind and biomass adequate enough to meet significant amount of her energy requirements (Banerjee, 1998).

Rapid depletion of traditional sources of energy has led to increasing concern and towards developing renewable sources of energy which would provide an everlasting solution. However, large scale exploitation of non-conventional sources require a high level of technology which can harness energy at costs that are comparable to those derived from conventional sources like coal and gas.

Recognising the above needs, the Government of India has concentrated its efforts for promoting appropriate alternate energy technologies through various departments and organisations, like Department of Science and Technology, Department of Rural Technology, etc., at the central level and Energy Development Agencies at the State level. As a result, considerable progress has been made during the last few years in research, demonstration and extension activities in areas of non-conventional energy sources keeping in mind the needs of the people. The whole spectrum of technologies which make use of non - conventional energy sources can be

categorised as household techniques, agricultural techniques and techniques for industrialisation.

The achievements in the field of non-conventional energy source are, about 1, 400 institutional plants were installed upto 1994-95. Against the annual target of 200 plants during 1995-96 the completion was reported as 288 plants at the cost of Rs. 2.48 crore. As against the potential of 1, 200 lakh numbers of chulahs have been installed upto the end of March 1996. Over 26 lakh improved chulahs have been installed during 1995-96 against the target of 24 lakh chulahs with budget estimates of Rs. 15 crore. Solar water heating systems for 3.51 lakhs sq. mt collector area and 4.7 lakh number of solar cookers have been installed by March 1996 in the country. During 1995-96, 680 street lighting systems and power plants of an aggregate capacity of 89 KWP were installed (India, 1997).

A notable feature of the growth in the renewable energy sector during the year 1995-96 is the significant increase in the extent of power generated from renewable energy sources. By the end of the financial year 1995-96 which is the fourth year of the 8th Five year plan, the total capacity connected to the grid has reached around 800 MV, constituting about one per cent of the total installed power generation capacity in the country. For the first time, renewable energy has come to be recognised as a contributor in the power scenario of the country.

With the package of incentives and promotional measures taken by the ministry, a momentum has been generated in this sector and an awareness has been

created among both the manufacturers and the users of renewable energy devices. India is now recognised as one of the leading countries where rapid strides have been made in harnessing renewable energy sources. As a result, major international commercial as well as developmental organisations are coming forward to establish joint ventures and extend technical and financial assistance in the renewable energy sector (Ministry of Non-conventional Energy Sources, Govt. of India. Annual Report, 1995-96).

The most important area that needs energy input in the domestic sector irrespective of all socio-economic varieties, is cooking. The consequences of inefficient and traditional cooking devices during the past have become alarming and pose serious threat to ecology and environment. The domestic cooking using biomass fuels such as wood, animal dung and crop residues in traditional chulahs which have low thermal efficiency and high emission factors have been a major cause for indoor pollution. Hence, it is to the women, who play a vital role in the domestic sector orientation and training on the correct use of the devices should be given which makes use of non-conventional energy sources and are the solution to the major health problems faced by women (Ravi and Moorthy, 1990).

Transfer of technology, to the needy people, is an activity which is intended to bring about socio-economic transformation by using available materials. The application of such a technology is expected to help generate employment, additional income, minimise fatigue, reduce drudgery among the users, eliminate wastage and ultimately improve the overall life style of the

masses. New household technologies not only reduced the drudgery of work but also offered the women convenient means to do the work. Smokeless chulahs and solar cookers, also offered the women environmental cleanliness. They decreased the work load, increased the leisure time and reduced drudgery of work. Thus the technology is to be judged by the contribution to social and economic development (Sharma, 1990). Negi (1995) pointed out that it was not possible to transfer each and every item developed by Research and development agencies, only those technologies which are considered as appropriate in the selected area should be attempted to popularise. An appropriate technology should utilise and upgrade man power resources, introduce new opportunities of work, reduce drudgeries, improve environmental and living conditions, so that the people may become self-reliant. The household technologies which make use of non-conventional sources of energy and are appropriate for the urban slum are Hay box, smokeless chulah and box-type solar cooker.

Indira Mahila Yojana (IMY) is a scheme by the Ministry of Human Resource Development in India. This scheme has been launched in 200 blocks in the states from 20th August, 1995. The IMY realises the need of full awareness of women in social, economical and procedural aspects in order to build the confidence of women, particularly rural women, so that they are able to decide their future course. The awareness building exercise will help them in their day to day activities. This will also help them in perceiving their immediate needs and identification of avenues for satisfying those needs.

The objectives of Indira Mahila Yojana are to ensure convergence of sectoral services at the local, block and district levels, through active involvement of women and sectoral departments; to optimise the utilisation of scarce resources in speeding up the process of mainstreaming women in development, to create awareness in women through provision of information on different development programmes and issues of specific concern to women, as also on equality of social status, legal rights, like those of property inheritance constitutional safeguards etc., to initiate a process of awareness generation education to enable them to understand and analyse their problems and find solutions through their collective interaction to match the individual programme benefits to their needs and to help women become self - reliant and independent by their economic empowerment through income generation activities and active participation in decision making at various stages (Department of Women and Child Development, 1995).

Avinashilingam Education Trust, Coimbatore has been given the responsibility of organising 40 IMKs in urban blocks in Coimbatore District by Department of Women and Child Development, Ministry of Human Resources Development, Government of India.

In the field of Science and Technology, though a large number of technologies have been developed by various research institutions and laboratories in our country, the benefits and fruits of such technologies have not percolated adequately down to the needy and the target group. This lacuna has been viewed

seriously by the Department of Home Science Extension Education, Avinashilingam Deemed University, which entrusted the investigator with the following objectives to be accomplished:

1. identifying various technologies appropriate to the urban slum in accordance with the socio-economic conditions of the locality.
2. educating the women on the use of non-conventional energy in the household.
3. motivating the women to adopt the selected technologies and devices and
4. studying the views of selected women on the use of the devices adopted

Review of Literature

II. REVIEW OF LITERATURE

The literature related to the study entitled “Popularisation of Non-conventional energy sources among IMK members of Venkitapuram area” was reviewed under the following headings:

- A. Indian Energy Scenario
- B. Women and ‘Science and Technology’
- C. Steps taken by the Government to popularise non-conventional energy sources and
- D. Related research studies

A. Indian Energy Scenario

Energy is an essential input for economic development and for improving the quality of life. India’s per capita consumption of commercial energy is only 1/8th of the world average. The non-commercial sources have been used extensively for hundreds of years but in a primitive and ineffective way. The indiscriminate use of renewable non-conventional energy sources, lead ~~US~~ to an energy crisis, (Chellappan, 1996 and Saradha, *et.al.*, 1992).

The energy conservation potential of industrial sector was 25 per cent and 20 per cent and 30 per cent in the transport and agricultural sector respectively. Utilisation of renewable energy sources was the need of the hour. Utilisation of renewable energy sources that is economically viable, technically feasible and is socially relevant to the conditions in India (Gopalswami, 1991).

India can follow a three path strategy in order to increase overall productivity. First, by better utilisation and using energy efficient appliances, waste of electricity (energy loss) can be put down and more goods and services can be produced using less energy. Secondly, substituting a more and more efficient form of energy in place of a less efficient form. Thirdly, increasing the dependence on solar and other renewable energy resources. Not only are they non-polluting but in the long run, become economically high because of depleting fuel resources (James and Schofield, 1990).

Targets were fixed for achieving efficiency standards on time bound basis. To meet the standards, incentives were provided for units. Table I gives the total consumption requirements for the year 2000 A.D.

TABLE - I

**ENERGY REQUIRED FOR HOUSEHOLD, INDUSTRY, TRANSPORTATION
AND AGRICULTURAL SECTORS FOR THE YEAR 2000 A.D.**

Sl.No.	Type of energy	Requirements
1.	Electricity	465.0 billion KWH
2.	Coal	188.0 million tonnes
3.	Oil	72.7 million tonnes
4.	Fuel wood	191.6 million tonnes
5.	Dung cake	105.0 million tonnes
6.	Vegetable waste	59.0 million tonnes

Domestic units require energy for a variety of needs like cooking, illumination, comfortable living, simplification of tasks, storage, recreation and entertainment and transport . The census of energy consumption in the households

covered by the 28th round of National Sample Survey showed that the share of non-commercial energy was 51 per cent in urban areas. Further on an average, 16.4 per cent of non-commercial fuel was collected in urban areas (Gopalan, 1990, Kalbagh, 1991 and Sharma, *et.al*, 1991).

The household sector is the largest consumer of energy accounting for about 50 per cent of the total energy consumption cooking is an important area in the domestic sector. Cooking consumes 79.72 per cent of fuel, water heating 17.84 per cent and lighting 3 per cent. The main cooking fuel in 90 per cent of the total households in the country was non-commercial (Financial Express, 1991 and Srinivasan, 1991).

By 2000 A.D. an average of 700 Kcal/day is required per person for cooking, heating and lighting. The total energy requirement for domestic use will turn out to be 25.5×10^{11} Kcal/year. Against this need, if one looks at the available sources and their calorific values (Table II) it becomes obvious that fuel wood consumption will be 100 times that of oil or gas (Gusain, 1990).

TABLE - II
SOURCE OF ENERGY AND ITS CALORIFIC VALUE

Sl.No.	Source of Energy	Calorific Value (Kcal/tonnes)
1.	Fuel wood	4.5×10
2.	Coal	4.6×10^6
3.	Methane gas	1.2×10
4.	Oil	4.4×10

B. Women and 'Science and Technology'

Women bear the brunt of 50-80 per cent of all agricultural production and are totally responsible on an average for the support of nearly 30 per cent of all rural families. The absence of an appropriate technology has long been felt, whether it is in housing, water supply, sanitation or other schemes for urban and rural needs. Women work mostly at two levels either in semi-skilled processing lines or in quality control and research and development (Chaturvedi, 1991 and Science for Villages, 1997).

Women show different participation rates in the current science and technology system. Women in many countries hold primary responsibility for agro forestry activities including the collection of fuels, fodder, medical plants etc. while the domain cash crops belongs to men. Their knowledge bases are different and their respective needs and interests are also distinct (Verma, 1991).

The world survey (1989) indicated that women normally do 2/3rds of the world's work, own 1/100th of the land and have only 1/100th of world income. This inequity had been recognised as the greatest challenge to Science and technology. Without technical knowledge women would be less able to realise their potential and contribute optimally to sustainable human development (Sardana and Gandhi, 1988).

In the field of science and technology, India stands third in global scene, but the representation of women in science subjects is only around 28 per cent.

Although there has been some improvement in women's access to science and technology education, women would still form only 9.3 per cent of scientific personnel, 0.7 per cent of engineering and technical personnel and 10 per cent in Medicine. This small number of women among scientific had to assert by themselves vigorously in order to get full access and also compete with men even to get equal treatment. In addition there are many hindrances, mostly inherited from the past, which prevent science and technology from having its full impact on women's empowerment, including socio-cultural aspects, parental obligations and role assignments which may start even from childhood and which may result in 'submissive' women. Women are also taught from early days not to question, whereas enquiry and questioning are essential for building up a proper scientific attitude (CAPART Clippings, 1993).

