"AN ANALYTICAL STUDY OF THE CAUSES OF UNDER-UTILISATION OF NON-CONVENTIONAL AND RENEWABLE SOURCES (NRSE) OF ENERGY SYSTEMS AND ITS MARKETING POTENTIAL IN PUNE DISTRICT."

A Thesis Submitted to the

UNIVERSITY OF PUNE

For the Degree of

DOCTOR OF PHILOSOPHY IN COMMERCE

BY

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May **2006**

DECLARATION

This is to declare that the thesis entitled **"AN ANALYTICAL STUDY OF THE CAUSES OF UNDER-UTILISATION OF NON-CONVENTIONAL AND RENEWABLE SOURCES (NRSE) OF ENERGY SYSTEMS AND ITS MARKETING POTENTIAL IN PUNE DISTRICT."** being submitted to University of Pune, for fulfillment of the requirements for the degree of Doctor of Philosophy (Ph.D.), is a record of bona-fide work carried out by me under the guidance and supervision of Dr. J. D. Takalkar, Principal, Rajgurunager College, Rajgurunagar, Dist. Pune. The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

Date: May ,2006

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CERTIFICATE

Certified that the work incorporated in the thesis **"AN ANALYTICAL STUDY OF THE CAUSES OF UNDER-UTILISATION OF NON-CONVENTIONAL AND RENEWABLE SOURCES (NRSE) OF ENERGY SYSTEMS AND ITS MARKETING POTENTIAL IN PUNE DISTRICT."** submitted by Shri R. W. Kulkarni was carried out by the candidate under my supervision/guidance. I find the research work adequate and satisfactory for the purpose of acceptance as per requirement of the awarding of Ph. D degree. Such material as has been obtained from other sources has been duly acknowledged in the thesis.

Place:

Date: May 2006

(Dr.J.D. Takalkar)

Research Guide

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The present research is an analytical study of the causes of under-utilization of the market potential of SWHS and Solar Cooker- the non-conventional energy devices. In fact, the subject of the present research, itself is considered 'Non-conventional' considering the other research problems being undertaken in the Department of Commerce. The entire credit for accepting this theme as a research problem goes to my research guide Dr. J. D. Takalkar, who not only welcomed this idea but also encouraged me to accept this topic as a challenge. Dr. J. D. Takalkar, being a Principal in one of the reputed colleges with strength of more than five thousand students has always to shoulder enormous responsibilities. In spite of his really busy schedule and tensions arising out his job expectations, he had always reserved a time slot for discussion and brainstorming, which has finally resulted into this work. He not only provided academic support, but also extended hospitability, every time I went to him for discussion in connection with the research. I wish to express my sincere gratitude towards Prin. Dr. J. D. Takalkar.

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Research conclusions have to validate with the use of statistical techniques. I am extremely obliged to Prof. Dr. Manisha Sane, Dept. of Statistics, Modern College, Pune – 411 005 for providing statistical support in hypothesis testing.

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I would be failing in my duties if I do not express my feelings about my colleagues in the Department of Commerce, Modern College, Pune 411 005. I am also thankful to the Library Staff of Modern College for providing the references required for the study.

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Place : Pune

(R.V.KULKARNI)

Date : May 2006

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ABBREVIATIONS USED

SWHS: Solar Water Heating System

RETs : Renewable Energy Technologies

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CHAPTER I

INTRODUCTION AND METHODOLOGY

1.1 BACKGROUND OF THE STUDY

1.1.1 ENERGY, THE BASIC REQUIREMENT

Use of energy has been the basic requirement for subsistence and development of mankind. Primitive man required energy primarily in the form of food and then for comfortable living. And at that time, only renewable sources of energy were used to fulfill the energy needs of men mainly by direct or indirect use of solar energy. During the industrial revolution in Eighteenth and Nineteenth centuries, the discoveries of steam engine and internal combustion engine led to better quality of life, prompted by phenomenal rise in the use of coal, fossil fuels, oil and natural gases. The 20th century saw a new source of energy i.e. nuclear energy that offered a new dimension to the world energy scenario. It is true that this contributed to the development process. But the development has been achieved at the cost of environment. The combustion of fossil fuels has caused serious air pollution and health hazards. Release of large amount of waste heat from power plants has adversely affected the local flora and fauna. The nuclear power plants have the serious problem of radioactive waste disposal. Now the world is realizing that the excessive use of fossil fuels has destroyed the environment, which was sustaining mankind for centuries. It is high time to opt for alternative sources of energy on a decentralized basis to meet our energy needs without wrecking havoc on the environment.

1.1.2 STATEMENT OF THE RESEARCH PROBLEM

The present research work is entitled as:

"AN ANALYTICAL STUDY OF THE CAUSES OF UNDER-UTILISATION OF NON-CONVENTIONAL AND RENEWABLE SOURCES (NRSE) OF ENERGY SYSTEMS AND ITS MARKETING POTENTIAL IN PUNE DISTRICT."

1.1.3 DEFINITIONS OF THE BASIC CONCEPTS

Before we proceed further, it is utmost necessary to have fundamental understanding of the basic concepts used in the present research work. These concepts are defined as below:

(a) **Energy**: Energy as defined by the Webster's The New International Dictionary is *'The ability to do the work'*

(b) **Renewable Energy**: *It is energy obtained from the continuous or repetitive currents of energy occurring in the natural environment.* An obvious example is solar energy, where 'repetitive' refers to the twenty-four hour major period. Note that this energy passes through the environment as a current or flow, irrespective of there being a man made device to intercept and harness this power. It is an infinite supply of energy.

(c) **Non-Renewable/Conventional Energy**: *Non-Renewable or conventional energy is an energy obtained from static stores of energy that remain bound unless released by human interaction.* For example, fossil fuels, coal, coke, oil and natural gas etc. are the non-renewable or conventional sources of energy. Initially, an isolated energy potential and external action is required to initiate

the supply of energy for practical purposes. Non-renewable or conventional energy supply is thus a finite source of supply.

(d) **Solar Water Heating Systems**: *The Solar Water Heating System is a device, which provides hot water using the energy of the Sun.* In further part of this thesis the acronym SWHS has been used for Solar Water Heating Systems.

(e) **Solar Cooker**: *The Solar Cooker is a device, which cooks the food using energy of the Sun.*

(f) **Community Solar Cooker**: *It is a device used for community cooking using energy of the Sun. It is also termed as Parabolic/Concentrating type solar cooker.*

1.1.4 COMPARISON OF RENEWABLE AND CONVENTIONAL ENERGY SYSTEMS

The present research work aims at evaluation of the causes of under utilization of NRSE (Non-Conventional and Renewable Sources of Energy) systems and its market potential. The causes of under utilization of NRSE systems cannot be explored unless we compare the renewable energy technology with conventional energy systems. Each of these technologies has their own merits and demerits. Therefore, it would not be out of place first to compare the NRSE systems with the conventional energy systems for a clear conceptual clarity of the subject. The table on the following page presents a comparison of NRSE with the conventional energy systems.

Table 1.1

Comparison of NRSE with Conventional Energy Systems

Sr. No	Point of Comparison	NRSE Systems	Conventional Energy Systems
01	Source of supply	Natural Local Environment	Concentrated Stock
02	Normal State	A Current of Energy	Static store of energy
03	Lifetime of supply	Infinite	Finite
04	Cost at source	Free	Expensive
05	Cost of Equipment	High Cost of devices required to tap the energy	Moderate
06	Variation and control	Fluctuating	Steady
07	Location for use	Site and society specific	General and international use
08	Scale of operation	Small scale economic, (On large scale may present difficulties)	Massive scale operations.
09	Skills required	Interdisciplinary and varied, wide range of skills, from bio-sciences, agricultural, natural sciences etc.	Strong link with electrical and mechanical engineering. Narrow range of skills is required.
10	Context	Rural/Semi-urban and decentralized industry	Urban, centralized industry
11	Dependence	Self-sufficient	Depends on outside inputs.
12	Safety of the equipments	Usually Safe	Most Dangerous when faulty
13	Pollution & Environmental damage	Environment friendly resource	Permanent damage to eco-system
14	Esthetics & user friendliness	R & D is required on the soft design of the equipments	Designs of the systems have been established to be user-friendly over a period of years.
15	Examples	Solar, Wind, Tidal, Bio-mass etc.	Coal, Oil, Natural Gas (Fossil Fuels)

1.1.5 ENVIRONMENTAL IMPACT OF ENERGY USE

Every option of generating electricity, every mechanism used for transportation or every and any use of energy for the production of goods and services affect environment. Table 1.2 gives qualitative major environment impact of energy.

Table 1.2

Environmental impact of energy use.

Energy Source	Air Pollution	Climate Change	Land use and degradation	Water Use and quality	Radiation
Coal	Very High	Very High	High – disturbed by mining	High use	Low
Oil	High	High	Moderate	Moderate	Near Zero
Natural Gas	Very low to High	High	Low to moderate	--	Near Zero
Wind	Near Zero	Very Low	High land use	Near Zero	Near Zero
Solar	Near Zero	Low	Very high use	Near Zero	Near Zero
Biomass	Low	Very Low	Low (High for plantation)	High use but low impact on water quality	Near Zero
Nuclear	Near Zero	Very Low	Very Low	High	Moderate to high

Source: Article in 'Physics Education' March - 2002 by Prof. V.G. Bhide, Dept. Of Physics, University of Pune.

1.1.6 SWOT ANALYSIS OF NRSE

After comparing the NRSE with the conventional energy source it is now appropriate to review NRSE as a source of energy by making a SWOT analysis of NRSE as an energy option.

Strengths

- Unlimited potential
- Environmentally benign
- Favored option for sustainable development
- Favored option for social justice ensuring equitable distribution benefits
- Naturally recycled resource base
- Modularity allowing small, decentralized installations.

Weaknesses

- Availability of energy is seasonal and intermittent.
- Renewable energy sources are usually low-density energies requiring larger areas of space.
- Financially viability in question, particularly in comparison to other conventional energy supply systems.
- Non-conventional energy is costlier and much more capital intensive than conventional energy systems, per unit capacity of installation.
- Due to low density and inconsistency of supply, the capacity utilization of these systems is low.

Opportunities

- Environment-driven awareness
- Policy initiatives-at global and national levels

- Short gestation period schemes
- Shorter lead time, quicker implementation of projects
- Easy to install 'stand alone' systems
- Provides opportunities for rural electrification, even in remote areas
- Generates employment in rural areas
- In most cases cost of fuel transport is eliminated
- Cost of other inputs is considerably reduced
- Social benefits accrue out of installation and utilization of renewable energy technologies
- Can be matched to the scale of the need

Threats

- If the environment driven momentum were lost, renewable energy thrust would die down.
- Social and environmental costs are not looked into; renewable energy would remain secondary to conventional energy.
- Enough R and D back up are missing in a rush for fast commercialization of these technologies prompted by incentives.
- Incentive/subsidy driven momentum could be temporary.

1.1.7 RENEWABLE ENERGY FOR SUSTAINABLE DEVELOPMENT

Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable development is the development that is environmentally, socially and economically sustainable.

Energy is the prime mover of the development process. Since 85% of the World's Commercial Energy Supply is met by Fossil Fuels, it is considered as the main hurdle in the process of sustainable development. The actual rate of consumption of fossil fuels is expected to multiply with the exponential growth of population and their aspirations.

Thermal plants continue to have the largest share in the power production globally and in India. Therefore, world attention is now turning towards greater use of renewable as an eco-friendly source of energy supply. During the past 150 years, lack of focus on renewable, combined with population explosion has created a difficult situation. Therefore, NRSE now should be given more attention as a change- agent in the process of sustainable development of mankind.

1.1.8 RENEWABLE TECHNOLOGIES AT A GLANCE

There are number of renewable sources of energy which can be used to supplement the conventional sources of energy like coal, kerosene, LPG, electricity etc. The saving in consumption of conventional energy is possible by using various devices, for different purposes like water heating, cooking, desalination of water, transportation etc. Thus, introduction of non-conventional and renewable sources of energy has become the vital part of preparing energy plan. Since the title of the present research work includes the term - NRSE ***(Though the scope of the study is limited to SWHS and Solar Cooker)*** it is necessary to briefly discuss about the wide range of NRSE technologies. The brief description of various NRSE technologies is given below:

(i) Wind Energy: Water Pumping Wind Mill

Water pumping windmill can be used to pump water from open/bore well if the conditions are suitable. Two types of windmills are available, (i) for shallow and (ii) for deep well. The windmill has capacity of 0.75HP equivalence to the electric pump. On a site of average wind speed, a wind mill pumps water up to 25,000 to 50,000 liters per day.

(ii) Wind Aero Generator

Electricity can be generated by Wind Energy, which can be stored inside battery and further used for running various electric equipments. This is called small aero-generator battery charger. Such units are available from 500 Watts to 15 KW. Solar energy is also used along with wind energy to charge battery. Such a system is called wind/solar hybrid system. Such systems can be used to charge battery for signaling/wireless equipments, water pumping, rural electrification at a particular place, poultry farm, tourist places etc.

(iii) Improved Biomass Chullha

In rural areas, the major requirement for consumption of energy is for cooking, water heating, lighting etc. Indigenously developed improved chulhas have higher thermal efficiency of 25-28% compared to 8-10% that in traditional ones. They have potential to conserve firewood, saving forests, eliminate indoor air pollution, and improve health of women and girl children. It saves more than 300 kgs. of fuel wood equivalent per year, besides reducing drudgery.

(iv) Improved Crematoria

A substantial quantity of wood is used for cremating human dead bodies with traditional cremating methods. Traditional crematoria require about 300 to 400 kgs. of wood, whereas the improved Crematoria saves about 150 to 200 kgs. of wood. In order to save such a large quantity of wood, an Improved Crematoria has been developed and promoted respecting the traditional customs.

(v) Biomass Gasifier

Biomass Gasifier is a device, which converts solid biomass such as wood pieces, agricultural residues, leaves, sticks etc. into combustible gas mixture, which contains mainly carbon monoxide and hydrogen as combustible gases. Biomass gasifier permits partial combustion of biomass under controlled supply of air. The generated gas has three applications viz. Mechanical-operating engine for pumping water, Thermal Cooking, and Power Generation.

(iv) Biogas

Biogas is a clean, non-polluting, and soot free fuel, containing inflammable methane gas, carbon- di-oxide and small amount of nitrogen, hydrogen sulphide etc. It is produced from cattle dung, night soil and other organic matters in biogas plant, through a process called "anaerobic digestion". Biogas is used for various purposes such as cooking, lighting and power generation.

(v) Solar Energy

Solar energy is used for two applications viz. Solar Thermal where solar energy is directly used by converting it into heat and Solar Photovoltaic where solar energy is converted into electricity by the use of semi-conductors and capacitors. The solar thermal technologies are discussed in part I and the solar photovoltaic systems are discussed in part II of the following:

Part I
Solar Thermal Technologies

(1) Solar Water Heating Systems

One of the areas of application of the Solar Thermal Technology is heating of water for domestic, commercial and industrial use. The radiation from the Sun is collected by solar collectors, which convert the radiation into heat energy. It is also possible to use solar energy for power generation. The solar water heating system can be used for heating water up to sixty to eighty degrees Celsius. The solar water heating systems can be installed at residential complexes, industries, hotels, hospitals, dairies etc.