In developing countries the NGOs especially women's organisations, play a vital role to make development participative. But the NGOs at the grassroots alone could not achieve results in the transfer of technology without the help of qualified professionals and technical institutions to which they belong. A members of experiments by the AIWC and other organisations have shown that wherever the women beneficiaries themselves were given orientation and training on the correct use of the new devices, be it an improved chulah, wood stove, solar cooker, biogas solar, photo voltaic lanterns or solar dries the programme becomes sustainable (Varma, 1990).

The renewable energy sources, in the field of science and technology was regarded as a new dimension involving women in science and technology. The renewable energy sources are:

Bio-energy: Biomass assumes greater significance in a country like India where agriculture and related occupation have been the backbone of national economy (Sootha, 1991 and Science for Villages, 1997).

Solar energy: Being a tropical country, most parts of India receive sunshine for over 250 to 300 days in a year. The solar energy received by India is about 10 per cent efficiency. The total potential solar energy works out to be 6000twh This is equivalent to about 35 times the present electricity generation in India (Muthu, 1991).

Wind energy: The wind energy was exploited for drawing water for drinking and minor irrigation and for various application on the farm. Wind energy potential in India is estimated at 25000 MW roughly equivalent to 1/3 of the expected installed capacity of electricity generation (Natarajan, 1993).

Ocean power: There are three types of energy derived from oceans that is tidal, wave and OTEC. The use of wave and OTEC had begun in India (Financial Express, 1992).

Other Non-conventional Sources

Smokeless chulah

Improved chulahs had gained more importance since they make use of resources available locally, have minimal fuel costs and can be assembled with local labour and hence they are ideally suited to Indian conditions (National Programme On Improved Chulah, 1996).

Hay box

Hay box is a simple device which reduces fuel consumption and retains heat to a considerable time. It employs the primitive method of heat retention (Devadas, *et.al*, 1996).

C. Steps Taken by the Government to Popularise Non-conventional Energy Sources.

The steps taken by the government to popularise non-conventional energy sources are summarised under the following headings:

1. Initiatives taken by the government
2. Information and public education.
3. Publicity through electronic media
4. Publicity through print media
5. Publicity through exhibition and exhibition vans.
6. Miscellaneous

1. Initiatives

Initiatives taken by the government to popularise non-conventional energy sources.

The following initiatives have been taken by the Ministry.

- a. Substantial reduction has been effected in the rate of interest for funding of solar photo voltaic systems through IREDA. This has resulted in large scale demand for these systems.
- b. A system of partial funding of industry;
- c. The categories of beneficiaries eligible for solar lanterns have been enlarged.
- d. A novel scheme of opening of show rooms-cum-information centres in cities for dissemination and sale of renewable energy products has been started.
- e. Collaboration was proposed with New Energy Development Agency (NEDA) of Japan in the field of fuel cells.
- f. A scheme of incentives to the state electricity boards has been introduced to encourage their acceptance of power from renewables and to increase the level of their involvement in the sustained generation of electricity from renewables (Negi, 1995).

2. Information and public education

The momentum relating to information and publicity activities was kept up during the year. The creation of mass awareness for quick adoption of renewable energy systems and devices as well as to boost commercialisation of systems and devices on a countrywide scale was undertaken. An enhanced allocation of Rs. 6

crores for information and publicity activities made it possible to support the scaled up publicity activities of state nodal agencies and NGOs in the regional languages (Chaudhary , 1993).

3. Publicity through electronic media

A 15 minute sponsored programme was basis for broadcast over All India Radio on a weekly basis on biogas, improved chulah, solar thermal, solar photovoltaic and biomass during the year. The programme was broadcasted from 30 CBS channels in 11 regional languages, besides Hindi. Tillers were telecasted through regional Doordarshan kendras on biogas, improved chulah, solar cooker, solar hot water systems and solar photovoltaics. An allocation of Rs. 80 lakhs was made to Doordarshan for production and telecast of quality films/fillers. Films including one serial of B episodes are under production and likely to be telecast shortly. To promote publicity through films/fillers in regional languages, the ministry has released financial assistance of Rs. 20 lakhs to various state nodal agencies. A 35 mm film on wind energy is under production by the films division, Bombay (Dharmarajan, 1993).

4. Publicity through print media

Thematic advertisements have been published in English, Hindi and regional language newspapers/magazines covering most of the NRSE programmes during the year. The advertisements contained information in regard to technology use, applications and benefits of NRSE in order to inform and motivate users, manufacturers, traders, NGOs. A lot of enquiries, interest and awareness have

been generated by these advertisement. Urja Bharati issues, devoted thematically to wind energy and solar energy were published during the year. The thematic issues have been well received and are in demand by the NGOs, industry, traders and academic community in the country. Production of thematic brochures on biogas, improved chulah and solar cooker in English, Hindi and regional languages for countrywide distribution, was assigned to DAUD for production. The ministry also sanctioned financial assistance to TERI of about Rs. 2.81 lakhs to bring out the journal that is ASSET, devoted to NRSE programme (Nagarajan, 1991)

5. Through exhibition and exhibition vans

Against the annual target of 50 exhibitions, 46 exhibitions were organised during the year (till 31.1.96). Mobile exhibition vans fitted with NRSE working systems and devices demonstrating actual operation to the viewers have become very popular in the states. In addition to video film shows and photographic display. Printed materials and brochures were distributed to the viewers. Over 820 such demonstrations have been held till January, 1996. The ministry provided 50 per cent grant to the state governments/nodal agencies for fabrication of the vans. The cost of running, maintenance, repair etc. is to be met by the concerned agencies. Such mobile exhibition vans are available in the states of Delhi, Gujarat, Hariyana, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttar Pradesh (Pragathi and Reddy, 1995).

6. Miscellaneous

The National Service Centre provides permanent display of various NRSE systems and devices, photographic panels and models in the energy hall. The ministry is maintaining a photo chit for coverage of NRSE installations and providing photographs, transparencies and slides for use in the print media, exhibitions, seminars, conferences and to outside agencies. The photo unit also arranges for photographic and video coverage of important activities of the ministry. The I and P Division of the ministry maintains, exhibits viz., actual working systems of solar cooker, solar photovoltaic lighting, solar water heater, improved chulah and portable working models on wind energy, mini micro hydel and biogas etc. for exhibitions. The collection includes photographic panels, NRSE films, audio visual aids for exhibitions and demonstrations. The ministry has a library, catering mainly to technical and scientific requirements for day-to-day use and reference. The total number of books is 4022 including 1277 books in Hindi. In addition, the library runs a reading room and maintains literature and publications on technical, financial and administrative subjects (Varadharajan, 1990).

D. Related Research Studies

Jeyagowri and Jagadeesan (1993) stated that the labour saving devices were really time and energy savers and made home makers happy by relieving their drudgery and tension in performing day to day activities.

Borah and Ogale (1996), reported that knowledge of the existence of an innovation can create motivation for its adoption. Demonstration, exhibition and discussion enable the women to acquire more knowledge and subsequently paves way towards adoption of improved technology for reducing drudgery.

According to the study conducted by Devadas (1992), on various renewable sources of energy, widespread utilisation of renewable energies will require a suitable infrastructure for the manufacture, installation and servicing of renewable energy systems. Special efforts will be needed for the development of infrastructure, manufactures, installation and maintenance of the new systems. An awareness has to be promoted regarding the newer techniques which offer more efficient ways of utilising the renewable sources. For successful transfer of technology it is necessary that emphasis is placed on adequate follow-up.

A study was conducted by Geetha and Rajagopal (1991) on the attitudes of rural women towards drudgery in household work performance. This study emphasised the need for co-ordinated research to improve the efficiency of the existing chulahs and popularise the same to relieve homemakers of their drudgery.

Rajagopal, Geetha and Manonmani (1992) in their study on "Performance of selected smokeless chulah" suggested that all types of fuels can be used, minimum of 3 to 4 pieces of fuel wood should be used at a time, the utensil whether flat or round should fit correctly within the pot seat of the chulah. Use of two pot seats for simultaneous cooking is advantageous, the chulah should be free

of ash and the chimney should be cleaned atleast once a month to allow free passage of smoke.

Pushpa and Ramaswamy (1993) opined consumption of more non-commercial fuel for high population demands and judicious use of the same in energy efficient chulahs. On an average about 26063.83 MJ of non-conventional energy is consumed by a rural household annually in Tamil Nadu.

Susheela, *et al.* (1993) reported that the efficiency of round bottom vessels was higher when compared to flat bottom vessels. The round bottom vessels fitted firmly into the pot seat and being closer to the flame prevented the heat loss and enhanced absorption of heat. Gandhi *et al.* (1995), observed that the highest average thermal efficiency was observed in aluminium vessel (20.19 per cent) followed by steel (19.81 per cent) and brass vessel (19.64 per cent) in the two-pot smokeless chulah irrespective of fuel used.

Devadas and Rajagopal (1993) study on fuel management revealed that the thermal efficiency of the smokeless chulah was 25 per cent and the time required for cooking selected items and the fuel consumption was less in smokeless chulah as compared to that of traditional chulah. A reduction in time (20-30 minutes) and fuel (155-180 gm) was noted as a result of adoption of smokeless chulah.

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III - METHODOLOGY

The methodology for the study on the 'Popularisation of Appropriate Non-conventional Energy Sources among IMK members of Venkitapuram area' included the following steps:

- A. Planning the training programme
- B. Conducting the training programme
- C. Adoption of technology by the selected women and
- D. Follow-up of adoption

A. Planning the training programme

Planning the training programme involves the following steps:

- 1. Selection of the area
- 2. Selection of the sample
- 3. Selection of appropriate technologies
- 4. Preparation of plan of work

1. Selection of the area

The area selected for the study was Venkitapuram due to the major reason that it is one of the 'Adopted 40 urban areas' of Avinashilingam Deemed University, Coimbatore, to which the candidate belongs. The other reasons for the selection were easy accessibility to the area and familiarity of the area to the investigator.

2. Selection of the sample

All the 200 IMK members were taken for the baseline survey. The baseline survey was conducted with the help of an interview schedule prepared for the purpose (Appendix - I). Out of the 200 members, 25 members who showed keen interest in knowing about new technologies were selected for the training.

3. Selection of appropriate technologies

According to Schumacher (1984) appropriate technology must provide low priced consumer goods which satisfy the needs of the people and should involve simple technology.

Based on the buying capacity of the members, that is ability to spend Rs. 100 to Rs. 200, technologies were selected for the training. They were box type solar cooker, Hay box and Kalipatti model smokeless chulah.

4. Preparation of plan of work

A plan of work is an outline of activities so arranged as to enable efficient execution of the entire programme (Reddy, 1995). A plan of work was framed for the study, which is given in Table III.

TABLE - III

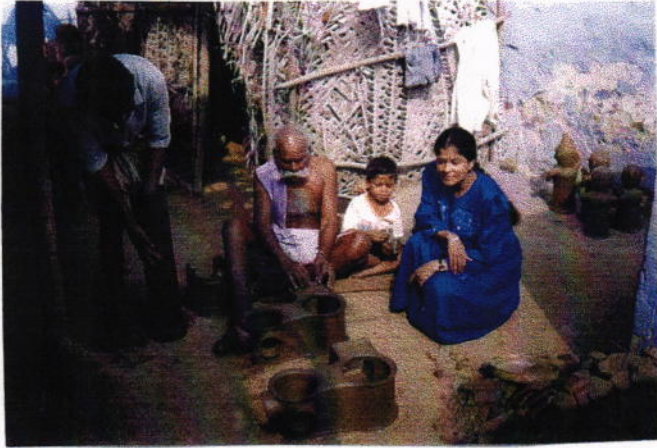
A PLAN OF WORK FOR EDUCATION ON NON-CONVENTIONAL ENERGY SOURCE FOR IMK MEMBERS OF VENKITAPURAM AREA

Sl. No	Date	Theme	Contents	Duration in minutes	Methods/ AV aids
1.	29.12.97	Know- edge test	Questions eliciting information about the knowledge of the IMK members about non-conventional energy sources before the training programme	40	Score card (Appendix -II)
		Introduc- tion	1. Present energy crisis in India 2. Use of renewable sources of energy 3. Hazards of using conventional type of energy sources	10 20 30	Lecture, Black board
2.	30.12.97	Non- conventio- nal energy sources	1. Significance of solar energy 2. Advantages of smokeless chulah over the conventional type 3. Hay box as an energy saving device	10 20 30	Talk, Exhibition, Posters, Charts
3.	31.1.98	Hay box	1. Different parts of the Hay box (Fig I.) 2. Procedure for using (Plate.I) 3. Maintenance of the Hay box 4. Advantages and disadvantages 5. Cost reference 6. Preparation of sweet pongal using Hay box(Plate.II)	15 20 10 30 10 30	Lecture Hay box Cooking demonstration

TABLE III (Contd.)

4.	19.1.98	Solar cooker	1. Parts of a solar cooker (Fig II)	15	Lecture Solar cooker cooking demonstration
			2. Procedure for using(Plate.III)	15	
			3. Maintenance of the solar cooker	20	
			4. Advantages and disadvantages	15	
			5. Cost reference	30	
			6. Preparation of vegetable noodles using solar cooker		
5.	13.2.98	Smokeless chulah	1. Parts of a smokeless chulah (Fig III)	15	Lecture, Blackboard
			2. Procedure for using chulah	20	
			3. Maintenance of the smokeless chulah	20	
			4. Advantages and disadvantages	15	
			5. Cost reference	15	
		Knowledge test	Questions eliciting information about the knowledge of the IMK members after the training programme	40	Score card (Appendix II)
6.	14.3.98	Working* of smokeless chulah	1. Possible fuels that can be used	15	Home visit Casual talk Working demonstration Cooking demonstration Smokeless chulah
			2. How to avoid blockage of the pipe?	10	
			3. How to clean the smokeless chulah after use?	15	
			4. Placement of vessels	15	
			5. Points to be remembered while cooking in a smokeless chulah.	30	
7.	23.3.98	Follow-up	1. To see the performance of the devices	45	Observation Interview schedule
			2. Benefits obtained	10	
			3. Problems faced	10	
			4. Suggestion for further improvement	10	

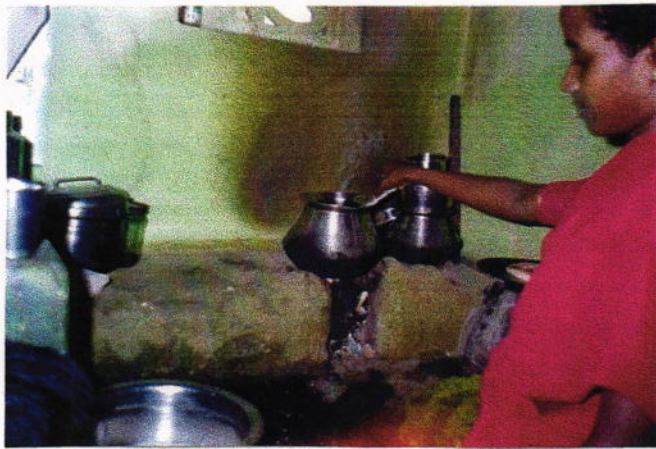
* The demonstrations were carried out in every house who had adopted the device.



CONSTRUCTION OF SMOKELESS CHULAH
Plate.V



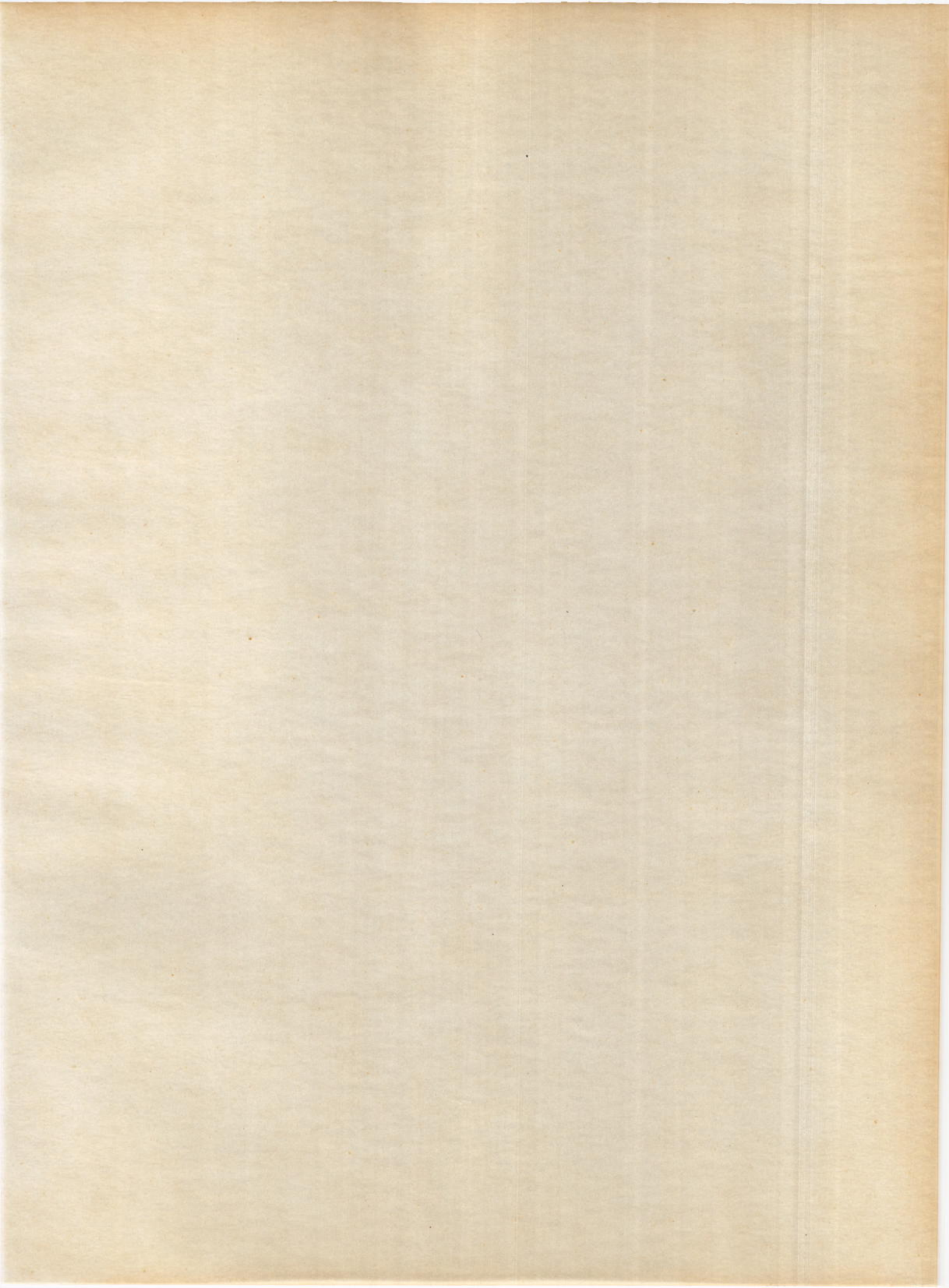
INSTALLATION OF
SMOKELESS CHULAH Plate.VI