(2) Solar Hot Air System

Solar hot air system can be used for drying of agricultural products like leaves of tea/coffee, groundnut, seeds, tobacco, chemicals, grapes, etc. The drying takes place under controlled conditions. Apart from saving in fuel costs, it is possible to get better yield and good product quality.

(3) Solar Desalination System

Solar energy can be used for getting distilled water. The device used is called solar still. It is made up of fibreglass material having tapered top surface. The daily output from solar still is 2-2.5 liters. It is used in laboratories.

(4) Solar Cookers

The heat from the sun can also be used for cooking food thereby saving conventional fuels. In the age where domestic fuel costs are rising every year, Solar Cooker is a real boon for the housewives. It involves no recurring cost and can cook the food without losing nutritional value.

Part II
Solar Photovoltaic Systems

(1) Solar Photovoltaic Lanterns

This is a small device resembling with the usual kerosene lantern. It is charged by a solar module (10W) and has the storage battery along with electronic control circuits. The light output is sufficient for a small room.

(2) Solar Home Light

This is the package of photovoltaic systems using solar cells, battery and electronic control devices, which can operate two or three lights or fans. This is especially useful at small house situated at a remote place such as farmhouses.

(3) Solar Street Light

For the outside application, solar streetlight has been found very useful. Light output equivalent to that of 40W normal tube is obtained through streetlights, which works on solar modules, battery storage and the electronic control systems. It automatically switches on in the evening and switches off in the morning through the light censor.

(4) Solar Power Fencing

Many a time the villages near forest area need to be protected from wild animals at night. Solar power fencing has been found to be very useful for such places. Through this device, mild shock is provided to the animals for a momentary period, but without any lethal effect.

(5) Solar Traffic Systems

The traffic signals can work on solar energy, which will be a support to the existing traffic signals. Thus, they save the electricity consumption in the existing signals and also are useful at the time of power failure. Similarly, traffic booth has been developed which can be placed in the middle of square having the facility of sound system, fan and light. This helps the traffic police to work efficiently with modern amenities.

(vi) Wind Power Project

Wind power technology converts wind energy into electricity by connecting to the grid power. Wind power energy is upcoming area in the NRSE technologies.

(vii) Bagasse Co-generation Projects

Bagasses is a process-waste generated in the sugar factories. A technology has been developed to generate electricity with the use of these bagasses.

(viii) Power Generation from Municipal and Industrial Solid Waste

As projected by MEDA (Maharashtra Energy Development Agency), in Maharashtra there is a potential for installation of 100 MW capacity power generation projects based on Urban Solid Waste. A technology has been developed to convert waste into electricity.

1.1.9 PROFILE OF PRODUCTS UNDER REFERENCE OF THE PRESENT RESEARCH

In 1.1.8 above the researcher has discussed in general about the NRSE devices. Since the present work is dedicated to discuss the causes of under utilization of the market potential of Solar Water Heating Systems and Solar Cooker it is necessary that **marketers should know the product with all its strengths and weaknesses.** Hence, product profile of SWHS and Solar Cooker is prepared and presented below:

1.1.9.1 Product Profile of Solar Water Heating Systems (SWHS)

The SUN is a source of 'inexhaustible energy' gifted by nature. Our country will have enough power if we harness it properly.

The SWHS is a powerful device, which helps you to heat water for your daily needs using the energy of the Sun resulting in bringing down your electricity charges. SWHS is a matter of great attention and curiosity for everyone. Marketer should first acquire product information and perceive the likely problems posed by the prospective consumers. Hence, the product profile of SWHS has been presented in a style of FAQs ***(Frequently Asked Questions)*** as below:

Q.1 How does the SWHS heat water?

Ans: The model of SWHS is shown below

The main part of the SWHS is the Flat Plate Collector or in common parlance 'PANEL'. Metallic strip (mainly of copper) is coated with thin layers of Nickel and Chromium, which is called as Solar Selective Coating. This selective coating ensures highest degree of absorption of Solar Heat and least possible emission of

the same. This results in optimal utilization of the Solar Heat. This component, which is the heart of any SWHS, is known as Absorber Fin.

In every Flat Plate Collector (panel) there are number of such absorber fins, which are connected on both sides to copper pipes known as headers. The heat collected by the Absorber Fin is transferred to the liquid flowing through the tubes/pipes. The liquid so heated becomes lighter and is pushed up by the cold water at the bottom helping it to fill the Hot Water Storage Tank. Thus, the cold water is continuously heated and collected in the Hot Water Storage Tank throughout the day. This is on the basis of natural thermo-siphon.

Q.2 Whether the water heated during the day remains hot throughout the night?

Ans: The Solar Flat Plate Collector is provided with insulation, which prevents heat loss. Similarly the Hot Water Storage Tank and the pipes carrying water upto user point are also properly insulated. This ensures minimum drop in the temperature of the hot water. As a result, you get hot water even on cold mornings.

Q.3 What are the types of SWHS?

Ans: There are two main types of SWHS:

a) Thermosyphon is a driving force for circulation of water through solar collector. These systems are useful for flats, residential complexes and individual bungalows, hospitals, hotels and health clubs.

b) Forced Flow is controlled through a control panel and pump. The cold water is circulated through the collectors and allowed to

stay there until the least temperature is reached. Only then the pump comes on and pushes the heated water into the storage tank. The entire system is automated and is used in the industrial sector.

Q.4 Where and for what application you can install such systems?

Ans: The SWHS have varied applications as listed in the following table:

Table 1.3

Applications of Solar Hot Water Systems

Where to use?	**Application of solar hot water**
Domestic	Bathing, cleaning etc.
Hostels	Bathing
Hospitals	Bathing, Washing, Cleaning etc.
Rest Houses	Bathing
Canteens and Restaurants	Cleaning, Dish Washing etc.
Industries	Process Heat Generation, Boilers, Sterilization, Steam Generation etc.
Dairies	Boiler feed, Cleaning, Bathing, Cleaning of Cattles etc.
Laboratories	For varied applications, distilled water is required.

Q.5 What is the expected life of a solar water heating system? What does it depend upon?

Ans: The life of solar water heating system depends on the absorber, the construction of the collector, quality of hot water tank and insulation etc. Tank made of mild steal (MS) may get rusted and start leaking after 4-5 years, thereby resulting in lot of headache and expenditure for replacement. An ideal solar water heating system should have high quality panel, stainless steel (SS

304) tank, good quality pipes of standard make and proper insulation. These things along with use of soft water ensure a long life of system. SWHS manufactured as per these technical specifications will have a life span of more than 25 years.

Q.6 How is the capacity of a SWHS decided?

Ans: Capacity can be decided broadly by the following tips:

Table 1.4

Capacity determination of SWHS

Place of using SWHS	**Mode of Hot Water Use**	**Apprx. Hot Water Requirement**
In house for taking bath	Using Bucket	20 to 25 liters per person
	Using hot and cold mixer and shower	30 to 35 liters per person
In Lodge, Hospital, Hostel and Rest House for taking Bath	Hot Water Common Tap outside the bathroom	20to 25 liters per person
	Hot water tap inside bathroom	30 to 35 liters per person
In Hotels:		
I) C Grade	Hot water tap inside bathroom	30 to 35 liters per occupant
ii) B Grade	With mixture and shower without tub bath	40 to 60 liters per occupant
iii) A Grade	With mixture, shower and tub bath	60 to 100 liters per occupant
In restaurants & canteens	Oily dish washing under hot water tap	5 to 10 liters per dish

Q.7 What is the maintenance cost of a SWHS?

Ans: A technically sound system installed by skilled technicians coupled with usage of water having salt contents of less than 100ppm will require minimum maintenance.

In this situation the only maintenance work, which can easily be done by any common man, is removing the dust on the glass of panel. After 7-8 years the rubber parts of the collector are advised to be replaced.

Therefore, before buying a SWHS buyers have to find whether the seller offers such service.

Q.8 Why are there complaints about the poor performance of SWHS?

Ans: There can be various reasons for poor performance of SWHS such as:

- Low quality absorber
- Improper installation of collector
- Improper direction of the panel (It must be facing **SOUTH**)
- Inadequate capacity of SWHS
- Continuous use of hot water over long period
- Hot water getting mixed with cold water
- Lack of adequate shadow free space for installation
- Use of hard water
- Poor quality of insulation of storage tank and pipes
- Blockage of system due to sediments in the water
- No frequent cleaning of Panel Glass affecting solar Transmittance.

Q.9 Are there any rules to ensure optimum utilization of SWHS?

Ans: The rules to be observed are:

- While selecting SWHS your needs and usage habits should be taken into account.
- In conventional thermo-siphon system for proper flow of hot water in the pipe equivalent amount of cold water should go into the hot water tank. Hot water should be used keeping this in mind.
- The glass on the panel should be kept clean.
- Overhead cold water tank should always have water.

Q.10 What is certified "ISI" marked SWHS?

Ans: To protect the interest of consumer and ensure proper return of their money the Bureau of Indian Standard (BIS) benchmarks certain standards for every item. Based on these quality standards a License to manufacturers is issued and the collector confirming to BIS 12933 carries ISI mark.

Q11 Is there any subsidy for SWHS?

Ans: As per the present Government policies for SWHS loan at subsidized interest rate at 5% (2% from September, 2005) is given.

Q.12 What is the warranty of SWHS? What is its period?

Ans: The manufacturers/dealer takes responsibility for the material used in the system and its workmanship for a period called as warranty period. The contents/language of guarantee clause needs to be examined carefully before buying solar system. Normally, it should be purchased from manufacturer, manufacturing the entire system or their official dealer.

The guarantee period is generally 5 years. This should be taken into consideration. Similarly if defect is detected during the warranty period, the process of rectification should be examined before purchasing SWHS.

Q.13 Are there any special exemptions in Income Tax for SWHS?

Ans: These exemptions are available to any business purchasing any equipment using non-conventional energy. 80% depreciation is granted in the first year of purchase. Hence, such benefit is available to SWHS also.

Q.14 What is the pay back period of SWHS?

Ans: Pay back period is the period within which initial investment is recovered by the savings resulted due to the installation of SWHS. It depends upon several assumptions such as:

- Optimum utilization of system
- Utility for 300 days in a year
- Increase of average 5-10% p.a. in rates of electricity/LPG /Kerosene etc.
- 20 years of life expected of the system
- Matching of hot water required per day with the output of the system installed.(For example in a hostel of 100 students a system of 2,500 liters per day is most suitable. However, if a system of 5,000 liters per day is installed, then the pay back period of such system would certainly be longer than the standard pay back of four to five years)

Hence, pay back period of the system is usually in the range of 4-5 years for a domestic SWHS. Of course this is only a trend calculation, the exact Pay Back Period depends upon the factors prevailing at the time of decision-making.

1.1.9.2 Product Profile of Solar Cooker/Community Solar

Solar cooking is an innovative method of cooking wherein sun's energy - an alternative energy form which is a plenty, renewable, zero private cost and freely available – cooks and transforms raw into edible form at low temperatures. The frequently asked questions about Solar Cooker are as below:

Q. 1 What is Solar Cooker?

Ans: The model of a box type solar cooker is shown below.

Domestic Solar Cooker

It is similar to what you use in your kitchen to cook food. But it does not require any cooking gas or kerosene, neither any coal nor any wood as fuel. We do not need any electricity to use it.

Q.2 How it works?

Ans: Solar cooker works only on solar energy. Solar cooking can be done in a variety of specially designed devices. Whatever the device, basically there are two methods of collecting sun's energy, normally trapping it in a box (Box Type Cooker) or focusing it to a point to cook. (Parabolic concentrating cooker). Box type cooker is

used for family cooking, whereas concentrating type cooker is used for community cooking.

Q.3 Why use a solar cooker?

Ans: Estimates show that fossil fuel reserves will not last long and will become costlier day by day. A wide gap between demand and supply of fuel-wood exists. Green house gases, global warming and climate changes are other issues linked with traditional cooking fuels; whereas solar energy and its applications do not have such implications. In other words, solar cooking is an environment and user-friendly process. A solar cooker is an appropriate device to tap solar energy to meet cooking needs on bright sunny days. What more can Nature offer to us for meeting our day –to-day cooking needs? What more reasons do we need, to supplement traditional cooking with solar cooking when the sun shines bright?

Q.4 What does solar cooking offer?

- Solar cooking is nutritious cooking.
- Solar cooking is pollution free-hazard free cooking.
- Solar cooking is quality cooking; safe cooking.
- Solar cooking is healthy cooking.
- Solar cooking time is fun time; free time.
- Solar cooking is fuel saver.
- Solar cooking is money saver.
- Solar cooking is time saver as it frees a cook from active cooking time, once food is loaded in the cooker.
- Solar cooking leaves vessels easy to clean (No soot deposits and no scorched food on cooking containers).
- It saves hard labour on long search in fuel collection.
- Solar cooking adds to family income.

- Solar cooking is easy cooking.
- It keeps the food hot for a long time.

Q.5 Where to place Solar Cooker?

Ans: Solar cooker has to be placed somewhere in the open, e.g. on a terrace where it can get sufficient solar radiation. Once cooking material is put in the Cooker, one should ensure that solar radiation does not in any way get obstructed and cast a shadow on the cooker.

Q.6 How to cook in solar cooker?

Ans: The preliminary planning for the recipe must be done in advance. Put the ingredients in the aluminum containers and add just sufficient quantity of water along with the required quantity of salt, pepper, spices etc. Open the Solar Cooker, clean it from inside with cloth and place the containers in it. The double glass covered should be properly closed. Place the cooker at such an angle that the upper lid with its single mirror faces with the sun. The sun's rays enter the box through the double glass cover. In addition, sun rays are also reflected on to the double glass cover by the mirror fixed in the cooker lid and enter the box. The inside temperature of the box rises to 100-125 degrees which is sufficient for cooking a meal.

Q. 7 What can you cook in Solar Cooker?

Ans: Anything and everything – from vegetarian to non-vegetarian and starters to dessert – can be cooked in solar cooker. Any recipe or dish that does not call for frying or turning of food can be cooked in solar cooker. A large number of items, which are needed for our daily meals, can be cooked in a Solar Cooker. Dal, Rice, Vegetables, Cereals, Potatoes etc. can be easily cooked.

Q. 8 How much time is required for cooking in Solar Cooker?

Ans: It takes about 2-2.5 hours for cooking depending upon the kind of food and the season. Different items like dal, rice, vegetables etc. are normally cooked simultaneously in separate containers. The time taken for cooking is less in summer than in winter. Moreover, based upon experience, following results have been obtained. In this connection ones own experience shall be the best guide to decide the average cooking time. However, some estimates are made below:

The kind of Food	**Time for cooking**
1. Vegetables	1 Hour
2. Rice	1.5 Hours
3. Cereals	2 Hours

Q.9 What is Community Solar Cooker/Concentrating Cooker?