BEFORE THE INSTALLATION
plate.VII



AFTER THE INSTALLATION
Plate.VIII





DEMONSTRATION OF SOLAR COOKER Plate.I



USING SOLAR COOKER Plate-II



DEMONSTRATION OF HAY BOX Plate III



USING HAY BOX Plate.IV

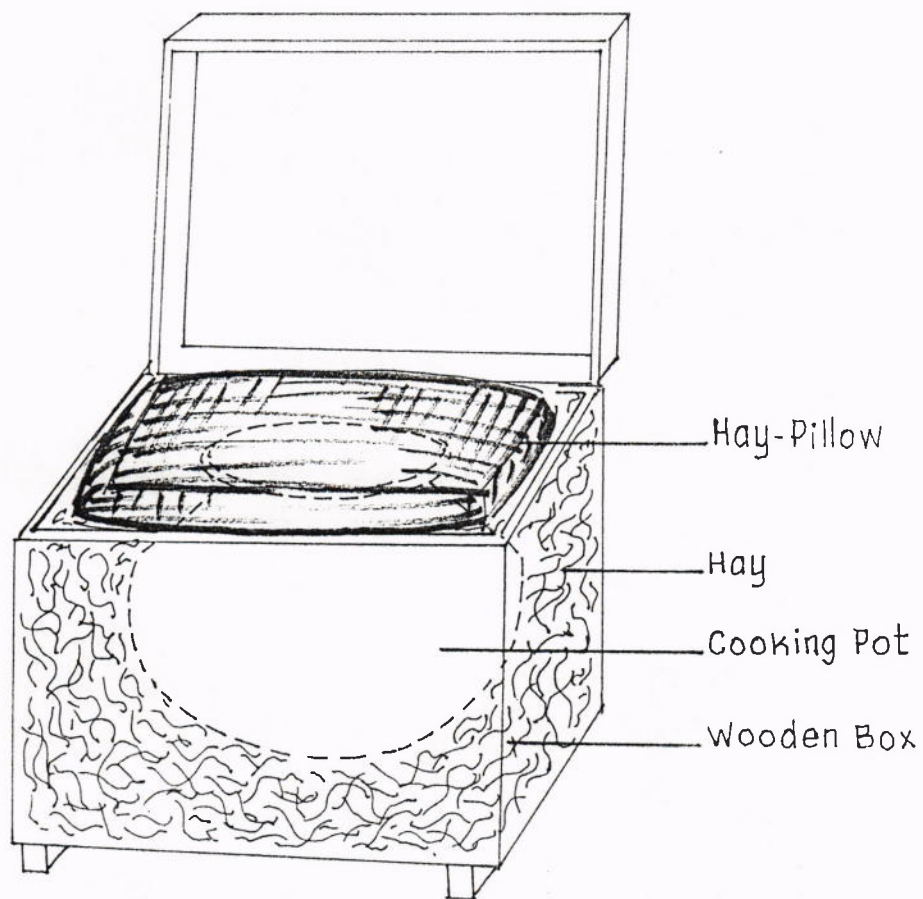


Figure. II PARTS OF HAY-BOX

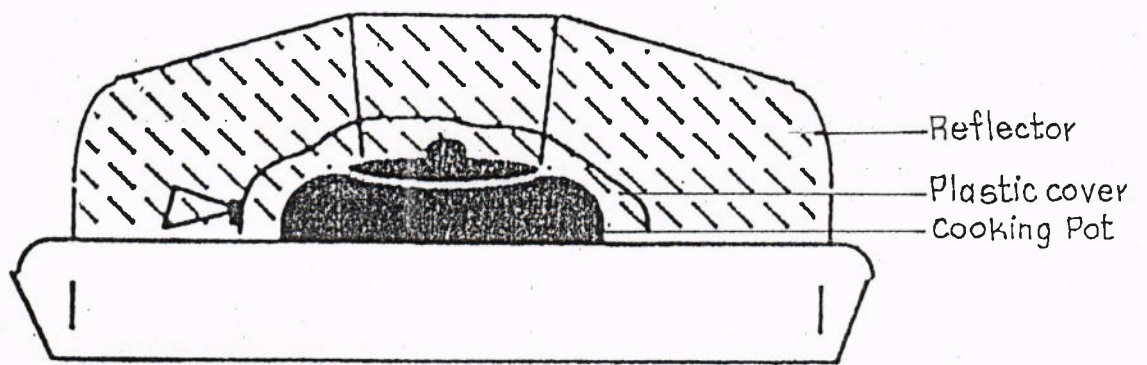


Figure.I PARTS OF SOLAR COOKER

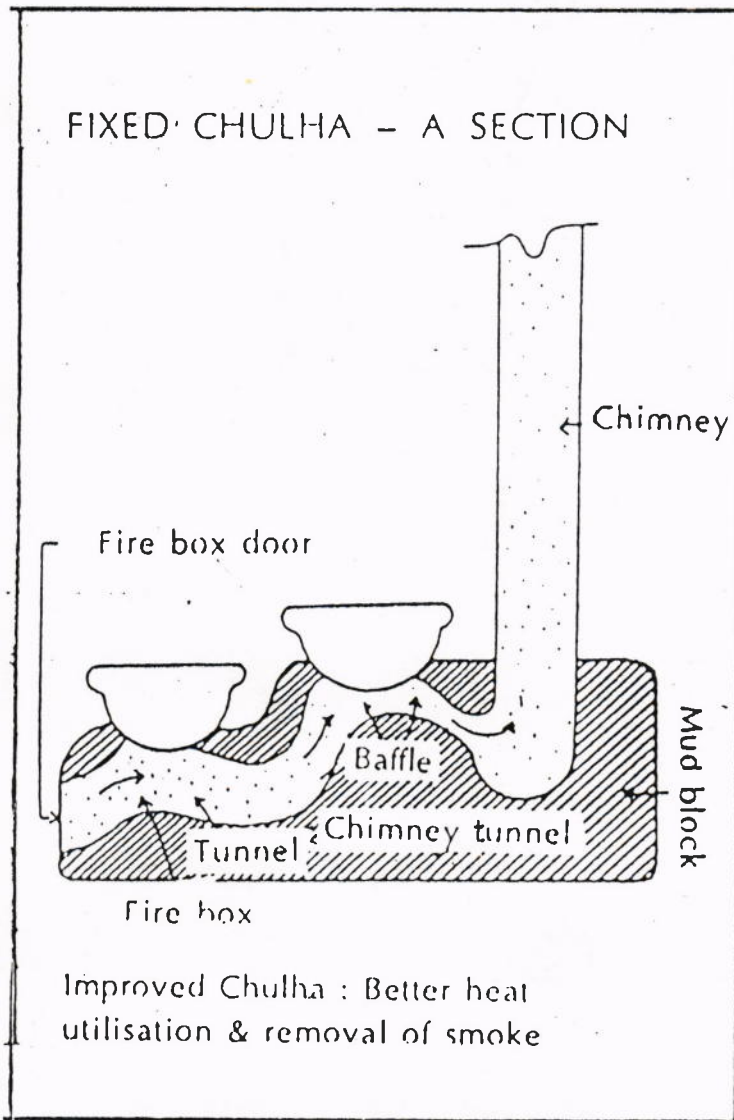


Figure. III PARTS OF SMOKELESS CHULHA

B. Conducting the training programme

The conduct of the training programme included the following steps:

1. Assessing the knowledge of the women before training programme
2. Implementing the programme
3. Evaluating the training programme

1. Assessing the knowledge of the women before training programme

Among the 200 IMK members, who were interviewed in the baseline survey, 25 women took active participation in the conduct of the training programme (List in Appendix IV). Using the score card (Appendix - II) the knowledge of 25 women was assessed before the training programme.

2. Implementing the programme

Based on the plan of work (Table III), the activities were carried out, step by step.

An introductory session was held to orient the members about the present energy crisis in India, use of renewable source of energy to combat the problem and the hazards of using conventional type of energy sources.

In order to give more emphasis on the use of devices using non-conventional energy sources, an exhibition was put up. The content of the exhibition includes the significance of solar energy, advantages of smokeless chulah over the conventional type and Hay box as an energy saving device.

A two hour programme was given exclusively on Hay box (Fig I). The knowledge dispersed were, the parts of the Hay box, procedure for using it, maintenance of the box, its advantages and disadvantages and cost reference. To make the learning process more lively, a cooking demonstration was also held.

By the grace of the sun god the investigator was able to instil in the minds of the people the significance of the sun energy in cooking. The information imbibed were regarding the different parts of the solar cooker (Fig II), procedures for using the solar cooker, its maintenance, advantages and disadvantages and cost reference. The preparation of vegetable noodles was also demonstrated by using the solar cooker to trigger the enthusiasm of the members.

To the majority who knew only about smoke-chulah, the introduction of 'smokeless-chulah was regarded as a boon. The investigator enlightened them by appropriate education on the different parts of smokeless chulah (Fig III) the procedure for using it, its maintenance, advantages and disadvantages and cost reference.

3. Evaluating the training programme

Having disseminated the knowledge regarding the selected technologies to the members, the members were tested to elicit information about their improved level of knowledge, using the same score card, used for the preliminary test. Summated scales (or Likert-type scales) are developed by utilising the item analysis approach wherein a particular item is evaluated on the basis of how well it

discriminates between those persons whose total score is high and those whose score is low. They are strongly agree, agree, don't know, disagree, strongly disagree.

Each point on the scale carried a score. Response indicating the least favourable degree of job satisfaction is given the least score and the most favourable is given the highest score (say 5). This way the instrument yields a total score for each respondent, which would then measure the respondent's favourableness toward the given point of view (Kothari, 1997). For analysis of the scores obtained before and after the training programme 't' test is used. Paired 't' test is used for judging the significance of the mean of difference between the two related samples (Gupta, 1996).

C. Adoption of the technology by the selected women

After the assessment of the training, the names of the members, who were interested in adopting the devices were taken into account. Only 15 members, out of 25 were ready to adopt smokeless chulah.

Fifteen smokeless chulah were bought from Thiru Rangasamy Udayar and Sons of Marudhur. As instructed by him the smokeless chulah was disseminated among the beneficiaries and they were instructed to keep eight bricks, four kgs cement, two measuring pan mud and 2 measuring pan sand for construction, on the particular date (13.3.98). As scheduled, the construction was carried out. The chulah was built on the floor or over a slab according to the wish of the

houseowner. It was allowed to set before use. A partial expenditure in buying and constructing the smokeless chulah was met by the Indira Mahila Yojana Scheme.

D. Follow-up of adoption

After the construction of the chulah, home visits were made every consecutive week, to each beneficiary's house, for two weeks and the extent of adoption of the technology was assessed through observation and using an interview schedule the benefits obtained, problems faced in using smokeless chulah and their suggestions were noted for further improvement. Further, an experiment was conducted to study the time, energy and fuel consumed for cooking the selected items before and after the adoption of smokeless chulah.

Results And Discussion

IV RESULTS AND DISCUSSION

The results of this effort on "Popularisation of Appropriate Non-conventional Energy Sources" are presented and discussed under the following headings:

- A. Background information of the IMK members
- B. Impact of the training of the IMK members and
- C. Strategies for follow-up

A. Background Information about the IMK members

This aspect is discussed as detailed below;

- 1. General information about the IMK members
- 2. Cognizance of the IMK members about the use of non-conventional energy sources in their household.

1. General Information about the IMK members:

Age, educational status, occupation and monthly income of the IMK members are furnished in Table IV.

TABLE - IV

DETAILS ABOUT THE IMK MEMBERS

Sl.No	Details	Percentage of IMK members (n:200)
1.	Age in years	
	below 30	50
	31-35	27
	36-40	23
2.	Educational status	
	Illiterate	51
	Literate	49

3. Occupational status	
Masonry	50
Household servants	40
Home maker	8
Others	2
4. Monthly income	
< = 1500	196
> = 1500	4

A majority of the IMK members belonged to the age group of below 30 years. Regarding their educational status, it is shocking that 51 per cent of them were illiterates. The different occupations of the IMK members were mason (50 per cent), household servants (40 per cent), Home makers (8 per cent) and others (2 per cent). Majority of the members were under the income level of Rs.1500 and below.

Table V gives details about the housing pattern of the IMK members

TABLE - V
HOUSING PATTERN OF THE IMK MEMBERS

Sl.No	Housing Pattern	Percentage of IMK members
1.	Row house	49
2.	Twin house	28.5
3.	Individual tiled house	21.0
4.	Individual terraced house	1.5

Among the selected IMK members 49 per cent were living in row houses followed by twin houses (28.5 per cent), individual tiled houses (21 per cent) and individual terraced houses.(1.5 per cent). Fuel expenditure pattern of the selected households are presented in Table VI.

TABLE - VI

FUEL EXPENDITURE PATTERN OF HOUSEHOLDS

Sl.No	Amount/Month in Rupees	Percentage of IMK members (n: 200)
1.	Below 150	19
2.	151-200	65
3.	201-250	16

For a majority of the households (65 per cent), monthly expenditure on fuel was Rs.150 to 200. About 19 per cent households spent below 150 per month and 16 per cent households spent Rs.200 to 250 per month.

Type of fuel and the gadget used by the households is given in Table VII.

TABLE - VII

TYPE OF FUEL AND GADGET USED

Sl.No.	Fuel type	Percentage of IMK members
1.	Gas	44
2.	Kerosene	41
3.	Conventional chulah	15

Majority of IMK members (44 per cent) used gas as the main source of energy for cooking, 41 members used kerosene and 15 members used fuelwood.

Among the 30 members who had conventional chulah, 25 had the system outside the house and five had inside the house.

The problems faced by the members in placing the chulah outside the house are given in Table VIII.

TABLE - VIII
PROBLEMS FACED BY THE MEMBERS

Sl.No.	Problems	Number of members stating (n: 25)
1	Cooking is difficult when it rains	25
2.	Cooking is impossible when the wind blows	25
3.	Open drainage and dust bins outside the house create unhygienic conditions for cooking	20
4.	Pets like dog, cat and hen disturb the cooking outside	20

The problems faced when the chulah is placed outside the house are, cooking becomes difficult when it rains, cooking is impossible when the wind blows, open drainage and dust bins outside the house create unhygienic conditions for cooking, and pets like dog, cat and hen disturb the cooking outside.