Ans: It also called as Parabolic Solar Cooker. It is a device useful for cooking for a group of persons. It is most suitable for small hostels, canteens and such other places where people take their food cooked in a common kitchen.

Q.10 What are the limitations of Solar Cooker?

Ans: Though useful, solar cooker has its limitations. These are:

- It does not work at night
- It does not work as well on a cloudy day
- Its performance is not so good in the early morning, late afternoon, or even in partly cloudy days.
- Solar cooker is not useful to prepare Chapatties
- It cannot be used for frying

Conclusion:

However, in spite of all these difficulties if a solar cooker is used throughout the year, it saves a substantial amount of cooking fuel and so contributes towards the economy for a family. We have to remember that our country is bestowed with plenty of solar radiation and in most of part of our country we get about 300 sunny days a year. It must be harnessed fully.

1.2 SCOPE OF THE STUDY

Scope of the present study is defined in terms of :

(A) the products under reference,

(B) the area of the study and

(C) end users of SWHS and Solar Cooker.

(A) Product Specific Scope

The NRSE (Non-conventional and renewable sources of energy) systems include a varied range of renewable technologies as briefly discussed in 1.1.8(Renewable Technologies at a glance) of this chapter. However, **the present study is confined only to the critical analysis of the causes of under utilization of Solar Hot Water Systems (SWHS) and Solar Cooker and their market potential.**

(B) Area Specific Scope

The present research aims at finding the causes of under utilization of SWHS and Solar Cooker and their market potential in Pune District. However, for the purpose of this study only urban and semi-urban divisions of Pune District have been considered. Thus, geographically the scope of the present research is Pune City (Pune Metropolitan Region) and the Head Quarter of each Tahshil in Pune District. Pune District includes fourteen tahshils.

(C) End User Specific Scope

The end-users of SWHS and Solar Cookers form a very wide range from individuals to the institutions of various types. End users for example include:

- Individuals
- Private Hospitals
- Public Hospitals
- Maternity Homes
- Swimming Pools
- Laboratories
- Lodges
- Hotels of all the types
- Educational Institutions
- Privately run hostels
- Hostels run by government organizations
- Hostels attached to colleges
- Farmers – Agro- products processing applications
- Industrial Process – Steam Generation
- Guest Houses of various types
- Milk Dairies
- Holiday Resorts
- Beauty Parlours
- Marriage Halls
- Highway Side Motels (Dhabas in regional language)
- Nature Cure Healing Centers
- Home for aging people
- Crematorium etc.

Thus, we observe that the scope of the use of SWHS and Solar Cooker is literally very wide. However, for the purpose of the

current study the following categories of end users have been included in the sampling plan:

Respondents defined for the current study are:

- Individual Households
- Hostels attached to the colleges
- Hostels run by Social Welfare Department, Govt. of Maharashtra
- Hostels run by Women and Child Welfare Department, Govt. of Maharashtra
- Hostels run by NGOs
- Government Guest Houses
- Public Hospitals

Note: 'Individual Households' in the context of the present study includes only those households, which are staying either in independent bungalows, or the households having an independent terrace/court yard.

Since the provision of independent terrace/court yard is the most important technical pre-requisite for installation of SWHS and the use of Solar Cooker(Considering the present level of technology), the house without terrace or open yard could not be included in the sample of households.

1.3 OBJECTIVES OF THE STUDY

The present study mainly aims at evaluation of the causes of under utilization of SWHS and Solar Cooker by the seven categories of the respondents defined as per the scope of the study. In relation to the problem chosen for the study the following objectives have been set:

i) To find out and analyze the causes of under-utilization of SWHS and Solar Cooker.
ii) To study the profile of manufacturers/dealers/installers of SWHS and Solar Cookers.
iii) To test the hypotheses about the under-utilization of SWHS and Solar Cooker.
iv) To make suggestions after analysis of the sample data for enhancing the utilization of SWHS and Solar Cooker.

1.4 HYPOTHESES

The present study is carried out in furtherance of the following hypotheses:

i) Irrespective of perception of the prices of SWHS there is an under- utilization of market potential of SWHS due to some unidentified reasons.
ii) Under-utilization of market potential of Solar Cooker is due to its low product performance.

It is necessary to conceptualize the term 'Under-utilization' in the context of SWHS and Solar Cooker. The overall utilization of SWHS in India is 6 lakh sq.m. collector area as against the potential of 1,400 lakh sq. m collector area. (Source: Reliance Review of Energy Market December, 2002). Thus, utilization of SWHS is hardly 0.43% of its potential.

The parameters for 'under-utilization' in the context of the present study, however, cannot be reconciled with the national level data; as the national level data applies to whole of India. India is a country where more than 60% of the population is still living in villages; more than 70% of the rural population is still dependent upon firewood as a cooking fuel. A sample of population

for the present study includes institutions and individuals, which are perceived as potential buyers of SWHS and Solar Cooker. Individual household included in the sampling plan are only those household, which stay either in independent bungalow or in a flat with an attached terrace. Thus, the household selected for the study do not pose any technical difficulty in installation of SWHS or in use of Solar Cooker. Naturally, the residents of bungalows or specified flats being very few in number in the total population, they represent the most favored potential buyers of the SWHS and Solar Cooker. While discussing with manufacturers and other players in the Solar Market it was a general feel of the market that Pune is the Best Market for Solar Product. MEDA (Maharashtra Energy Development Agency), a State Nodal Agency of MNES has also projected Pune on the Second Rank as regards to utilization of domestic water heating systems. (Bangalore, being ranked First). (Source: Newsletter Loksatta, Pune Daily, 21st October, 2005). Hence, 'Underutilization', conceptualized in the present study is different than the national level statistics. The norms of 'underutilization' in the context of the present research have been set as under:

1. For a sample of Institutions: Utilization, less than 50% to the total institutions in the sample selected for the study.

2. For a sample of Individual Household: Utilization, less than 10% to the total households in the sample selected for the study.

In relation to these hypotheses a line of action is evolved to study the causes of under utilization of SWHS and Solar Cooker separately.

1.5 RESEARCH METHODOLOGY

1.5.1 Selection of Samples:

The term 'Sample' in the context of the present study means and includes a sampling unit selected by **'Stratified Random Sampling Method'.** Since the current study is primarily based on a sample survey, selection of 'Sampling Unit' has to be made by using statistical methods and techniques. The various 'Sampling Units' defined in the context of the present research are the different categories of respondents as specified in the scope of the present study. The sample size of the respondents in each category is given in the table 1.5 below:

Table 1.5

Sample size of the respondents included in the study

Sr.No.	Category of the Sampling Unit	Sample Size
01	Hostels attached to the colleges	81
02	Hostels run by Social Welfare Department of Maharashtra Government	31
03	Hostels run by Women and Child Welfare Department, Maharashtra Government	16
04	Hostels run by NGOs	24
05	Government guest houses	35
06	Public Hospitals	41
07	Individual Households	1058

As already clarified in defining the scope of the present study, 'Individual Households' in the context of the present study includes only those households, which are staying either in

independent bungalows, or the households having an independent terrace/court yard.

Since the provision of independent terrace/court yard is the most important technical pre-requisite for installation of SWHS and the use of Solar Cooker (Considering the present level of technology), the house without terrace or open yard could not be included in the sample of households. This has put natural limitation on the selection of sample of individual households.

1.5.2 Segregation of study area into 'Urban' and 'Semi-Urban' segments

The present study is an attempt to find out causes of under utilization of SWHS and Solar Cooker and its market potential in Pune District. These two renewable energy technologies can be perceived as substitutes (may not be total replacement) to the conventional energy sources such as electricity, LPG etc.

As revealed by The Census Survey of India, 2001 nearly 70% of our rural population depends on non-commercial energy such as cow dung cake, crop residue and fire wood etc. Thus, the households in pure rural area (barring few exceptions) should normally be out of scope of the present research considering the present research problem; which is concerned with under-utilization of market potential of SWHS and Solar Cooker. Hence, area selected for the study should be such, as to include potential buyers of SWHS and Solar Cooker. And it is presumed that the urban and semi-urban population has a potential to buy SWHS and Solar Cooker, which is under utilized. Hence, the present research. Therefore, the data from the Urban and Semi-urban centers are collected. 'Urban' means and includes Pune City

including its urban agglomeration; whereas 'Semi-Urban' means and includes the area of the headquarter of each Tahshil.

1.5.3 CRITERIA USED FOR SELECTION OF SAMPLE OF 'INDIVIDUAL HOUSEHOLDS'

As mentioned above 'Stratified Random Sampling Method' was used for selection of sampling units for the present study. However, the products for which causes of under utilization are to be explored are SWHS and Solar Cooker. Hence, the pre-requisites for utilization of those products have been considered while selecting the sampling units. This problem was found more relevant for sample of 'Individual Households' included in the present study. Individual households staying either in independent bungalow or flats with independent terrace could only be included in the present sample. Hence, questionnaire was administered only on such respondents.

A sample of households from Pune Urban was selected in such a manner as to represent households from all the directions of Pune Metropolitan Region (PMR). PMR for the purpose of the sample collection was divided into eight zones and the sample of individual households was collected from each zone by 'Stratified Random Sampling' method so as to be representative sample.

1.5.4 METHODOLOGY FOR COLLECTION OF DATA

This study is based on the sample survey of respondents of the categories specified above. The data required for the purpose of the study has been obtained from both primary as well as secondary sources.

1.5.4.1 The Primary Data

(A) Questionnaire

The primary data are collected through questionnaires for each category of the respondents. Questionnaires were prepared to collect data from hostels, mess owners and manufacturers. This field survey was conducted from July 2004 to January 2005.

(B) Personal Interviews

In order to understand the causes of under utilization of SWHS and Solar Cooker the researcher also met with various dealers, manufacturers and the heads of various hostels. Personal interviews of the owners of solar manufacturing units were also arranged for collection of field data on the topic of the research. User feed back in respect of users of SWHS and Solar Cooker was also taken through the questionnaire prepared for them.

1.5.4.2 Secondary Data

Since renewable energy is a national priority agenda; various reports on energy, renewable energy, and non-conventional energy were of much use to the researcher. The secondary data have been collected from the following libraries:

1. MEDA (Maharashtra Energy Development Agency), Pune
2. Gokhale Institute of Politics and Economics, Pune
3. Modern College of Arts, Science & Commerce, Pune
4. National Institute of Bank Management, Pune
5. Vasantadada Sugar Institute, Manjri, Pune
6. Pune University, Pune
7. Energy Division, Maratha Chamber of Commerce, Pune
8. WEBSITES were also referred for collection of secondary data.

1.6 LIMITATIONS OF THE STUDY

The problem chosen for the present research is a problem of national priority. Hence, the research in this area by any individual is bound to have some limitations. Therefore, the conclusions arrived at after critical analysis of the sample data have to be interpreted in view of the limitations of the study. These limitations are listed below:

- Due to wide geographic coverage of Pune District, researcher has collected the primary data from the headquarters of Tahshils from urban area of Pune District.
- Since the present study mainly deals with recording responses of users and non-users of SWHS and Solar Cooker, an element of individual perception has played an important role. However, attempts are made to record such perceptions in more quantitative manners.

1.7 IMPORTANCE OF THE STUDY

Indian energy sector has been characterized by low per capital commercial energy consumption, skewed distribution of primary commercial energy sources, high energy intensity, distorted energy pricing and high level of environmental pollution. Energy hungry India is passing through critical times. The conventional energy deposits are depleting at an alarming rate. On the background of all these factors, there is an urgent need to shift from conventional to non-conventional energy sources. Renewable energy options provide an opportunity to meet the energy needs without damaging environment.

The World Bank, in one of its reviews in 1996 on role of renewable concluded that:

- The basic technologies are fully proven, work well and are no longer experimental.
- The potential for further development and cost reduction is considerable and will be facilitated by further investment, research and development.
- Developing countries are increasingly becoming interested in the wider use of renewable sources and the investment in them will benefit from the enabling conditions in these countries.

Review of literature on the present subject reveals the fact that most of the research is confined to research on the renewable energy technologies. This is the first research of its kind where the marketing of NRSE has been taken as a problem for research. In the changing scenario this research will certainly prove beneficial to the players in the energy field. This type of research is a socio-economic research where the issue relating to under utilization of SWHS and Solar Cooker, has been chosen as a research problem.

The cause-wise analysis of under utilization of SWHS and Solar Cooker would certainly prove useful to the manufacturers in designing the appropriate technology suited to the consumer expectations. The user feedback will be helpful in updating the current models. The marketers also can design an appropriate marketing strategy for targeting the right market segment for SWHS and Solar Cooker. The study, thus, is an important work from all the angles.

1.8 SCHEME OF PRESENTATION/CHAPTER PLAN

The present research work has been divided into seven chapters:

The **First Chapter** deals with background, hypotheses, objectives, scope, research methodology, limitations, importance and chapter scheme of the study.

The **Second Chapter** presents the profile of Pune District. It thus, gives the information about population, physical set up, rainfall, climate, population, sex ratio, and fuel consumption pattern of the households in Pune District.

The **Third Chapter** takes an overview of energy sector – across the globe, of India and Maharashtra State. It covers review of conventional as well as non-conventional energy sector, policies of MNES and various schemes promoted by MNES for promotion of solar energy devices.

The **Fourth Chapter** presents in detail the analysis of responses collected through questionnaires and interviews from the institutional respondents. It also includes cause wise analysis of under-utilization of SWHS and Solar Cooker.

The **Fifth Chapter** includes the analysis of the questionnaires collected from individual households. It also includes presentation of case studies on the successful Research and Development in solar cookers.

The **Sixth Chapter** is an analysis of supply side of SWHS and Solar Cookers. In other words, it analyzes the responses collected

from the manufacturers/dealers/installers of the SWHS and Solar Cooker.

The **Seventh** Chapter presents summary of conclusions drawn from the analytical study of the causes of under utilization of SWHS and Solar Cooker and its market potential. It also includes recommendations to manufacturers/marketers/dealers of SWHS and Solar Cookers.

CHAPTER – II

PROFILE OF PUNE DISTRICT

2.01 Geography of Pune District

2.02 Climatic Conditions of Pune District

2.03 Physical Set-up

2.04 Administrative Set-up

2.05 Population of Pune District

2.06 Sex Ratio

2.07 Literacy Ratio

2.08 Population Density

2.09 Household Distribution by type of Cooking Fuel

2.10 Conclusion

CHAPTER II

PROFILE OF PUNE DISTRICT

Introduction

The present study aims at exploring the causes of under utilization of marketing potential of solar water heating systems and solar cookers in Pune District. Thus, the study area includes all the 14 tahshils including Pune City and Pimpri Chinchwad (Pune Metropolitan Region). Among other factors determining the market potential of these products; climate, rainfall and other physical conditions are the predominant variables affecting the consumer decision-making on SWHS and solar cookers. Hence, an attempt has been made in this chapter to throw light on the physical set up and other related factors affecting the market potential of SWHS and solar cookers.