The problems sited by members who have the conventional chulah placed inside the house are, accumulation of smoke in the room, irritation of eyes, throat irritation, soot formation on vessels and over the cooking area, and affecting the health condition of the home makers.

2. Cognizance of IMK members about the use of non-conventional energy sources before the training programme

In order to find out the cognizance of the IMK members about new non-conventional energy sources, details were gathered regarding the knowledge about

the different types of non-conventional sources, reasons for not installing improved chulahs and the source of information about new technologies.

Table IX indicates the different types of non-conventional energy sources (used in household) which the IMK members had come across.

TABLE - IX

KNOWLEDGE OF THE IMK MEMBERS ABOUT THE DIFFERENT TYPES OF NON-CONVENTIONAL HOUSEHOLD DEVICES

Sl.No.	Sources	Percentage of IMK members (n:200)
1.	Hay box	44
2.	Smokeless chulah	40
3.	Solar cooker	60
4.	No idea	14

Forty four per cent of the member were aware of the principle behind Hay box. It was expressed by the members that it is identical to the age old custom of keeping food items covered by hay to retain heat, ripen the fruits etc. About 40 per cent knew about smokeless chulah and 60 about solar cooker. Though few members had an idea about the non-conventional energy sources they did not get opportunity to take interest in gathering additional informations about the devices and installing them in their houses. Fourteen per cent had no idea about the different types of non-conventional household devices.

The reasons for not installing improved chulahs before the training programme as expressed by the members are given in Table X.

TABLE X**REASONS FOR NOT INSTALLING IMPROVED CHULAHS BEFORE
THE TRAINING PROGRAMME**

Sl.No.	Major Reasons	Percentage of households (n:200)
1.	Not having adequate knowledge about the device	45
2.	Difficulty in locating the installation team	40
3.	Initial cost is not affordable	40
4.	Not satisfied with the working of the devices, as hinted by friends and relatives	10

It was shocking to find that about 45 per cent of them had no knowledge about the existence of a thing called smokeless chulah. The rest of the reasons were difficulty in meeting the initial cost and also in locating the installation team with skilled masonry help.

Table XI depicts the different sources of information, which the members are subjected to and which provides them with the information about new technologies regarding the use of non-conventional energy sources in their household.

TABLE XI**SOURCES OF INFORMATION ABOUT THE NEW TECHNOLOGIES**

Sl.No	Sources of Information	Percentage of members (n:200)
1.	Impersonal (print and non-print)	12.5
2.	Personal	
	a. Extension Agents	55
	b. Friends and Relatives	36
	c. Voluntary organisations	5

The study brings out that more than impersonal sources, the personal channels were the principal sources of information. The major sources of communication among the IMK members were the extension agents(55 per cent members) and friends and relatives (36 per cent).

B. Impact of the training of the IMK members

The impact of the training programme conducted for the selected 25 members is discussed in terms of cognizance of the IMK members on

1. Solar cooker
2. Hay box
3. Smokeless chulah
4. Overall gain in knowledge by the IMK members

1. Cognizance of the IMK members about solar cooker

The cognizance of IMK members about solar cooker is discussed in terms of sources obtained by the IMK members on different aspects of solar cooker before and after the training programme and individual scores obtained by the IMK members before and after the training programme regarding solar cooker. The data supporting these two and their discussions are presented in Table XII, Fig IV and Table XIII separately.

TABLE - XII**SCORES OBTAINED BY THE IMK MEMBERS ON DIFFERENT ASPECTS OF SOLAR COOKER**

Sl.No.	Aspects	Scores obtained by the members		Mean gain
		Before training (n:25)	After training (n:25)	
1.	Solar cooker-non-conventional energy	16	90	74
2.	No Fuel cost	18	86	68
3.	Reduces drudgery	43	85	42
4.	Nutrients saved	29	87	58
5.	Pollution free	38	88	50
6.	Saves attending time	37	99	62
7.	Foods does not get charred	36	90	54
8.	Food tastes good	30	87	57
9.	Less weight	35	92	57
10.	Simple operation	28	90	62

The mean gain in scores was high for the aspect, regarding solar cooker as a non-convention energy source (74 marks). Followed by it is no 'fuel cost'. The gain in score for it is 64 marks. Regarding the other aspects the gain in scores were almost same.

TABLE - XIII**INDIVIDUAL SCORES OBTAINED BY THE IMK MEMBERS REGARDING SOLAR COOKER**

Sl.No.	Scores obtained by the IMK members		Mean Gain
	Before training(n:25)	After training(n:25)	
1.	16	35	19
2.	12	35	23
3.	12	35	23
4.	12	35	23
5.	12	35	23
6.	15	35	20
7.	13	35	22
8.	12	35	23

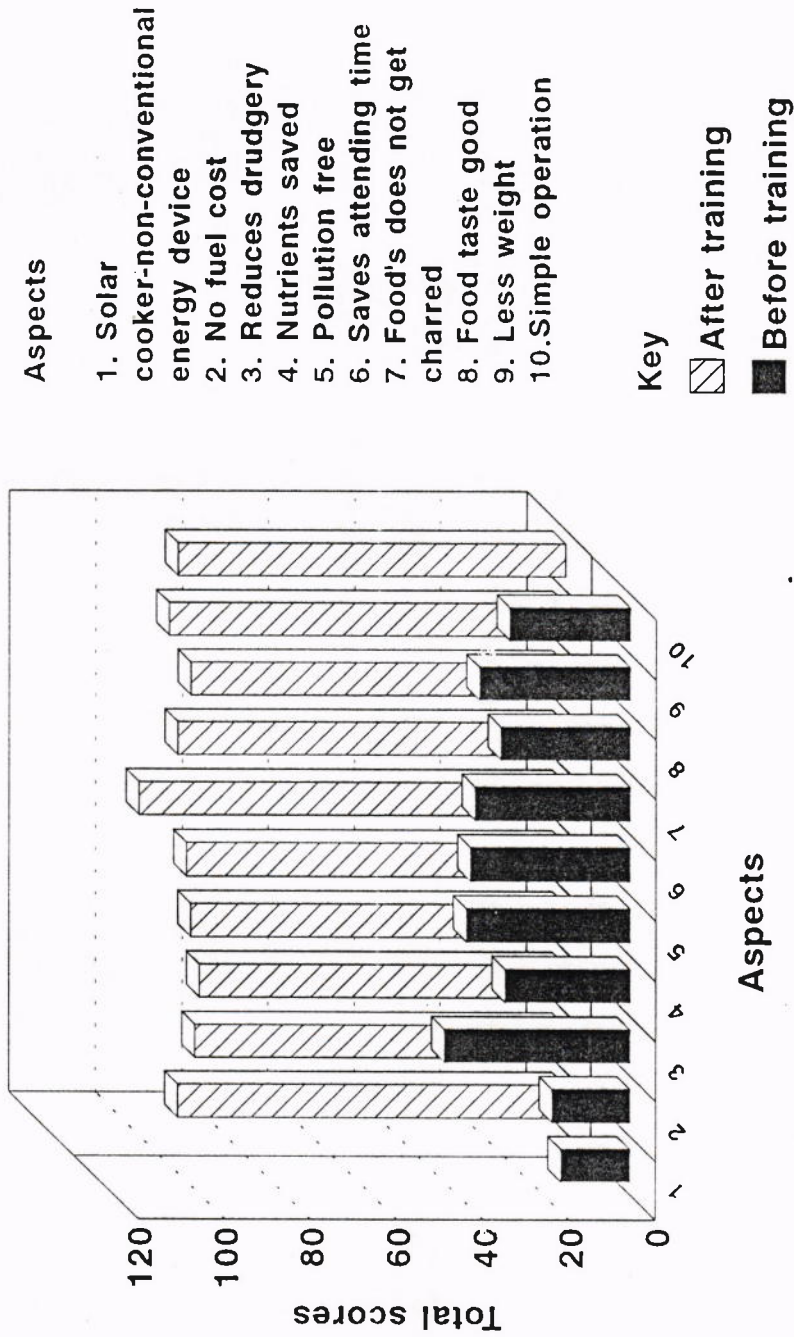


Fig. IV. Knowledge of IMK members on different aspects of solar cooker before and after the training programme

9.	12	36	24
10.	13	36	23
11.	13	38	25
12.	13	37	24
13.	13	36	23
14.	13	35	23
15.	12	35	23
16.	12	35	23
17.	15	35	20
18.	10	35	25
19.	12	35	23
20.	11	35	24
21.	11	35	24
22.	11	35	24
23.	10	35	25
24.	12	35	23
25.	15	35	20
Average	12.48 (31.20)	35.36 (88.40)	22.88 (57.20)
't' value	81.4		

*Percentages are given in parentheses.

From the data given in Table XIII it can be inferred that the mean percentage score before training was 31.20 and after training it was 88.40. Hence the mean percentage gain, that is mean percentage of the knowledge gained, by the trainees was 57.20. This figure shows a distinct increase of knowledge after the training by the trainees about solar cooker.

The calculated 't' value is greater than the table value. Hence the difference in the two means is significant at 0.01 level.

2. Cognizance of the IMK Members About Hay box

The cognizance of the IMK members about Hay box is analysed in terms of the scores of the IMK members on different aspects of Hay box before and after the

training programme and the individual scores obtained by the members with regard to Hay box before and after the training programme.

The data regarding the above two terms are given in Table XIV, Fig V and Table XV.

TABLE - XIV
SCORES OBTAINED BY THE IMK MEMBERS ON DIFFERENT ASPECTS OF HAY BOX

Sl.No	Aspects	Scores obtained by the IMK members		Mean gain
		Before training (n:25)	After training (n:25)	
1.	Hay box -- non-conventional energy device	50	76	26
2.	Hay is an insulating material	45	98	53
3.	Relives drudgery	44	96	52
4.	Saves 50 per cent fuel	38	94	56
5.	Retains heat	47	99	52
6.	Reduces attending time	45	87	42
7.	Foods does not get charred	41	90	49
8.	Hay box is inexpensive	45	85	40
9.	Saves money	40	92	52
10.	Does not require servicing charge	47	86	39

The mean gain in scores was high for the aspect that the 'hay box saves 50 per cent of fuel'(56).

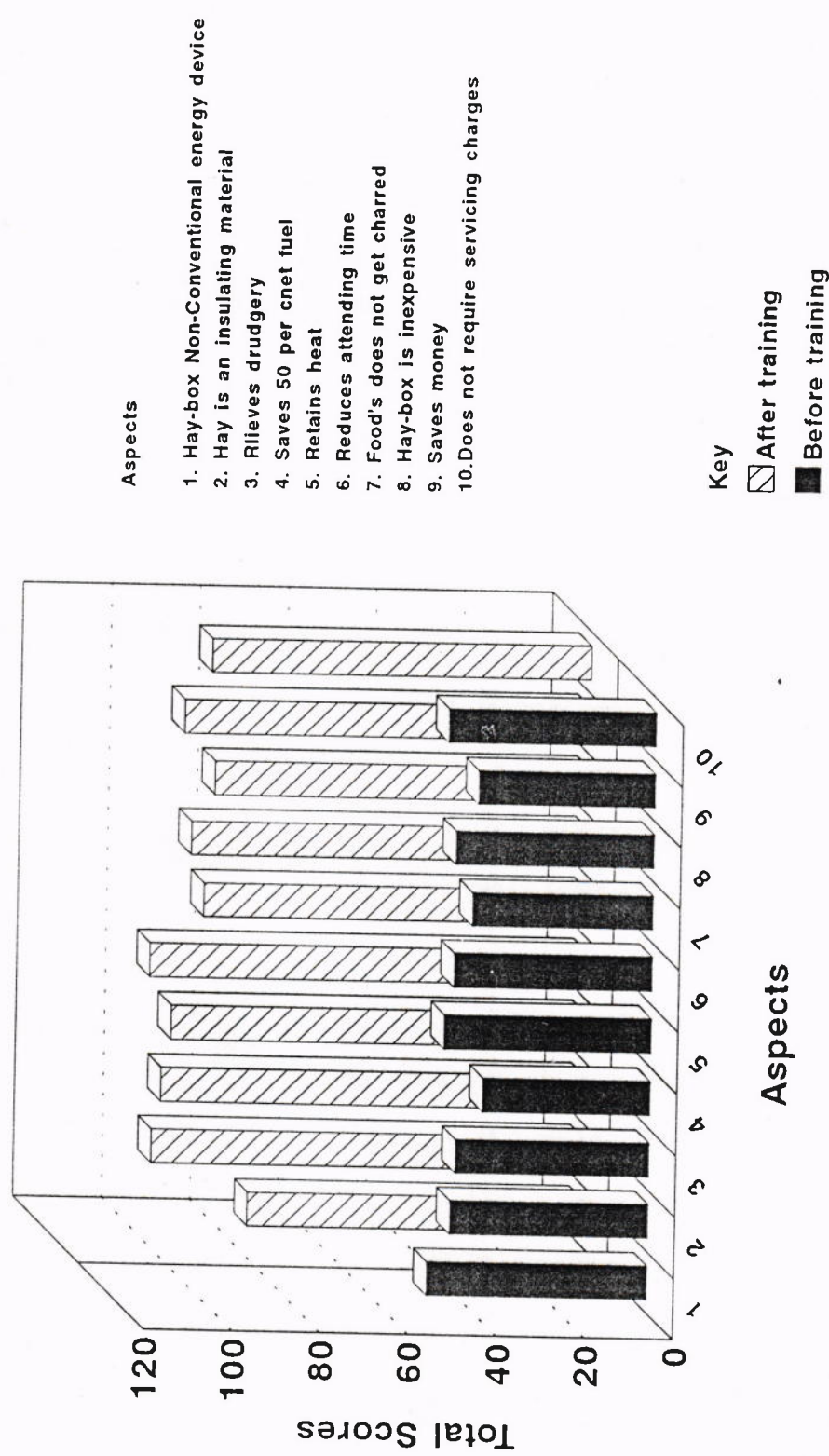


Fig. V. Knowledge of IMK members on different aspects of Hay box before and after the training programme

TABLE - XV

KNOWLEDGE OF IMK MEMBERS BEFORE AND AFTER THE TRAINING PROGRAMME ABOUT HAY BOX

Sl.No. of trainees	Scores obtained by the IMK members		Mean gain
	Before training(n:25)	After training(n:25)	
1.	20	36	16
2.	20	46	26
3.	17	46	29
4.	17	47	30
5.	16	47	31
6.	18	47	29
7.	17	47	30
8.	17	47	30
9.	18	48	30
10.	19	48	29
11.	19	49	30
12.	20	48	28
13.	20	48	28
14.	19	48	29
15.	19	48	29
16.	19	48	29
17.	18	48	30
18.	17	48	31
19.	16	48	32
20.	16	45	29
21.	17	45	28
22.	16	45	29
23.	18	45	37
24.	19	45	36
25.	20	43	23
Average	18.76 (46.90)	36.72 (91.80)	17.96 (44.90)
't' value	67		

*Percentages are given in parantheses

The mean percentage score before training was 46.90 and after training it was 91.80. Hence the mean percentage gain that is mean percentage of the

knowledge gained by the trainees was 44.90. This figure shows a distinct increase of knowledge after the training by the trainees about hay box.

The calculated 't' value is greater than the table value. Hence the difference in the two means is significant at 0.01 level.

3. Cognizance of the IMK members about smokeless chulah

The cognizance of the IMK members about smokeless chulah is presented in terms of scores of the IMK members on different aspects of smokeless chulah before and after the training programme and the individual scores obtained by the members with regard to smokeless chulah before and after the training programme. The data regarding the above two terms are presented in Table XVI, Fig. VI and Table XVII.

TABLE - XVI
SCORES OBTAINED BY THE IMK MEMBERS ON DIFFERENT ASPECTS OF SMOKELESS CHULAH

Sl. No.	Aspects	Scores obtained by the IMK members		Mean Gain
		Before training (n:25)	After training (n:25)	
1.	Smokeless chulah-non-conventional device	19	89	70
2.	Eliminates smoke	20	89	69
3.	Removes eye strain	17	89	72
4.	Removes drudgery	20	70	50
5.	Keeps kitchen wall clean	14	89	75
6.	L nds for the use of all types of fuels	13	88	75
7.	Gives soot free utensils	17	89	72
8.	Simple technology	17	90	73
9.	The food gets cooked fast	16	89	73
10.	Thermal efficiency is higher than the conventional chulah	13	89	76

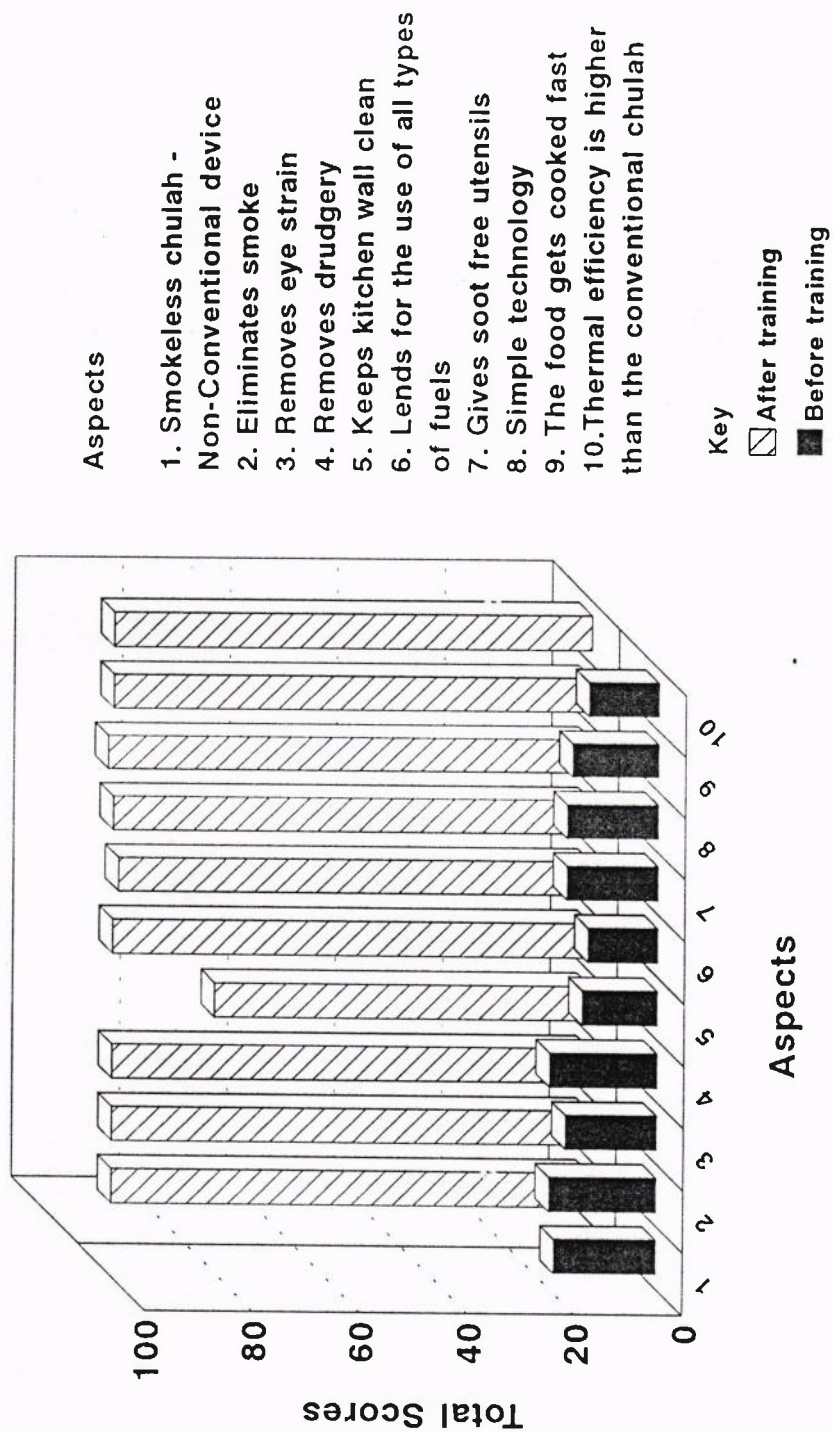


Fig. VI. Knowledge of IMK members on different aspects of smokeless chulah before and after the training programme

The mean gain in knowledge by the IMK members was high for the aspect of smokeless chulah's high thermal efficiency (76).

TABLE - XVII

KNOWLEDGE OF IMK MEMBERS BEFORE AND AFTER THE TRAINING PROGRAMME ABOUT SMOKELESS CHULAH

Sl.No of the trainees.	Scores obtained by the IMK members		Mean Gain
	Before training(n:25)	After training(n:25)	
1.	10	30	20
2.	6	33	27
3.	5	34	29
4.	5	35	30
5.	5	35	30
6.	5	35	30
7.	5	35	30
8.	5	35	30
9.	5	36	31
10.	7	38	31
11.	8	40	32
12.	8	40	32
13.	8	40	32
14.	9	40	31
15.	9	40	31
16.	9	37	28
17.	8	36	28
18.	8	35	27
19.	6	35	29
20.	5	35	30
21.	5	35	30
22.	5	35	30
23.	5	35	30
24.	6	34	28
25.	10	30	20
Average	6.28 (16.70)	34.12 (89.30)	29.04 (72.60)
't' value	43.93		

*Percentages are given in parantheses

The mean scores obtained in the pre and post training period are 16.70 per cent and 89.30 respectively amounting to 72.60 per cent mean gain. The calculated 't' value is greater than the table value. Hence there is a significant difference in the means at 0.01 level.

4. Overall gain in knowledge by the IMK members

To elicit comparison of extent of knowledge gained by the trainees on the selected technologies, the results are given in a consolidated form in Table XVIII and Fig VII.