2.1 Geography of Pune District

The total area of this district is 15,642 square kilometers. It is 5% of the total area of the State of Maharashtra. Pune is the central administrative place. It is situated on Mumbai-Bangalore highway. The distance between Pune and Mumbai, the Capital State of Maharashtra is 192 kms. by rail route and 160 kms. by road. There are fourteen tahshils in the Pune District as below:

1. Haveli	2. Shirur	3. Mulshi
4. Maval	5. Daund	6. Indapur
7. Baramati	8. Purandar	9. Khed
10. Junner	11. Ambegaon	12. Bhor
13. Velhe	14. Pune City(PMR)	

Pune Municipal Corporation and Pimpri Chinchwad Corporation are the two corporations in the District. In addition to these, there are Cantonment Boards in Pune, Khadki and Dehuroad areas. There are eleven Municipal Councils in the District as below:

1. Alandi (Tahshil Khed)
2. Jejuri (Tahshil Purandhar)
3. Saswad (Tahshil Purandhar)
4. Talegaon Dabhade (Tahshil Maval)
5. Lonavla (Tahshil Maval)
6. Bhor
7. Daund
8. Baramati
9. Shirur
10. Junner
11. Indapur

2.2 Climatic Conditions of Pune District

In the study of the products employed for harnessing solar energy, climate of the location/sites where these NRSE have to be installed plays an important role.

The climate of the district is generally hot. In the Eastern part i.e. in Indapur, Daund and Baramati, it is hotter as compared to the Western Ghats. The district receives its maximum rainfall from the Southwest monsoon, but the average rainfall differs from place to place. The Western Ghats receives the average of 3000 to 4000 mms. where as the Eastern end of the district receives only 750 mm average rainfall. Since the climate and rainfall are the two important factors affecting the efficiency of the SWHS and Solar Cooking systems, it is necessary to record the month wise

temperature and the average rainfall in Pune District. Table 2.1 gives the month wise temperature during 2002-03:

Table 2.1

Month wise temperature during 2002-03

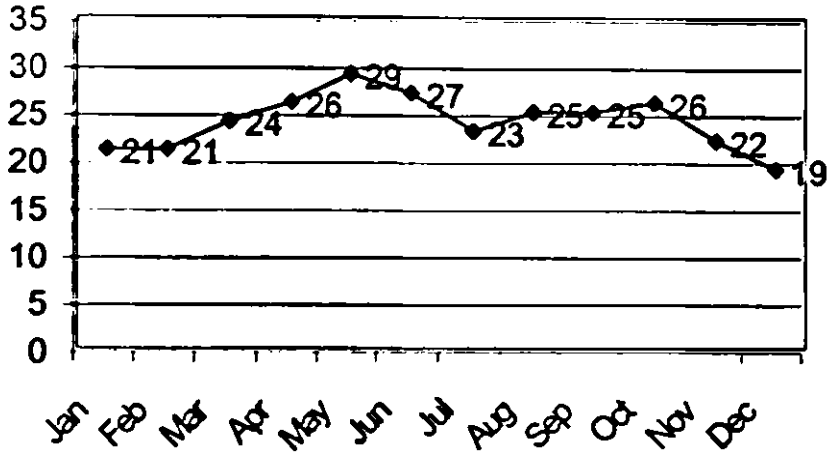
Sr.No	Month	Maximum(C)	Minimum(C)	Average(C)
01	January	30.4	10.8	20.60
02	February	30.7	12.0	21.35
03	March	35.3	13.5	24.40
04	April	38.7	13.9	26.30
05	May	35.2	22.6	28.90
06	June	30.8	22.7	26.70
07	July	28.0	21.6	24.80
08	August	28.6	21.8	25.20
09	September	30.2	20.6	25.40
10	October	33.8	18.9	26.35
11	November	31.5	13.1	22.30
12	December	30.1	8.0	19.05

Source: District Statistical Abstract, Pune District 2003-04

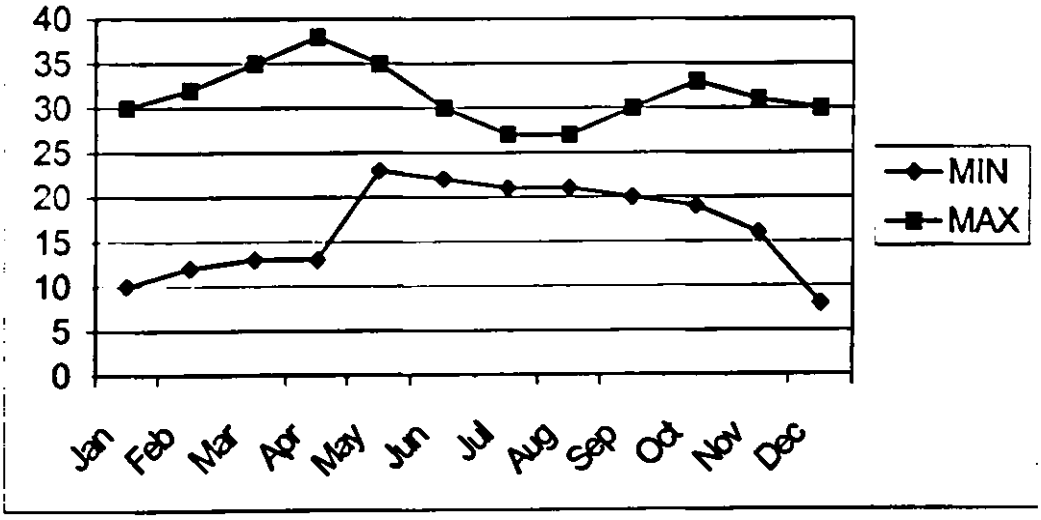
The average minimum temperature is **10.5** degree Celsius and the average maximum temperature is **37.7** degree Celsius as per District Statistical Abstract for the year 2003-04.

Above table thus, provides information on the maximum and minimum temperature recorded in Pune District for the twelve months of the year 2002-03. In addition to the figures of the minimum and the maximum temperature, it is also required to find out the range of the temperature for Pune District. The charts on the next page depicts the range of temperature recorded in 2002-03:

PUNE DISTRICT
AVERAGE TEMPERATURE
IN CELSIUS



PUNE DISTRICT
RANGE OF TEMPERATURE



Information is also be collected on the total rainy days in the year. These figures are useful to determine the site-specific problems in the installation of SWHS. On the basis of this data the availability of rainy days can be arrived in each Tahshil of Pune District.

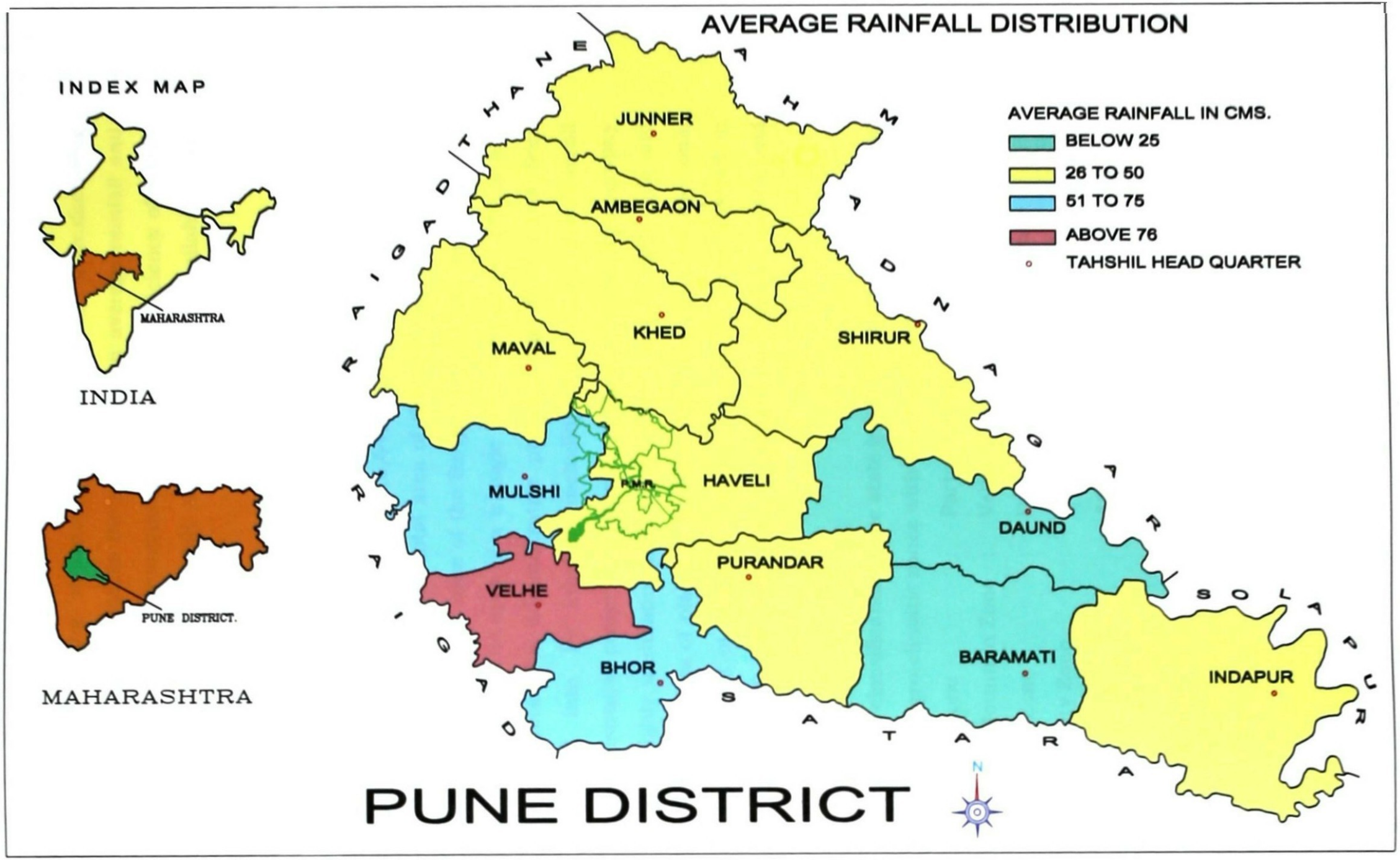
The following table shows total number of rainy days in 2002 along with average rainfall in each Tahshil of Pune District.

Table 2.2
Average rainy days and rainfall in 2002 in each Tahshil of Pune District

Sr. No	Tahshil Head Quarter	Average Rainy Days	Average Rainfall
01	Pune City	32	673.10
02	Khed	40	682.70
03	Ambegaon	31	770.50
04	Junner	34	810.10
05	Shirur	23	507.50
06	Daund	20	464.60
07	Indapur	22	512.80
08	Baramati	19	426.80
09	Purandhar	29	581.50
10	Bhor	53	1,991.00
11	Velhe	74	3315.90
12	Mulshi	55	1545.00
13	Haveli	NA	523.10
14	Maval	59	2558.00

Source: District Statistical Abstract, Pune District 2003-04

The average rainfall recorded in Pune District is shown in the graph of Pune District. The graph on the next page shows division of Pune District on the basis of average rainfall during 2003-03. Manufacturers of SWHS and Solar Cookers should collect information on the average rainfall in each Tahshil of Pune District.


AVERAGE RAINFALL DISTRIBUTION
INDEX MAP
MAHARASHTRA
INDIA
PUNE DISTRICT.
MAHARASHTRA
AVERAGE RAINFALL IN CMS.
BELOW 25
26 TO 50
51 TO 75
ABOVE 76
TAHSHIL HEAD QUARTER
JUNNER
AMBEGAON
KHED
SHIRUR
MAVAL
MULSHI
HAVELI
DAUND
PURANDAR
VELHE
BHOR
BARAMATI
INDAPUR
THANE
AHMEDNAGAR
RAIGAD
SATARA
SOLAPUR
PUNE DISTRICT
N

The marketing department of any solar manufacturing company should possess the above data on average rainfall and average rainy days throughout the year as the efficiency of SWHS and Solar Cooker certainly depends upon the availability and intensity of sunlight.

2.3 Physical Set-Up

Pune District is the second largest District in Maharashtra State and has an area of 15,642 square kilometers, which accounts for 5% of the total area of the State of Maharashtra. A district lying at the base of the Sahyadri Mountain has the shape of a triangle. The apex of a triangle is on the point of Bhima and Nira rivers. For administrative purpose, the district has been divided into 14 tahshils including Pune City, the overall administrative center. The district presents a varied physiography with highly undulating hilly topography on the Western Side and large stretches of plains in Eastern side. The agro-climatic zonal planning unit of planning commission has put Pune District in Zone No. 09-sub zone No. 01 along with Nashik, Satara and Kolhapur Districts.

In the classification of the state levels the District falls into four different agro-climatic zones with tahshils as under:

i) Ghat Zone	:	Part of Maval
ii) Sub-Mountain Zone	:	Velhe, Bhor, Mulshi, Khed and Maval
iii) Plain Zone	:	Haveli, Junner and Ambegaon
iv) Scarcity Zone	:	Baramati, Indapur, Purandar, Daund and Shirur

Pune District lies between 17.5^0 to 19.2^0 in North Latitude and 73.2^0 to 75.1^0 East Longitude.

2.4 Administrative Set -up

The administrative head quarter of Pune District is Pune, which is 160 kms. by rail from the State Capital Mumbai. Pune District is divided into 14 tahshils as mentioned above. There are 25 towns and 1866 villages in Pune District.

2.5 Population of Pune District

Population of Pune District as per 2001 census is tabulated below:

Table 2.3
Population of Pune District

Sr. No.	Tahshil	Rural	Urban	Total
01	Junner	3,45,065	24,741	3,69,806
02	Ambegaon	2,00,043	13,799	2,13,842
03	Shirur	2,83,591	26,999	3,10,590
04	Khed	2,86,333	56,881	3,43,214
05	Maval	1,77.118	1,27,965	3,05,083
06	Mulshi	1,19,409	7,976	1,27,385
07	Haveli	2,88.325	10,64,725	13,53,050
08	Pune City	--	26,95,911	26,95,911
09	Daund	2,99,184	42,204	3,41,388
10	Purandhar	1,74,604	48,824	2,23,428
11	Velhe	55,874	--	55,874
12	Bhor	1,53,833	17,886	1,71,719
13	Baramati	3,21,518	51,334	3,72,852
14	Indapur	3,26,821	21,592	3,48,413
Total		**30,31,718**	**42,00,837**	**72,32,555**

This data is most useful to know the size of the solar market in Pune District.

Above table also reveals that Rural Population of Pune District is 3032 (42%)thousands while urban population is 4201 thousands (58%). Population of Pune District is 7.5% of the population of Maharashtra State.

2.6 Sex Ratio

Out of total population of 7233 thousands, male population is 3769 thousands and the female population is 3464 thousands. Thus, the sex ratio of female population is 919 females for 1000 males.

2.7 Literacy Ratio

In any study on awareness testing the literacy ratio plays an important role. The present study is based on the hypothesis that there is under utilization of SWHS and Solar Cooking Devices. One of the factors responsible for such under utilization may be the literacy level of the respondents. Hence, it would be interesting to review the literacy ratio for the District as a whole. Accordingly, the literacy ratio for Pune District is:

Overall Literacy Ratio	:	80.45%
Male Literacy Ratio	:	88.34%
Female Literaccy Ratio	:	71.89%

(Source: District Statistical Abstract)

2.8 Population Density

This is another important factor affecting the marketing strategy of any product. The higher is the population density; higher is the potential of any consumer product. Hence, the population density in the Pune District as per District Statistical Abstract is recorded below:

Overall density	:	462 per sq.km
Rural Area	:	202 per sq. km.
Urban Area (Towns)	:	6,765 per sq. km
Pune City	:	14,652 per sq.km.
Lowest in Velhe Tahshil	:	112 per sq.km

2.9 Households distribution by type of fuel used for cooking

One of the objects of the present research is to find out the causes of under utilization of market potential of Solar Cooking Systems. It is, therefore, necessary to know the cooking fuel pattern of the households in the Study Area. The households have various options as regards fuel is considered. Again the type of fuel for one application may not be the same as that used for other applications. For example, LPG may be used as a cooking fuel; whereas the same family may use Kerosene as a fuel for heating the bathing water. It is also likely that the pattern of fuel may not remain fixed even for a single household. Even though this is so it is necessary to get a rough idea on the fuel pattern of the households. Hence, the figures on the classification of households in Pune District by type of fuel used are given below:

Table 2.4

Households distribution by type of fuel

Sr.No	Type of cooking fuel	Rural	Urban	Total
01	Firewood	3,64,268 (64)	27,753 (4)	3,92,021 (27)
02	Crop Residue	22,433 (4)	5,758 (1)	28,191 (2)
03	Cow Dung Cake	12,943 (2)	1,389	14,332 (1)
04	Coal	445	519	964
05	Kerosene	57,128 (10)	2,50,887 (29)	3,08,015 (21)
06	LPG	1,00,889 (18)	5,78,152 (66)	6,79,041 (47)
07	Electricity	469	153	622
08	Biogas	5,857 (1)	896	6,753
09	Any Other	220	771	991
10	No Cooking	1,908	6,772	8,680 (1)
	Total Households	**5,66,560**	**8,73,050**	**14,39,610**

Note: Figures in bracket refers percentage to total households

Source: Table H –11 Census of India, 2001

2.10 Conclusion

Profile of Pune District as presented above will certainly help manufacturers/dealers/installers of SWHS and Solar Cooking Systems to design appropriate marketing network required to promote these products on systematic basis.

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CHAPTER III

REVIEW OF ENERGY SECTOR

Introduction

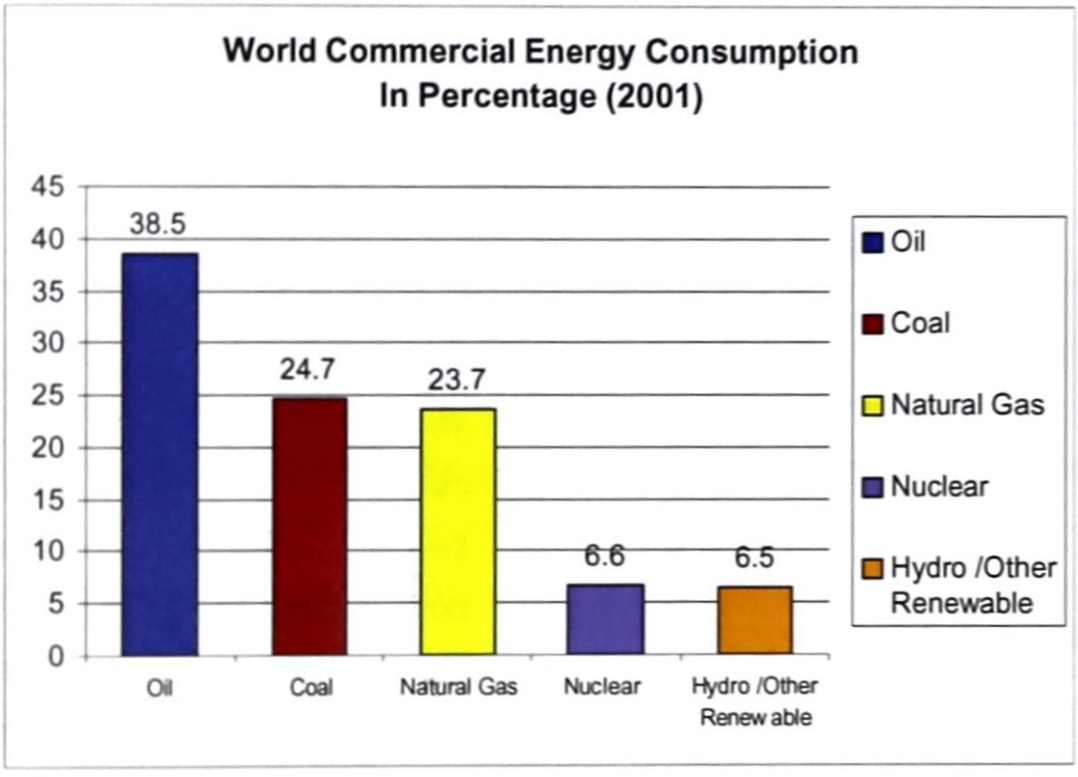
Energy is universally recognized as one of the most significant inputs for economic growth and human development. The growth of a nation, encompassing all sectors of the economy and all sections of the society, is contingent on meeting its energy requirements adequately. In an attempt to study the causes of under-utilization of SWHS and Solar Cooker, it is necessary to review the energy sector (Conventional and Non-Conventional) across the globe. This chapter presents a brief review of energy sector across the globe, in India and energy scenario for Maharashtra. Though the present research aims at exploring the causes of under-utilization of market potential of SWHS and Solar Cooker (Being part of the NRSE) the review includes both, the review of conventional as well as non-conventional energy sector.

3.1 World Energy Consumption

Energy is the currency of change in the world. It makes things happen and is literally the force, which drives our life. No wonder, it is always in great demand, but unfortunately in short supply. Thanks to the unprecedented population explosion and our changing life style. Indeed, we are facing an energy crisis. Energy has become the most important commodity and dictates not only national, but also international policies and politics.

Though nature continuously showers energy on us in various forms – heat, light, wind and sound- the bounty of nature is not always usable directly in the way the humans need and want. The

humans want to run their machines and engines for performing functions of myriad types in factories, fields, transport vehicles, communication networks, offices and homes. These machines and engines are mostly geared to use energy in the form of heat or electricity. The primary resources of energy for us so far have been fossil fuels like coal, petroleum and natural gas. The world's primary energy consumption in the year 2001 was 9,125 Million Tons of Oil Equivalent divided as shown in the following graph:



The World's Total Primary Energy Consumption in 2000 was 9,096 million tons of oil equivalent, and with a world population of 6,056 million, it translates into global per capita energy consumption of about 1,502 kg.

The demand for energy is increasing almost exponentially all over the world. In underdeveloped countries, it doubles itself in 3-5 years. In developing countries like India it doubles in 5-7 years while in developed countries the doubling time is 10-15 years.

Even the annual increment in energy consumption per capita in developed countries exceeds even the total energy consumption per capita in under developed countries.

Looking at the world as whole, one finds that from the time of Christ till the middle of the last century man consumed 8Q *(1Q)=10x10²¹* of energy. In the last century itself man consumed 4Q of energy and it is estimated that energy demand in the 21st century will be in the neighbourhood of 100Q. Against this energy demand, one may examine the known energy sources available to man. Table 3.1 shows the primary energy reserves

Table 3.1

Primary Energy Reserves (in units of Q)

Resource	World	USA	India
Coal	30	7	0.3
Oil	06	1	0.024
Natural Gas	05	1	0.06
Total Fossil Fuels	**41**	**9**	**0.3084**
Nuclear Energy	02	0.6	0.3103
Total Non-renewable energy reserves	**43**	**9.6**	**0.3103**
Hydroelectric Potential Per year	0.2	0.001	0.00018

Source: World Energy Report

It is thus seen that the total energy reserves do not exceed 45Q as against demand of 100 Q for the 21st Century. Human civilization is, thus, faced with the unprecedented problem of exponential increase in demand for energy to sustain growth on one hand and the fast depletion of known non-renewable sources of energy on the other. Hence, an urgent need is to supplement

these energy resources by the use of non-conventional and renewable sources of energy.

3.2 Overview of world renewable energy scenario

Renewables are sometimes described as the ***"dreams of the 1970s, realities but luxuries of 2000, and the necessities of 2020 and thereafter."***

Renewables include Hydropower, Biomass, Solar, Wind, Geothermal and Oceanic sources. The renewables included in the Commercial Energy statistics account for about 6-7% of the World's Primary Commercial Consumption. The total renewables including traditional or non-commercial, currently account for almost 14% of World's total primary energy consumption, with Biomass dominating the bulk of the non-commercial energy use. If hydro is excluded, the other renewables account for just about 1% of the world's energy consumption.

Renewable resources are more evenly distributed than the fossil fuels and nuclear, and possible energy flows from renewables are more than three orders of magnitude higher than the current global energy use.

However, the economical exploitation of the renewables is dependent upon many factors like competing land use, interruptible nature of resources like solar radiation, wind patterns and the cost of harnessing the resources.

While the costs of installation and generation of electricity with renewable resources continue to decline and technological advances improve generation efficiencies, historically they have not kept pace with the economics of energy from fossil fuels.

The environmental concerns and the commitments made by various countries to the *Kyoto Protocol* are expected to create the appropriate market conditions, thereby, fostering renewed interest in renewable energy development. This is because the renewables have the potential to provide energy services with zero or near zero emissions of both the air pollutants and the greenhouse gases. In addition, the indigenous nature of renewable energy sources contribute to reducing dependency on energy imports and increasing security of supply.

The US senate passed a comprehensive energy bill in April 2002, which builds on the proposals for promoting renewable technologies that were contained in the "National Energy Plan" released by President George Bush in May, 2001. The bill has a provision requiring 10% of the electricity produced in the US by 2020 to come from renewable energy resources, up from the current level of 2%.

Similarly the EU 2000 green paper on energy security outlines financial supports aimed at achieving core EU policy objectives of developing renewable energy generation to account for 12% of overall consumption by 2010, versus current level of 3%. This has been followed by a Renewable Directive in September 2001.

The strong proponents of renewables reiterate that sometime in future, be it 20, 50 or 100 years hence, the fossil fuel sources will be exhausted, and something has to replace them. The only answer according to them is – ***Renewables.***

3.3 World Solar Energy Scenario

The annual solar energy potential across the globe is given in the following table:

Table 3.2

Annual Solar Energy Potential across the globe

(MTOE)

Region	Minimum	Maximum
North America	4,316	176,588
Latin America and Caribbean	2,683	80,868
Western Europe	598	21,782
Central and Eastern Europe	107	3,670
Former Soviet Union	4,750	206,267
Middle East and North Africa	9,828	263,571
Sub Saharan Africa	8,863	227,062
Pacific Asia	977	23,688
South Africa	925	31,910
Centrally Planned Asia	2,752	98,541
Pacific OECD	1,730	53,930
Total	**37,529**	**1,187,666**

Source: Reliance Review of Energy Markets

Edited by Energy Research Group, Reliance Industries Limited

The earth continuously receives a power input of 1.73×10^{14} KW from the sun. This translates to 1.5×10^{18} KWh /year, which is about 10,000 times the world's current annual energy consumption

Solar energy thus, has an immense theoretical potential. In practice, several factors like daily, seasonal and geographical variations; weather conditions and land availability make the possible potential much lower.

The current maximum solar energy potential is placed at over 2,000 MTOE per year. This assessment is before the conversion to secondary or the final energy demand. The amount of final energy potential will depend upon the efficiency of the conversion devices used.

3.3.1 Solar Photovoltaic

Photovoltaic solar energy conversion is the direct conversion of sunlight into electricity. An essential component of these systems are the solar cell, in which the photovoltaic effect i.e. the generation of free electrons using the energy of light particles takes place. These electrons are then used to generate electricity.

The average power density of solar radiation is about 100-300 watts per square meter. The average conversion efficiency of a photovoltaic power system is typically about 10-15%. So substantial areas are required to capture and convert solar energy into final energy on a large scale. For example, for an average plant size of 100 MW, an area of anything between 3-10 square kilometers would be required, depending on the power density and conversion efficiency.

Thus, while the theoretical potential for power availability from solar resources is limitless, these have little significance for assessing the technical and economic potential.

The technical potential of photovoltaic has been studied in several countries. In densely populated countries with a well-developed infrastructure, the emphasis is on applications of grid-connected systems in an already built environment. These systems are necessarily small or medium sized typically 1 KW to 1 MW.

The electricity generated is close to the place where it is also consumed. In less densely populated countries, there is considerable interest in "Ground based" systems, generally larger than 1 MW. In countries or rural regions with a weak or incomplete grid infrastructure, small standalone systems and modular electric systems may be used for electrification of houses or village communities.

3.3.2 Solar Thermal

Solar radiation can produce high temperature heat, which can generate electricity. The most important solar thermal technologies to produce electricity use the direct radiation.

Low cloud areas with little scattered radiation like the deserts are considered most suitable sites. The worldwide capacity of Solar Thermal Electricity is expected about 12,000 MW to 18,000 MW by 2020.

3.4 India's Energy Scenario

3.4.1 Conventional Energy Sector

Energy sector in India has received a high priority in the planning process at the macro level, and so also in the planning process of public funds for its growth and R & D. Its share of funds has risen from 15% in the Third Five Year Plan to 27% in the Tenth Five Year Plan. In spite of continued efforts, the growth of this sector has not been fast enough to keep pace with the demands for energy services by the individual consuming sectors.

There exists a strong casual relationship between economic development and energy consumption. The two key socio-economic indicators that drive the pace of energy demand are population and domestic product. Economic development and a rapidly growing population that has taken the country from 300 million people in 1947 to over one billion people today is putting a strain on the environment, infrastructure, and the country's natural resources.

3.4.2 Demand and supply scenario

India is relatively well endowed with both, exhaustible and renewable energy resources. Coal, oil, and natural gas are the three primary commercial sources of energy. Over the years, there has been a significant change in the pattern of supply and consumption of energy. The share of commercial fuels in the total energy has risen from 41% in 1970-71 to approximately 70% in 2003-04, despite the dominance of traditional fuels in the energy sector in India. The total domestic primary commercial energy supply in India has risen from 147.05 MTOE in 1970-71 to 248 MTOE in 2003. Table 3.3 gives the break up of estimated energy demand in India.