TABLE - XVIII

OVERALL GAIN IN KNOWLEDGE BY THE IMK MEMBERS

Sl.No..	Devices	Mean gain in scores of the IMK members	S.D.	't' value
1	Solar cooker	22.88 (57.20)	0.9969	81.14
2	Hay box	17.96 (44.90)	1.513	67
3	Smokeless chulah	29.04 (72.60)	2.34	43.93

* Significant at 0.01 level
Percentages are given in parantheses

The mean gain in percentage scores by the IMK members was highest for smokeless chulah (72.6 per cent) as majority of the trainees were using conventional chulah at the time of the training, followed by solar cooker (57.2 per cent) and Hay box (44.9 per cent).

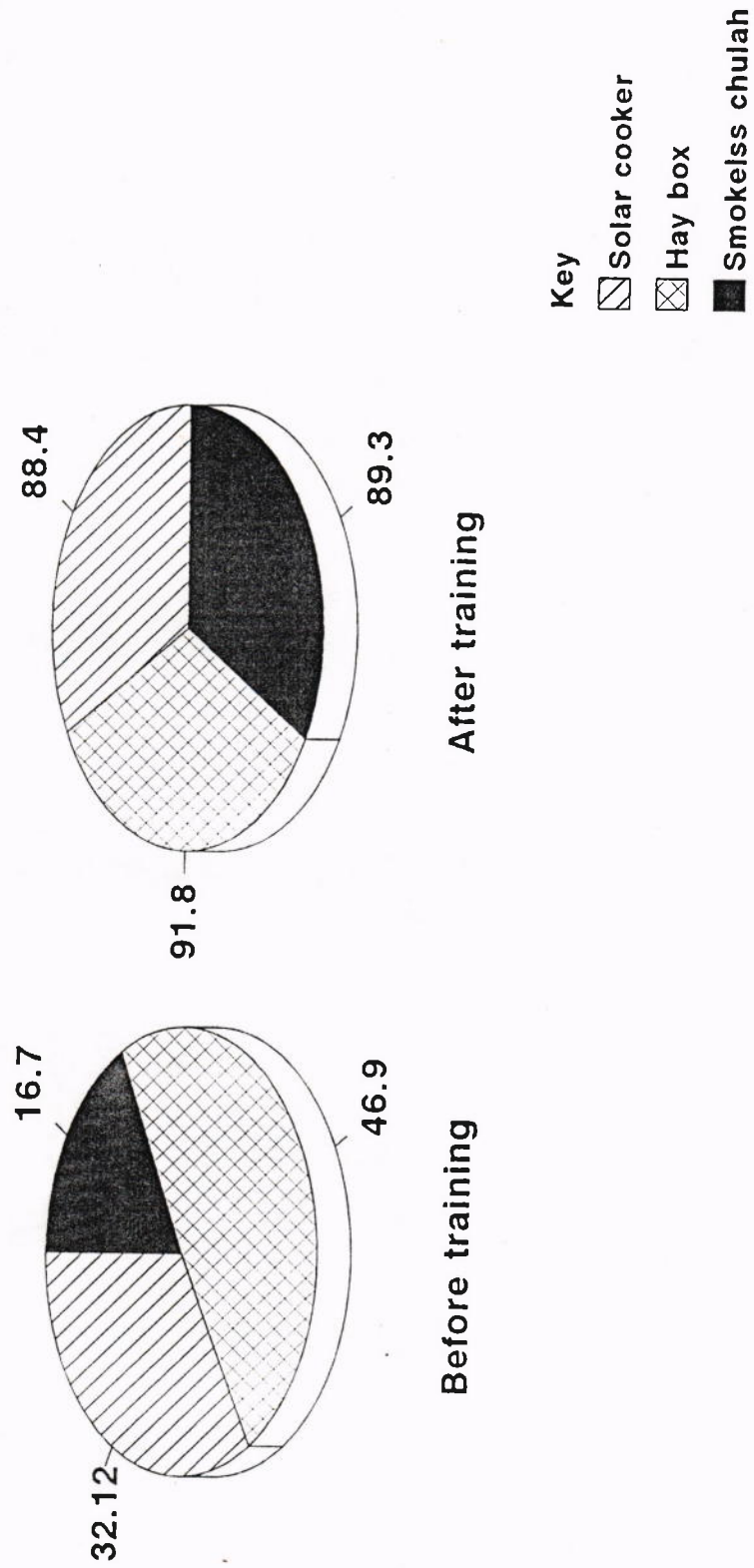


Fig. VII. Overall gain in knowledge by the IMK members

The 't' values are also greater than the table values which further stresses the significant difference of the mean at 0.01 level.

C. Strategies for follow up

As a follow up of the training the investigator collected information regarding the extent of adoption of smokeless chulah and the feedback of the beneficiaries.

This aspect is discussed in terms of

- i) Extent of adoption of the smokeless chulah
- ii) Feedback of adoption

I, Extent of adoption of the smokeless chulah

Out of the 25 members trained only 15 members adopted smokeless chulah. In six households the chulah was constructed and in nine households the beneficiaries agreed to erect it after sometime.

The reasons for 10 members not adopting smokeless chulah after exposure to training were, they wanted to see the experience of their friends and relatives who adopted smokeless chulah. Secondly, they used chulah only for water heating purpose and the Kalipatti model popularised by the investigator does not serve the purpose.

Nine members bought the chulah but did not construct it owing to reasons such as they themselves know masonry. They wanted to construct the chulah by themselves and thereby reduce the construction charge of Rs.50. Some wanted to build it after shifting the house and a few after reconstructing their kitchen.

CASE STUDIES

CASE-I

Lakshmi Thilagam is an young energetic woman of 27 years. She has studied upto middle school. Her family members consists of four members. Their monthly income is Rs. 1, 000 and their monthly fuel expenditure is Rs. 165. She takes an active part in the proceedings of the IMK. When the investigator introduced smokeless chulah in her area she was the first to come forward and adopt the technology. She wanted to be a model to others. Seeing the performance not only she was dumb-folded but even her neighbours, who also wanted to install the device in their own houses. the type of fuel used in Lakshmi's house was wood. it took 60 minutes to cook 1 kg rice and 150 gms dhal in traditional chulah. But in the improved chulah it took only 42 minutes. Similarly regarding the fuel consumption a little less than 1 kg that is about 800 gms was consumed by the traditional method to cook the referred items. But only 635 gms was consumed by making use of the improved smokeless chulah. Thilagam was very happy that she had made a sensible investment.

CASE-II

Manickam is a neighbour of Lakshmi Thilagam, who adopted the chulah and is of the same age group. Their monthly income was Rs.1, 000 and their monthly fuel expenditure was Rs.150. She was motivated by Thilagams adoption of the chulah and wanted to install the device in her house also. After few days of installing, her attitude distinctly changed towards cooking. Her family consisted of

five members. It took 50 minutes to cook 1 kg of rice and 200 gms of dhal in the traditional chulah. But in the improved chulah it took only 30 minutes to cook the same. It consumed 825 gms in the traditional model but it consumed only 650 gms in the improved chulah. She always felt frustrated to cook in the traditional chulah. But now she enjoys cooking in the smokeless chulah. She expressed that apart from making the kitchen a livable place, the smokeless chulah plays a significant role in reducing the drudgery in cooking.

CASE-III

Savithiri is a 29 year old woman. Their monthly income was Rs.1, 500 and their monthly fuel expenditure Rs.185. She was malnourished and anaemic. She was advised by the doctor to avoid smoke. But she could not do it, as she had to cook food for her family. She took part in the training programme and was motivated to install the device in her house. Her family consisted of six members. It took her 60 minutes to cook 1 kg and 250 gms of rice and 200 gms of dhal in the traditional chulah. But in the Improved chulah it took only 40 minutes to cook the same. The primary type of fuel used was firewood. It costs 850 gms to cook the indicated amount of ingredients in the traditional chulah. But it took only 670 gms of firewood to cook in the new smokeless chulah. She owes her gratitude to the smokeless chulah which has brought forth happiness into her house. She attributes more positive points in the use of the smokeless chulah as fuel efficient, time saving and soot free.

CASE-IV

An anganwadi worker, Mrs. V.G. Manickam was one of 'educated' few of the IMK members, who took an active part in the training programme. Her family consisted of four members. Their monthly income was Rs. 1, 000 and their monthly fuel expenditure was Rs.175. She made use of barks and twigs as fuel for the traditional chulah. She could cook 750 gms of rice and 150 gms of dhal using 750 gms of barks and twigs in 55 minutes. But after adopting smokeless chulah her fuel consumption had reduced to 576 gm and the time taken reduced to 26 minutes, for cooking the same. Her dream of a well lighted, well ventilated, smokeless and dirt free kitchen was fulfilled by adopting the smokeless chulah.

CASE-V

Mrs. Thilagamani was a young home maker of a family. Their monthly income was Rs. 1, 500 and their monthly fuel expenditure was Rs. 155 Consisting of five members, She was 20 years old. She had always controversies in a new technology. She was somehow pacified to adopt the smokeless chulah, she was in a confused state. After making use of the smokeless chulah she reported that she used 900 gms of fuel wood and took 60 minutes to cook 1 kg of rice and 200 gms dhal in the traditional chulah. But the smokeless chulah had reduced the consumption to 720 gms and the time reduced to 30 minutes to cook the same. She had her traditional chulah placed outside the house due to reasons such as smoke accumulation in the room and unable to carry out other activities in the multipurpose room. Now they had the smokeless chulah placed inside the house

but they don't face the problems as sited earlier in the traditional chulah. Now the members of the house have free movement in the house irrespective of whether cooking is carried out or not.

CASE-VI

Shakir Nusa, a 40 year old women was regarded as the head of a family consisted of five members. The family income was Rs. 1500 and their monthly fuel expenditure was Rs.165. She was traditional bound. She was not the one to easily change her ways when the smokeless chulah was first introduced in the area by the investigator. She just took part in the training programme out of eagerness to know what it is but ended up adopting the same. She was thrilled to see the modification of the traditional chulah and the wonders it could do. She heats water (20 litres) in 30 minutes using traditional chulah which was nearly half the time taken by the traditional chulahth at is 65 minutes. And even the fuel consumption was comparatively less. That is 800 gms was consumed in the traditional chulah but only 630 gms of fuel wood consumption was observed in the smokeless chulah. She recommended the smokeless chulah as a necessary part of a middle income household.

The average fuel, moneyand time consumed for cooking before and after adopting smokeless chulah by the selected home makers is presented in Table XIX.