Table 3.3

Estimated energy demand in India

Primary Fuel	**Unit**	**Demand (in original units)**		**Demand (MTOE)**	
		2006-07	**2011-12**	**2006-07**	**2011-12**
Coal	Mt	460.50	620.00	190.00	254.93
Lignite	Mt	57.79	81.54	15.51	22.05
Oil	Mt	134.5	172.47	144.58	185.40
Natural gas	BCM	47.45	64.00	42.70	57.60
Hydro power	BKwh	148.08	215.66	12.73	18.54
Nuclear power	BKwh	23.15	4.74	6.04	14.16
Wind power	BKwh	4.00	11.62	0.35	1.00
Non commercial energy	--			151.30	170.25
Total Energy Demand	--			**563.21**	**723.93**

Mt: Million Tonnes; bcm: billion cubic meter; bkwh: billion kilowatt hour

Source: Planning Commission

Trends in supply of primary commercial energy in India and & Energy and Power Supply: Indian Scenario are given in Table 3.4 and Table 3.5 respectively

Table 3.4

Trends in supply of primary commercial energy in India

(MTOE)

	1953-1954	1960-1961	1970-1971	1980-1981	1990-1991	2001-2002
Coal	23.62	35.6	36.48	56.96	94.68	133.89
Lignite	--	0.01	0.81	1.23	3.34	6.52
Oil	0.19	0.46	7.01	1.79	33.92	32.03
Natural gas	--	--	0.60	1.41	11.73	26.72
Hydro power	0.24	0.67	2.17	4.00	6.16	6.37
Nuclear power	--	--	0.63	0.78	1.60	5.15
Wind power	--	--	--	--	--	0.14
Total	24.05	36.78	47.67	75.19	151.43	210.82
Net Imports	2.20	6.04	12.66	24.63	31.69	87.85
Commercial Energy Supply	26.25	42.82	60.33	99.82	183.12	298.67
Primary Non-Commercial Energy Supply	64.13	74.38	86.72	108.48	112.07	139.02
Total Primary Energy Supply	90.38	117.20	147.05	208.30	305.19	437.69

Source: Planning Commission

Table 3.5

Energy And Power Supply: Indian Scenario

	2002-2003*	2001-2002	2000-2001	1999-2000	1998-1999
Energy (MU)					
Requirement	458,777	522,537	507,216	480,430	446,584
Availability	417,090	483,350	467,400	450,594	420,235
Shortage(%)	9.1	7.5	7.8	6.2	5.9
Power (MW)					
Peak Demand	81,492	78,441	78,037	72,669	67,905
Peak Demand Met	71,520	69,189	67,880	63,691	58,445
Shortage (%)	**12.2**	**11.8**	**13.0**	**12.4**	**13.9**

- Figures from April – January
- Source: Statistical Outline of India 2003-2004 prepared by Tata Services Limited, Dept. of Economics and Statistics

3.4.3 Domestic Production and Consumption of LPG in India

Since the present study also aims at finding out the causes of under-utilization of solar cooker, which is a partial substitute to LPG, it is necessary to review the production and consumption of LPG in India and to find the gap between the two, which is met by imports of LPG. Table 3.6 gives the domestic production and consumption of LPG in India from 1995-96 onwards:

Table 3.6

Domestic Production and Consumption of LPG in India

('000 Tonnes)

Year	Production	Consumption
1995-96	1539	3922
1996-97	1598	4267
1997-98	1666	4803
1998-99	1724	5352
1999-00	2487	6421
2000-01	4088	7016
2001-02	4778	7698
2002-03	4903	8351

Source: Indian Petroleum & Natural Gas Statistics 2002-03 published by Ministry of Petroleum and Natural Gas, Economics and Statistics Division, Govt, Of India.

3.4.4 Sectoral use of LPG

The above table provides the details about the consumption as well as production of LPG in India. However, LPG is consumed in various sectors of the economy such as domestic, industrial purposes, transport etc. And since the present study focuses on LPG consumption for households it would be interesting to study the domestic consumption of LPG vis-à-vis the consumption of LPG by other sectors in India. Table 3.7 provides the information on the sectoral use of LPG in India.

Table 3.7

Sectoral Use of LPG in India

('000 Tonnes)

Sector	2000-01		2001-02		2002-03	
	Consumption	%	Consumption	%	Consumption	%
Domestic	5432	75	6067	76	6820	79
Industry	1009	14	1050	13	1105	13
Transport	5	0.1	5	0.1	6	0.1
Power Generation	2	0.0	2	0.0	3	0.0
Agriculture	3	0.0	5	0.1	4	0.0
Mining	2	0.0	2	0.0	4	0.0
Manufacturing	132	1.8	109	1.4	150	1.7
Miscellaneous	160	2.2	179	2.3	202	2.3
Private Party Sales	403	5.5	418	5.3	208	2.4

Source: Indian Petroleum & Natural Gas Statistics 2002-03 published by Ministry of Petroleum and Natural Gas, Economics and Statistics Division, Govt, Of India.

From the above table it is thus concluded that the domestic sector dominates the use of LPG and the utilization percentage is found to record the increasing trend over the years.

3.4.5 Overview of Non-conventional Energy Sector in India

India has the distinction of being the only country in the world to have an exclusive Ministry dealing with renewable energy sources. During the last two decades there has been a vigorous pursuit of activities relating to the development, trial and induction of a variety of renewable energy technologies.

The MNES is broadly organized into six groups:

- Rural Energy
- Solar Energy
- Power from Renewables
- Energy from Urban and Industrial wastes
- New Technologies
- Administration and Coordination

MNES has issued guidelines to all the States on policies for power generation from renewables with a view to encourage commercial developments. In the new Electricity Act, 2003 there is a provision to generate 10% of the energy from renewable sources. The estimated potential and the extent of exploitation as per MNES report is given in the following table:

Table 3.8

Renewable Energy Potential and Current Achievements in India

(As on March 31, 2003)

S.No	Source/Technologies	Units	Apprx. Potential	Achievements
(A) Power from Renewables				
01	Wind Power	MW	45,000	1,870.00
02	Small Hydro Power (upto 25 MW)	MW	15,000	1,519.28
03	Biomass Power/Cogeneration	MW	19,500*	484.00
04	Biomass Gasifiers	MW	--	53.17
05	Energy Recovery from Wastes	MW	1,700	25.75
06	Solar Photovoltaic Power	MW	20MW/sq.m	2.50
Total power from renewables		MW	81,200	3,950.93

(B) Decentralized Energy Systems				
01	Family-size Biogas Plants	lakhs	120	34.40
02	CBP/IBP/NBP/Plants	Nos	--	3,902
03	Improved Chulha	Crore	12	3.52
04	Solar Photovoltaics	MW/sq.m	20	
	i) Solar Street Lighting systems	Nos.	--	47,969
	ii) Home Lighting Systems	Nos.	--	2,56,673
	iii) Solar Lanterns	Nos.	--	5,09,894
	iv) SPV Power Plants	KWP	--	1,637
05	Solar Water Heating Systems	MSQ	140	0.70
06	Solar Cookers			
	i) Box Solar Cookers	Nos.	--	5,41,000
	ii) Concentrating Solar Cookers	Nos.	--	632
	iii) Solar Steam Cooking Systems	Nos.	--	06
07	Solar PV Pumps	Nos.	--	5,113
08	Wind Pumps	Nos.	--	854
09	Hybrid Pumps	Nos.	--	183

(C) Other Programmes				
01	Aditya Solar Shops	Nos.	--	35
02	Battery Operated Vehicles	Nos.	--	300
03	Energy Parks	Nos	--	285
04	IREP Parks	Nos	--	860

MW = Mega Watt MSQ = Million Square KM. Collector Area

KWP = Kilo Watt Peak

Source: MNES Annual Report 2001 -2002

The launch of *Kyoto Protocol* was followed by the launch of the Clean Development Mechanism (CDM), which envisages technology transfer and financial assistance from the developed countries to the developing, to promote systems that would help reduce greenhouse gas emissions. In these circumstances, developments of renewable sources have emerged as a viable option and this scenario argues well for India's renewable energy resources development.

3.4.6 Renewable Energy and Five Year Plans

A modest beginning in the development of renewable energy technologies was made by the government during the Sixth Five Year- Plan Period (1980-85) with an allocation of Rs.996 million. The financial commitments over the years have been consistently increasing. While the current utilization of renewable energy sources is much below their potential, there have been constant endeavors to promote the use of these technologies over the Five Year-Plans. Table 3.9 below gives the budgetary allocation for Renewable Energy Sources in the Five-Year Plans.

Table 3.9

Budget Allocation for Renewable Energy Sources in the Five Year Plans (Rs. Million)

Plan Period	Total	Solar PV	Wind	Biogas	Solar Thermal	Improved Stoves	Others
VI Plan	996	149	150	500	--	--	197
VII Plan	4120	270	200	2000	320	400	930
VIII Plan	8570	900	900	3200	800	800	1970
IX Plan	39230	2750	2750	6750	2000	1500	18090

Source: Planning Commission Reports

Within the budgetary framework, the government apportioned a significant percentage of total outlay for the energy sector from the Fifth to the Nineth Five -Year Plans. Up to Eighties, the government, as the sole owner, undertook the entire investment in the energy sector. Recently, the government realized that it would not be possible for it to make the level of investments to meet the future demands, mainly due to competing fund requirements from the social sectors.

A policy of involving the private sector and seeking private (domestic and foreign) investment was therefore put in place. India's energy sector has been linked to international developments. Environmental concerns are both globally as well as locally relevant. These have influenced critical changes in strategies linked to the opening up of the energy sector to private and multinational companies. The private sector has added about 1430 MW against the targeted 2810 in the Eighth Plan period (Planning Commission, 1999)

The energy-environment-development interface is becoming a major component of the government's changing strategies. The Ninth Plan places considerable emphasis on integrating energy, environment and economic policy decisions for sustainable development. Some of the key features of the changing energy strategies through the plans are as follows:

- Ensuring greater output from existing capacities
- Conservation through increased efficiency
- Increased exploitation of renewable energy sources
- Implementation of demand management measures
- Promotion of decentralized energy systems
- Promoting research and development transfer and use of technologies and practices for environmentally benign

energy systems, including new and renewable energy sources.

Realizing the need for a dedicated financing agency for renewable energy sources, the Working Group set up by the Planning Commission recommended the establishment of a revolving fund tobe administered by renewable energy authority. Accordingly, in March 1987, the Govt. of India set up IREDA as a public limited Government Company. IREDA is the financing arm of MNES and implementing agency of its market oriented programmes. IREDA's activities form an integral part of the National Five-Year Plans and are part of the MNES Five-Year Plan. The motto of IREDA is 'Energy Forever' and its objectives are:

- To promote renewable sources of energy
- To provide financial support to users and manufacturers
- To act as a financial intermediary
- To assist in rapid commercialization.

3.4.7 Solar Thermal Energy Scenario in India – Policies of MNES

In India, there are about 300 clear sunny days in a year and solar energy is widely available in most of the country. India is literally soaked in sunshine.

Under the solar thermal energy programme, solar water heating systems, which help in saving on electricity consumption and preventing CO2 emissions, are becoming very popular, in addition to Solar Cooking including both for individuals and for communities.

The policies framed by MNES are for the development of renewable energy sector in India. These policies are discussed in the subsequent part of this chapter.

3.4.8 Renewable Energy Policy of MNES

A comprehensive RE Policy for all-round development of the sector, encompassing all the key aspects, has been formulated by MNES. The broad objectives envisaged in the policy are:

i) Meeting the minimum energy needs through RE

ii) Providing decentralized energy supply in agriculture, industry, commercial, and household sectors in rural and urban areas.

The policy envisages 10% of additional grid power generation capacity to be from RE by 2012.

3.4.9 Policy for All-round Development of Renewable Energy

Policy measures aim at overall development and promotion of RETs and applications. Policy initiatives encourage private as well as FDI including provision of fiscal and financial incentives for a wide range of RE programmes. Further, the procedures have been simplified, and provide excellent opportunities for increased investment in technology up gradation, induction of new technologies, market-development and export promotion.

3.4.10 Foreign Investment Policy

Foreign investors can enter into a joint venture with an Indian partner for financial and/or technical collaboration and for setting up of RE-based power generation projects.

Proposals for up to 100% foreign equity participation in a joint venture qualify for automatic approval.

Hundred percent foreign investments as equity as permissible with the approval of the Foreign Investment Promotion Board (FIPB) Foreign investors can also set up a liaison office in India.

The Government of India also encourages foreign investors to set up RE-based power generation projects on BOO basis. Various chambers of Commerce and industry associations in India provide guidance to the investors in finding appropriate partners.

3.4.11 Industrial Policy

The features of Industrial Policy are listed below.

- MNES is promoting medium, small, mini and micro enterprises for manufacturing and servicing of various types of RE systems and devices. Industrial clearances are not required for setting-up of an RE industry.
- No clearance is required from Central Electricity Authority (CEA) for power generation projects up to Rs.1, 000 million.
- A five-year tax holiday is allowed for RE power generation projects.
- Soft loans are available through IREDA for RE equipment manufacturing.
- Facilities for promotion of Export Oriented Units (EOUs) are available for the RE industry.
- Financial support is available to RE industries for R & D projects in association with technical institutions.
- Import of power projects is allowed.
- Private sector companies can set up enterprises to operate as licensee or generating companies.
- Customs duty concession is available for RE spares and equipment, including those for machinery required for renovation and modernization of power plants. Excise duty on a number of capital goods and instruments in the RE sector has been reduced or exempted.

3.4.12 Policies by State Governments

A number of states have announced policy packages including wheeling, banking, third party sale and buy-back.

Some states are providing concessions or exemption in state sales tax and octroi. These rates vary widely from state to state for different technologies and devices and in periodicity.

3.4.13 Fiscal Incentives (Includes Direct and Indirect Tax Concessions)

The fiscal incentives include direct taxes – 100% depreciation in the first year of the installation of the project, exemption or reduction in excise duty, exemption from central sales tax, and customs duty concessions on the import of material, components and equipment used in RE projects.

MNES has issued guidelines to all state governments for creation of an attractive environment for evacuation and purchase, wheeling and banking of electrical power from RE sources. The Ministry has urged that the states should announce general policies for purchase, wheeling and banking of power from all sources. Fourteen states have so far announced such policies.

The fiscal incentives applicable to RE sector are stated under the following sub-heads:

3.4.14 Indirect Taxes

(A) Customs Duty

i) Customs Duty: Customs duty for wind energy equipment and components.

ii) Customs duty for Solar PV equipment and materials.

iii) Customs duty for solar thermal equipment and systems.

iv) Customs duty for power generation plants and machinery.

(B) Excise Duty (RE devices exempt from Excise Duty)

Specified list of RE devices and systems for excise duty concession is as follows:

- Flat plat solar collector
- Black, continuously-plated solar selective coating sheets
- Concentrating and pie type solar collectors
- Solar cookers
- Solar water heaters and systems
- Solar air heating systems
- Solar low pressure steam systems
- Solar stills and desalination systems
- Solar pumps based on solar thermal and SPV conversion
- Solar power generating systems
- Solar crop driers and systems
- Solar lantern etc.

3.4.15 Direct Taxes

Under Income Tax Rules following concessions are available to the non-conventional energy sector. (The list is based on the A.Y. 2006-2007)

- **Section 32**

  Accelerated 80% depreciation on specified RE-based devices.
- **Section 80 IA**

Industrial undertakings set up in any part of India for the generation or generation and distribution of power at any time during the period beginning on 1st day of April 1993 and ending on the 31st day of March 2006. Hundred percent deduction from profits and gains for first five years and thereafter 30% of the profits and gains. This benefit can be availed for any 10 consecutive assessment years falling within a period of 15 assessment years beginning with the assessment year in which that industrial undertaking begins generation or generation and distribution of power.

3.4.16 Soft Loan Scheme of Solar Water Heaters

Under the Interest Subsidy Scheme of the MNES, the designated banks provide soft loans for installation of SWHS. The SWH financed through banks must utilize **BIS** (Bureau of Indian Standards) approved solar collectors. Soft loans are available from the branches of the designated banks. Any individual, institution, association, small business establishment is eligible for this loan up to 85% of the cost of the system at an interest rate of 5% (2% from September, 2005) per annum repayable in 5 years. Terms of loans under this scheme are presented in the following table:

Table 3.10

Terms of loans under Soft Loan Scheme on SWHS

Capacity	Up to 5,000 liters of hot water at 60-80 degree per day
Loan amount	85% (90% from September,2005) of the ex-factory or ex-showroom cost of the system
Interest rate for soft loan	5% (2% from September, 2005)
Loan repayment period	5 years
Repayment starts at	3 months after the release of funds to the consumers
Penalty for defaulted loans	For defaulted loans, banks may charge penal interest @ 2% over and above the stipulated interest rate.
Eligibility for loan	Any individual, institution, association, business establishment etc.

The names of the designated banks and their area of operation is given in the following table:

Table 3.11

Banks under Soft Loan Scheme and Area of Operation

Name of the Bank	**Area of Operation**
Canara Bank	Pune, Kolhapur, Satara, Sholapur, Srigonda,(Also includes 54 branches all over India from other states)
Punjab National Bank	All branches in the country
Union Bank of India	All branches in Maharashtra State (Also includes all branches in U.P. and 45 branches from other states in India.
Andhra Bank	All branches in the country
Bank of Maharashtra	All branches in the country
Punjab & Sind Bank	All branches in the country
Syndicate Bank	All branches in the country

3.4.17 MNES Financial Incentives for Solar Cookers

(A) Promotional Scheme

In order to promote the sale of solar cookers throughout India MNES provides assistance to the end users through the State Nodal Agencies. Incentive to State Nodal Agencies (MEDA in Maharashtra) and associated promoters for promotional activities/service charges is given as shown in the following table:

Table 3.12

Promotional incentives for sale of solar cooker

Type of Solar Cooker sold	Incentive per cooker to SNA if sale is made through their own outlets
ISI marked box solar cooker	Rs.200
Non-ISI box solar cooker but approved by test centers	Rs.100

(B) Support to reputed NGOs/universities/institutions etc.

The financial support up to a maximum of Rs.1.5 lakhs, towards organization of promotional activities like publicity, cooking demonstrations/ competitions/ seminars/ workshops, evaluation studies, development of improved models, etc. on solar cookers based on specific proposal received from them in the prescribed format is given. This support is also extended to SNAs for organizing workshops / seminars / training programmes/ business meets on solar cookers.

(C) Support to manufacturers for taking BIS approval

Support to manufacturers for taking BIS approval is given in the form of reimbursement of BIS fee directly by MNES on 100% basis during 1st year and on 50% basis during further years of 10th Plan.

(D) Financial support on installation of Concentrating Solar Cookers

Financial support by MNES on installation of Concentrating Solar Cookers are given in the following table:

Table 3.13

Financial support on installation of concentrating solar cookers

Type of solar cooker	Support to users	Service charges to SNA
Dish Solar Cooker(Minimum Diameter 1.4 m)	50% of total cost, limited to Rs.2, 500 Per cooker	Rs.250 per cooker
Community Solar Cooker for Indoor Cooking	50% of total cost, limited to Rs.25, 000 per cooker	Rs.2, 500 per cooker
Solar steam cooking system	50% of eligible capital cost, as agreed upon by the MNES	1 to 2% of MNES support depending on the system capacity
For solar steam cooking systems the support is also made available if they are used for other applications also like drying, sterilization, water pasteurization besides cooking.		

E Aditya Solar Shops

E.1 Establishment of shops owned by State Governments/agencies

Non-recurring grant : Rs.5 lakhs for construction/ purchase And furnishing or Rs.3 lakhs for renovation including rent for one year.

Recurring grant : Rs.0.50 lakhs per year for 2 years

Grant for inauguration : Up to Rs.35,000

E.2 Establishment of private Aditya Shops/Solar Counters

Rs.50,000 per Aditya shop and Rs.20,000 per solar counter, as a one time grant for meeting the expenditure on furnishings and fittings, sign boards etc.

E.3 Publicity of Aditya Shops

Rs. 50,000 per year to a maximum of Rs. 10 lakhs to each state.

3.4.18 Conclusion

All the above schemes of MNES are aimed at encouraging maximum use of RETs. The schemes are in the nature of Fiscal Benefits (Direct and Indirect Tax Benefits) as well as various subsidies either to the manufacturers or users of the solar energy devices. However, in my study it is found that many people are not aware of such schemes, and therefore, there as un urgent need to increase the awareness of such schemes by proper media coverage.

3.5 Overview of NRSE sector in Maharashtra: Role of MEDA

During the last two decades, there has been a vigorous pursuit of activities relating to the development, trial and induction of a variety of renewable energy technologies. The Ministry of Non-conventional Energy Sources, Government of India provides the financial assistance depending upon the projects and schemes. In Maharashtra, Maharashtra Energy Development Agency (MEDA) implements the programmes covered under NRSE.

For about one decade since its inception, MEDA did extensive work in the field of renewable energy focused in rural areas on stand-alone devices. Energy conservation work was also taken up in 384 industries in the State.

The performance in respect of the Solar Thermal Programme implemented by MEDA is shown in table 3.14 below

Table 3.14

Performance of Solar Thermal Schemes implemented by MEDA

Sr.No	Item	During 2003-04	Cumulative up to March, 2004
01	Solar cookers sold (NOs)	970	47,257
02	Total capacity of solar systems (Lakh liters per day)	7.7	58.2
03	Solar desalination systems installed (Nos.)	00	954
04	Solar Photovoltaic Lanterns installed (Nos.)	300	8,977
05	Solar PV Battery Chargers distributed (Nos.)	00	310
06	Solar PV sprayers supplied (Nos.)	00	179

Source: Economic Survey of Maharashtra 2004-05
Published by Director of Economics and Statistics,
Maharashtra Government

3.6 CONCLUSION

Solar energy devices have been distributed in the field since last 15 years. Initially it passed through research and development stage. The next stage was optimization and field application. Field-testing of many devices finally proved that certain items could be made commercially viable while some of them still need the cost optimization although they are technically mature. The initial hesitation of common public has now turned into the confident use of renewable energy devices. Confidence level has increased to such an extent that even private investors are ready to invest in the renewable energy projects at a larger scale. To achieve this purpose, MEDA has been acting as an effective catalyst.

CHAPTER – IV

ANALYSIS OF PRIMARY DATA - I

[Institutional Respondents]

CHAPTER – IV

Analysis of primary data – Part I

(Institutional Respondents)

4.1 Introduction

This study aims at finding out the causes of under-utilization of Solar Water Heating Systems and Solar Cookers by two segments viz.

i) Institutional Respondents;
and
ii) Individual Households

In furtherance of the objects of the study, the researcher has collected data from a sample of institutional as well as individual respondents in the study area. (Study area is Pune District including Pune Metropolitan Region). The present chapter is the presentation of analysis of data collected from a sample of institutional respondents.

The study aims at analysis of various factors responsible to foster the market potential of SWHS and Solar Cookers in the study area. These institutional respondents represent the demand side of the problem under review. For analysis of the causes of under-utilization of any product, the demand side i.e. the feedback received from the present as well as prospective end users of the products must be studied. Therefore, the present chapter deals with analysis of the responses collected from the sample of institutional respondents.

4.2 Categories of institutional respondents

Institutional respondents selected for the present research are divided into six categories as mentioned below:

i) Hostels attached to the colleges in the study area -

In the study area almost all the colleges are affiliated to Pune University. The list of colleges along with the hostels attached to such colleges is obtained from Pune University.

ii) Hostels run by Social Welfare Department, Government of Maharashtra -

The Social Welfare Department, Government of Maharashtra runs hostels mainly for the school going children from the families belonging to the weaker sections of the society and the backward class community. It is a social welfare measure of the Government. Lodging and boarding facilities are freely provided to the students belonging to particular class of the society and from economically backward class families. Hostels are located at semi-urban as well as at remote areas of the State. Hostels at the district place i.e. Pune City as well as at the head quarter of each tahshil representing hostels located in the semi-urban area are selected as a sample for the present research. The list of such hostels is obtained from The Social Welfare Department, Government of Maharashtra.

iii) Hostels run by The Women and Child Welfare Department -

Maharashtra Government also runs rescue homes for women and orphanage homes for boys and girls in the minority age group. Government also gives grants to the private institutions that have

been working as Womens' Shelter Homes. Government makes all the arrangements of lodging and boarding by creating hostel facilities for such women. These women are allowed to stay in such hostels till they are rehabilitated. The Government at every important place in the District provides such hostel facilities. Hostels are located at semi-urban as well as at remote areas of the State. Hostels at the district place i.e. Pune City as well as at the head quarter of each tahshil representing hostels located in the semi-urban area are selected as a sample for the present research. The list of such hostels is obtained from The Women and Child Welfare Department, Government of Maharashtra.

iv) Hostels run by Non-Government Organizations

Various NGOs and voluntary organizations run the hostels for the upliftment of the people from downtrodden sector. Hostels are in the form of homes for the blind, homes for the mentally retarded people, hostels for the hearing impaired persons, hostels for the crippled persons, hostels for the ageing persons etc. Hostels for the purpose of the present research were selected on Stratified Random Sample basis giving proper representation to urban as well as semi-urban area.

v) Government Guest Houses

Various departments of the Government viz Central as well as State have maintained guesthouses at different places in the District. The respective departments maintain these guesthouses. Central Railway, for example, maintains guesthouses at Lonavla and Daund for its Railway Drivers and Guards. The Irrigation Department of Maharashtra Government has also constructed guesthouses at various Dam sites for the engineers and survey staff. The Public Works Department has also made provision for

guesthouses at important places in the District for the use by the Inspection Staff and other Administrative Personnel of the Department. These guesthouses also represent the prospective users of the NRSE devices including Solar Water Heating Systems and Solar Cookers. Hence, they are included for the purpose of the present study on under-utilization of the market potential of SWHS and Solar Cookers in Pune District. The information as regards guesthouses maintained by various departments of the Government has been collected from District Census Book for the year 2001.

vi) Public Hospitals in Urban and Semi-urban area -

Hospitals are also the prospective buyers of Solar Water Heating Systems and Solar Cookers. Therefore, they have also been included in the scope of the present study. The following hospitals have been included and data are collected from such hospitals:

a) Primary Health Centers and Rural Hospitals at the Head Quarter of each Tahshil. Such information as is available from Health Department of Zilla Parishad, Pune is considered as authentic for the purpose of the present study.

b) Sassoon General Hospital, which is the largest Government hospital at the District Head Quarter (Pune District) with a bed capacity of 1,300 patients.

c) Hospitals run by Pune Municipal Corporation representing the urban segment of the study area. The data as regards the hospitals in the jurisdiction of Pune Municipal Area is obtained by visit to Health Department of Pune Municipal Corporation.

4.3 Sample Size

In any socio-economic study the sample to population ratio is an important factor to be considered in the discussion on the methodology adopted for the study. Validity of the conclusions can be acceptable if the sample is representative of the population.

In selection of sample of respondent hostels and other institutions, care has been taken that they represent the population. Hostels of each of the categories have been selected on a Stratified Random Sample Basis. Hostels of various types such as Boys Hostels, Girls Hostels, Hostels of Professional Colleges, and Hostels of Non-professional colleges have been properly included in the sample selected for the purpose of the study. It is also ensured that the hostels are selected from urban as well as semi-urban segment of Pune District. The following table shows the sample-population ratio in respect of each category of the respondent:

Table 4.1

Sample - Population Ratio of Institutional Respondents

Sr. No	Category of the Institutional Respondent	Population as per Authentic source	Sample selected for the present study	Sample / Population Expressed in percentage
01	Hostels attached to the colleges	125	81	65
02	Hostels run by The Social Welfare Dept., Government of Maharashtra	77	31	40
03	Hostels run by The Women and Child Welfare Dept.Government of Maharashtra	47	16	34
04	Hostels run by NGOs	N.A.	24	--
05	Government Guest Houses	69	35	50
06	Public Hospitals	126	41	33

Inference:

The above table clearly indicates that the sample of respondents selected for the study sufficiently represents the population, so as to validate the conclusion drawn from the study.