TABLE - XIX

AVERAGE FUEL, MONEY AND TIME CONSUMED FOR COOKING BEFORE AND AFTER ADOPTING SMOKELESS CHULAH BY THE SELECTED HOME MAKERS

Sl. NO.	Name	No. of members in the Family	Items cooked	Amount cooked	Fuel consumption (gms)			Cost of fuel used (Rs.)			Time consumption (mts)		
					TC	SC	D	TC	SC	D	TC	SC	D
1	Lakshmi Thilagani	4	Rice	1 kg	800	635	165	2.05	1.80	.25	60	42	18
			Dhal	150 gms									
2	Manikam	5	Rice	1 kg	825	650	175	2.15	1.95	.20	50	30	20
			Dhal	200 gms									
3	Savithri	6	Rice	1 kg &	850	670	180	2.20	1.80	.40	60	40	20
			Dhal	250 gms									
				200 gms									
4	Manikam, V.G.	4	Rice	750 gms	750	576	174	1.90	1.65	.25	55	26	29
			Dhal	150 gms									
5	Thilagamani	5	Rice	1 kg	900	720	180	2.25	2.05	.20	60	30	30
			Dhal	200 gms									
6	Shakir Nusa	5	Hot water	20 lit	800	630	170	2	1.60	.40	65	30	35
Total					4925	3881	1044	12.55	10.85	1.9	410	198	152
Average					820.8	646.8	174	2.09	1.8	.28	58.3	33	25.3

Key: TC = Traditional chulah; SC = Smokeless chulah; D = Difference

Fuel consumed in cooking the selected preparations (rice and dhal or hot water) was 820 .8 gms using the traditional practice and 646.8 gms after adopting the improved practice arriving at a saving of `74 gms and 28 paise. About 25 minutes and 30 seconds was saved for cooking the same.

ii. Feed back of adoption

The advantages of using smokeless chulah as elicited from the homemakers are given in Table XX.

TABLE - XX
ADVANTAGES OF USING SMOKELESS CHULAH

Sl.No.	Advantages	Percentage of homemakers stating n:9
1	Eliminated smoke from the kitchen	100
2	Keeps the kitchen wall clean	100
3	Tends for the use of all types of fuel	100
4	Saves time in cleaning utensils	98
5	Saves time in meal preparation	97
6	Saves fuel wood	97
7	Simple technology	93
8	Reduces the attention given to the chulah	93
9	Removes eye strain	92
10	Removes drudgery in cooking	92

All the homemakers expressed their gratitude towards the investigator for making them install the smokeless chulah in their home and making their home a happy place to live in. They spontaneously mentioned the benefit of smoke free kitchen which enabled them to perform cooking in hygienic and pleasant atmosphere. Providing opportunities for all the family members to remain inside the multipurpose room, this simple device helped to develop better family relationship.

Summary and Conclusion

V - SUMMARY AND CONCLUSION

The “Popularisation of Appropriate Non-conventional Energy Sources Among IMK Members of Venkitapuram Area in Coimbatore Corporation” was a study taken up with an intention to train the members and motivate them to adopt the possible technology.

All the 200 IMK members of the selected area were covered under the baseline survey to elicit information about the background and cognizance about the use of non-conventional energy sources. Among the 200 numbers, 25 interested members were trained on the “use of appropriate non-conventional energy devices’ such as solar cooker, hay box and smokeless chulah. The impact of the training was assessed through a score card before and after the training programme. Since ‘adoption’ involves economic capability in addition to ~~attitudinal~~ change, only 15 women were able to adopt the energy device namely smokeless chulah. As a follow up of the training programmes, evaluation was carried out to study the extent of adoption.

The major findings of the study are summarised below;

1. Of the 200 IMK member, 50 per cent were found to be below the age of 30 years.

It was disheartening to note that 51 per cent were illiterates. The occupation of majority of them was masonry (50 per cent). About 49 per cent were living in row houses.

2. The fuel management practices of the IMK members were observed to be very poor before the training programme. A majority spent 15 per cent of their income on fuel.
3. About 15 per cent of the IMK members were using conventional chulah and they faced many problems (drudgeries) due to the same.
4. The knowledge about non-conventional energy sources was meagre, that is, only 44 per cent knew about Hay box, 40 per cent about smokeless chulah and 60 per cent about solar cooker and the adoption was not feasible.
5. The major sources of communication among the IMK members were extension agents (55 per cent members) and friends and relatives (36 per cent).
6. Regarding the knowledge gained by the IMK members on different aspects of solar cooker the average mean gain was 58.4 and the mean average gain of knowledge by the individuals about solar cooker was 22.88.
7. The average mean gain in knowledge by the IMK members on different aspects of Hay box was 46 per cent and the individual mean average gain in score was 17.96.
8. The IMK members obtained an average mean gain of 70.5 on different aspects of smokeless chulah. The average mean gain of individual scores was 29.04.
9. Out of the 25 trained members, 15 were motivated to adopt smokeless chulah with the unstinted initiative of the investigator. Six households made use of the smokeless chulah whereas in nine households the beneficiaries had agreed to erect after sometime.

10. Case studies of six members who adopted the smokeless chulah revealed that the adoption had saved 174 gms of 'Fuel', 25 minutes 'Time' and 28 paise 'money' in cooking the selected items.
11. All the homemakers expressed spontaneously the advantages of using smokeless chulah as it had saved their time, fuel, money and relieved them from the drudgery involved in cooking.

CONCLUSION

The conventional energy sources contributing about 90 per cent of the total demand are getting rapidly exhausted. Therefore, it is imperative to promote energy self sufficiency by augmenting energy production of various research departments, increasing the efficiency of energy use and substituting commercial sources with renewable sources of energy.

This research has thus thrown light on the immense potentialities of training the IMK members on the 'use of appropriate non-conventional energy devices'. The following recommendations emerged out of this study:

1. The Government should take steps to augment new technologies which harness the renewable sources of energy to a large extent so that the costs could be comparable to those energy derived from conventional sources like coal and gas.

2. The success achieved by the government agencies is not commensurated in the field of transfer of non-conventional energy technologies with the efforts put in. This indicates that there are some missing links or gaps between the first step of initiating the project and the last step of achieving results. These missing links should be identified and fulfilled.
3. Since the use of non-conventional energy source would create conduciveness for ecofriendly environment, concerted efforts must be taken to publicise the idea.
4. All the NGO s must be enlightened on non-conventional energy sources and they should be provided with the technical knowledge that can be utilised in training and transferring the technologies to the beneficiaries.
5. The Government authorities, panchayat unions, municipalities, corporations and institutes must introduce smokeless chulah, Hay box and solar devices as part of the Groups Housing Scheme and Noon Meal Programme of the schools and balwadies.

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Appendices

3. Twin house :

4. Row house :

E. Information on Fuels :

1. What type of fuel do you use in your household?

2. What is the amount of monthly expenditure on fuel in your household?

F. Information on the devices used for cooking:

1. What are the devices used for cooking in your household?

. **Conventional chulah :**

Gas :

Stove :

Any other :

2. Where is the chulah placed in your house?

Separate Kitchen :

Inside the house :

Outside :

3. What are the problems faced in placing the conventional chulah inside the house?

4. What are the problems faced when the conventional chulah is placed outside the house?

5. What are the reasons for not installing improved chulah?

H. What are the sources of information about the new technology that you had come across?

1. Impersonal (print and non-print) :

2. Personal :

i. Activities of voluntary organisations

ii. Exdtension Agents :

iii. Friends and Relatives :

G. Information about Non-conventional energy sources and the devices which make use of them.

1. Do you know what is a non-conventional energy source : **Yes/No**

2. If yes, what are the different types of household devices you had come across?

3. Are you interested in taking part in the training programme on the use of non-conventional energy sources in the household? **Yes/No**

APPENDIX - II

AVINASHLINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION
FOR WOMEN (DEEMED UNIVERSITY), COIMBATORE - 641 043

SCORE CARD TO ELICIT INFORMATION ABOUT THE KNOWLEDGE OF THE
IMK MEMBERS REGARDING THE DEVICES SELECTED FOR THE TRAINING

	SA	A	DA	SDA	DK
I. Solar cooker					
1. Solar cooker makes use of non-conventional energy source					
2. There is no fuel cost involved in using solar cooker					
3. Solar cooker reduces the drydgerly involved in cooking					
4. Nutrients are saved to a greater extent when foods are cooked in the solar cooker					
5. Solar cooker is a pollution free device					
6. Solar cooker saves the attending time					
7. Foods doesn't get charred when cooked in a solar cooker					
8. Foods cooked in solar cooker tastes good					
9. Solar cooker is of less weight and can also be taken on a picnic or journey					
10. Solar cooker involves simple operation					
II. Hay box					
1. Hay box is a non-conventional energy source					
2. Hay is an insulating material					
3. Hay box saves fuel					

4. Hay box relieves drudgery
5. Hay box retains the food hot for a considerable time
6. Hay box reduces attending time
7. Hay box reduces the expenditure on fuel
8. Hay box is inexpensive
9. Foods does not get charred in a Hay box
10. Hay box does not require servicing charge

III. Smokeless-Chulah

1. Smokeless chulah is a non-conventional device
2. Smokeless chulah eliminates smoke from the preparation area
3. Smokeless chulah removes eye strain
4. Removes drudgery in cooking
5. Keeps the kitchen wall clean at lower cost
6. Lends for the use of all types of fuels
7. Gives soot free utensils
8. Simple technology
9. Food is cooked fast
10. Thermal efficiency is higher than the conventional chulah

Note : SA - Strongly agree
SDA - Strongly disagreed
A - Agreed
DA - Disagree
DK - Don't know

APPENDIX - III

**AVINASHLINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION
FOR WOMEN (DEEMED UNIVERSITY), COIMBATORE - 641 043**

INTERVIEW SCHEDULE TO ELICIT INFORMATION ON THE EXTENT OF ADOPTION OF SMOKELESS CHULAH

I. To the members who had adopted and installed

1. What are the benefits obtained by adopting smokeless chulah?
2. Are you satisfied with the performance of the smokeless chulah? Yes/No
3. If no, what are the problems do you face in using smokeless chulah?
4. Do you have any suggestion for further improvement?

II. To the members who had adopted but have not installed

1. What are the reasons for not adopting smokeless chulah after the training programme?
2. When do you plan to construct

APPENDIX - IV

LIST OF IMK MEMBERS WHO HAVE BENEFITTED FROM THE POPULARISATION PROGRAMME HELD BY THE DEPARTMENT OF HOME SCIENCE EXTENSION EDUCATION

1. Meena, M., 74, Netaji Colony
2. Lakshmi Thilagam, 81,
Subramaniapuram
3. Savithiri, K., 78, Subramaniapuram
4. Manickam, V.G., 61, Shastri Nagar
5. Manickam, T., 74, Subramaniapuram
6. Thilagamani, R., 84A,
Subramaniapuram
7. Ranganayaki, M., 78 V.K.R.Street
8. Usha, M., 91, Satya Street
9. Shakir Nusa, 71, V.K.R.Street
10. Deivanayaki, R., 76, Netaji Colony
11. Ganamayil, 98 C, Subramaniapuram
12. Chinnammal, 83, Netaji Colony
13. Kuppamma, 88, Shashtri Nagar
14. Saroja, 89, Subramaniapuram
15. Parvathi, 79, Shastri Nagar
16. Vijaya, 98, Satya Street
17. Latha, 20, Netaji Colony
18. Nalini Vijayan, 24, Subramaniapuram
19. Ranganayaki, D., 25,
Subramaniapuram
20. Rajamma, 57, Subramaniapuram
21. Mayilamma, 77, Subramaniapuram
22. Iyyamma, 82, Subramaniapuram
23. Malathi, ICDS Centre No.187
24. Santha, 70, Subramaniapuram
25. Ponammal, 79 A, Subramaniapuram