These institutional respondents fall into three different categories viz.

i) Hostels, (Clause 4.4)
ii) Government Guest Houses (Clause 4.5)
iii) Public Hospitals, (Clause 4.6)

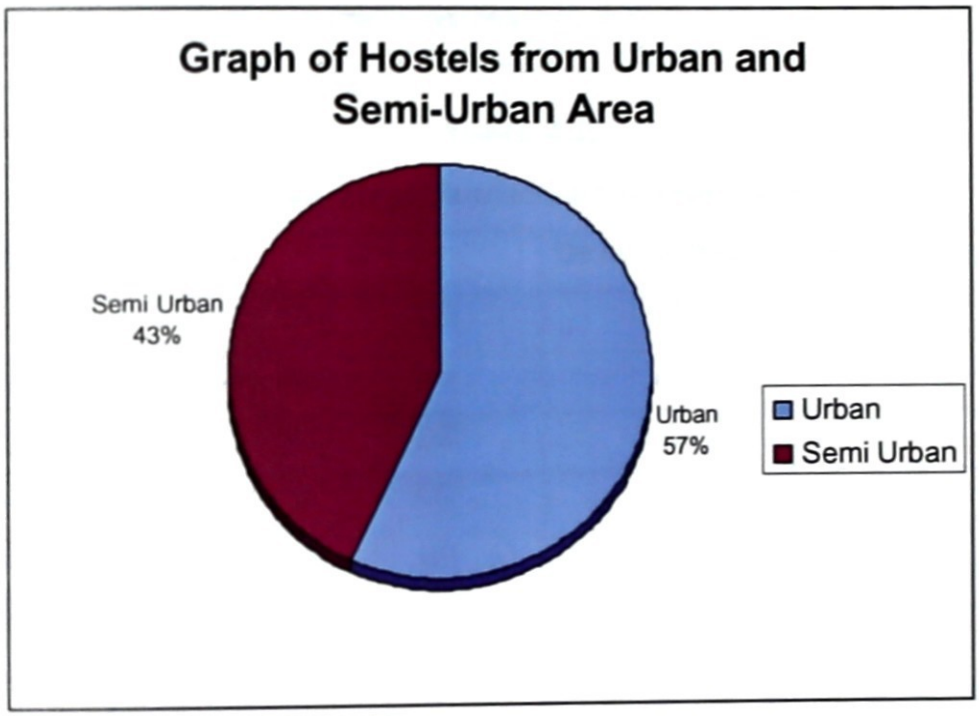
The institutional respondents selected for the study have distinct features of their own. The pattern of use of hot water is different for each category of the respondents. Users of the hot water also represent different categories, as for example hostel students are the users of solar hot water and the patients need hot water for different purposes in the hospitals. Therefore, the analysis of institutional respondents has been made separately for each category of the respondents. First part of the analysis deals with the hostels, followed by Government Guesthouses and Public Hospitals thereafter.

4.4. Analysis of the responses collected from heads of various hostels

4.4.1 Area wise analysis

Hostels in the study area are perceived as the present as well as prospective users of SWHS and Solar Cookers. The study, therefore, aims at studying the profile of sample of hostels located within the geographical territory of the study area. The geographic classification of the study area is Urban Area and Semi-Urban area. In the pilot study conducted, it was observed that hostels located at the rural centers could make use of firewood and other bio–mass such as crop residue as a fuel for heating the bath water as well as for cooking purpose. Therefore, the devices such as smokeless chullhas, biomass gassifiers, gobar gas, biogas etc. are

well suited for the hostels located in such areas where biomass etc. is available as a fuel. Therefore, the present study considers urban as well as semi-urban segment as a potential market for the NRSE devices including SWHS and Solar Cooker, the products under reference of the present research. Therefore, a sample of the hostels from Urban and Semi-urban area are selected for this research. The following pie diagram clearly shows the percentages of hostels from each of these areas:



Thus, 87 out of 152 i.e. 57% hostels have been selected as a sample from urban area and 65 out of 152 representing 43 % hostels have been selected as a sample from semi-urban area. Semi-urban area is considered as the head quarter of each tahshil in Pune District.

4.4.2. Age wise classification

Age of the hostel implies the number of years a particular hostel is in use. The decision to install solar water heating system

and solar cooking system is an asset acquisition proposal and, therefore, it depends upon so many factors, such as availability of funds, justification for the equipment as well as on the stability of the organization. The hostels having completed a certain number of years can certainly be treated as the stable organizations. Therefore, they could be considered as prospective buyers of the devices. Hence, the present study has given importance to the age factor of the hostel. The following table points out the age of the hostel. The period of reference for the purpose of calculating age of a particular hostel is taken as March, 2004.

Table 4.2

Age wise classification of sample hostels

Sr.No.	Age	Urban	Semi-urban	Total
01.	00 - 10	20	15	35
02.	10 - 20	25	15	40
03.	20 - 30	02	12	14
04.	30 - 40	09	10	19
05.	40 - 50	02	09	11
06.	50 - 60	12	00	12
07.	60 - 70	01	00	01
08.	70 - 80	02	03	05
09.	80 - 90	04	00	04
10.	90 - 100	02	01	03
11.	100 - 110	07	00	07
12.	110 - 120	01	00	01
Total		**87**	**65**	**152**

4.4.3. Sex – wise Classification of the sample hostels

The products for which causes of under-utilization of market potential are evaluated are solar water heating system and solar cooker. Of these two products, solar water-heating systems has a

particular market segmentation viz. ladies hostels as prospective buyers. Usually it is observed that arrangement of hot water for bath is an essential pre-requisite of any ladies hostel. Of course, for boys hostels too hot water is provided but it may not be treated as an utmost necessity. Therefore, an attempt is made to find out the proportion of boys hostels and ladies hostels out of the sample of hostels from urban as well as semi-urban area of the study. The following table gives the sex wise classification of the boys and girls sample hostels in Pune District.

Table 4.3

Sex –Wise Classification of sample hostels

Sr. No	Area	Boys Hostels		Girls Hostels		Total
		No.	%	No.	%	
01	Urban	47	54.02	40	45.98	87
02	Semi-Urban	37	56.92	28	43.08	65
Total		**84**		**68**		**152**

Inference:

From the above, it is clear that 54.02% of the hostels in the urban area are boys' hostels and the remaining, i.e. 45.98% hostels are girls' hostels. Whereas, 56.92% of the hostels in the semi-urban area are the boys' hostels and the remaining 43.08% represent the girls' hostels in the semi-urban area. Any marketing drive always first tries to understand as to "Who are our prospective customers?" In this attempt of knowing the customers, this classification would certainly useful to devise suitable marketing strategy. As pointed out earlier, the girls' hostels in the study area must be chosen first and the hostels not using the solar water heating system must be convinced about the

techno-economic benefits of the solar water heating systems and community solar cooking system.

4.4.4 Classification on the basis of type of organization

The decision to install solar water heating systems and community solar cooking also depends upon the attitude of the management, flexibility in the decision-making etc. It is normally experienced that decision-making process in any Government organization is too lengthy. In spite of this, it has to be accepted that the Government could be one of the most important consumer of the solar water heating systems and community solar cooking unit considering the total number of Government hostels in Pune District, including Pune City (Which is the study area).

On the basis of this parameter, therefore, sample hostels in the study area are classified into two categories and shown in the table as below:

i) Hostels owned and controlled by Government Organization

ii) Hostels owned and controlled by any other institution not being Government Organization.

Table 4.4

Classification of sample hostels on Govt./Non-Govt. Basis

Sr. No.	Category	Urban			Semi-Urban			Total		
		Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
01.	Run by Govt.	14	08	22	13	16	29	27	24	51
02.	Run by Institutions other than Government	33	32	65	24	12	36	57	44	101
	Total	**47**	**40**	**76**	**37**	**28**	**65**	**84**	**68**	**152**

The Government hostels included in the table(4.4) are the hostels attached to educational institutions run by Government such as Government Engineering College, Pune, B.J. Medical College (Government Medical College, Pune). Government hostels also include hostels run by Social Welfare Department and Women and Child Welfare Department of The Government of Maharashtra.

This study also aims at finding out the causes of under-utilization of SWHS by Government vis-à-vis institutions other than Government. Central Government has created a separate ministry called as MNES (Ministry Non-Conventional Energy Sources, Govt. of India) at the Center. Maharashtra Government also has created a separate cabinet portfolio as Ministry, Non-Conventional Energy Sources. The study, therefore, wants to explore whether the policies of one department of the Government have been put into practice by the other departments. This calls for integration of government policies by various Government departments by proper co-ordination among themselves. Hence, the classification into Government Owned and Other Hostels is purposely made to further find out the User and Non-users of solar water heating systems and community solar cooking among Government Hostels.

4.4.5 Classification of hostels on the basis of categories

After collecting information from the solar equipment manufacturers, it was found that solar energy devices are sold to different categories of customers, hostels being the major buyer of solar water heating systems. These hostels are further classified as hostels owned and controlled by private individuals ***(which is not included in the present study)*** and hostels owned and controlled by educational institutions and Government departments. This classification must be considered in an analysis of market potential. The following table shows classification of hostels by their categories.

TABLE 4.5

Category wise Classification of sample hostels

Sr. No.	Category Of Hostels	Urban			Semi-Urban			Total		
		Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
01.	Hostels attached to colleges	34	32	66	11	04	15	45	36	81
02.	Hostels run by social welfare departme nt.	06	01	07	12	12	24	18	13	31
03.	Hostels run by women and child welfare departme nt of Govt. of Maharash tra	06	05	11	01	04	05	07	09	16
04.	Hostels run by NGOs.	01	02	03	13	08	21	14	10	24
	Total	**47**	**40**	**87**	**37**	**28**	**65**	**84**	**68**	**152**

Information on utilization or otherwise has been collected from the heads of the above hostels through a separate questionnaire. The researcher has also been able to meet the Rectors of some of these hostels and the causes of non-utilization are discussed with them. These causes will be presented in the later part of the present study.

4.4.6 Occupancy wise Classification

The daily requirement of hot water depends upon the number of end users of solar water heating system. Pay back period of a particular system may not reconcile with the standard pay back

period if the requirement of hot water is not matched with the capacity of the system. The longer pay back period of a particular system may be due to installation of a solar water heating system of a capacity more than the occupancy of the end users. For example, in a hostel of 100 students, solar water heating system in the range of 1,500 to 2,000 LPD is most suitable. If in such hostel the capacity of the system is more than 2,000 LPD then the price paid must be certainly more so that the actual pay back of the system would certainly be higher than the standard pay back period. Hence, capacity of the solar system should match with the requirement of the solar water by the end users.

Therefore, the sample hostels in the study area are analyzed into their occupancy i.e. number of students in each hostel. The hostels run in one campus are divided on the basis of the strength of each hostel. This division of hostels into their occupancy helps to assess the market potential of the systems.

Table 4.6

Occupancy wise classification

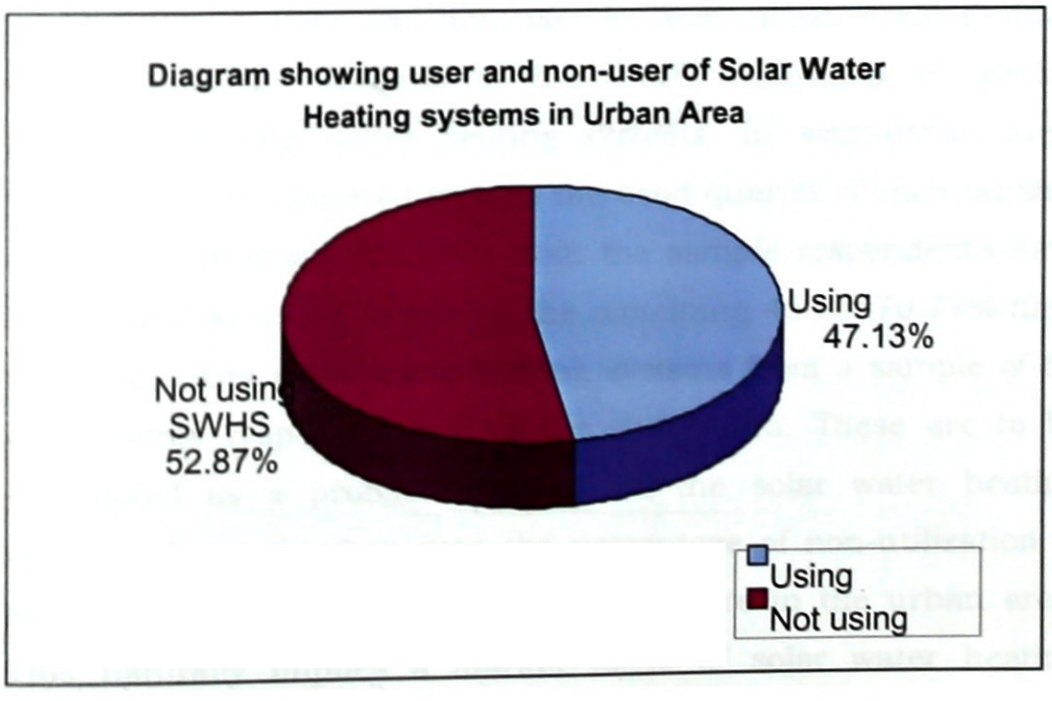
Sr. No.	Occup-ancy Of Hostels	Urban			Semi-Urban			Total		
		Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
01	00 -50	04	09	13	18	12	30	22	21	43
02	50-100	12	07	19	04	13	17	16	20	36
03	100-150	23	18	41	10	01	11	33	19	52
04	150-200	05	05	10	03	00	03	08	05	13
05	200-250	03	01	04	02	02	04	05	03	08
	Total	**47**	**40**	**87**	**37**	**28**	**65**	**84**	**68**	**152**

Inference:

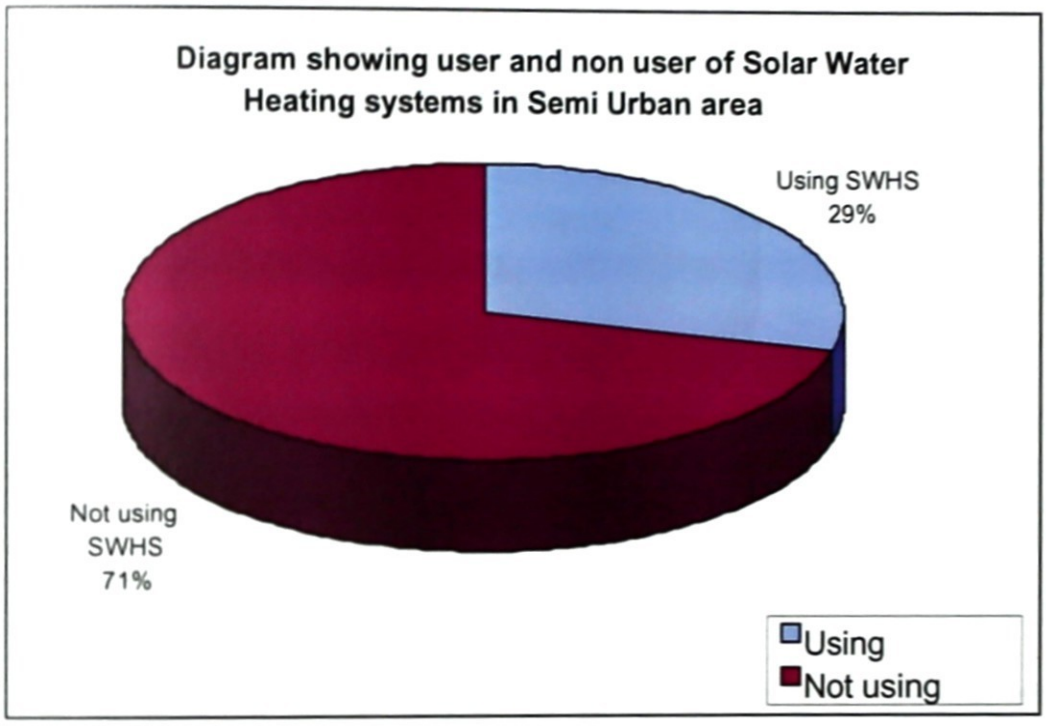
It is thus concluded that maximum number of hostels i.e. 52 out of 152 being 34% are in the occupancy range of 100 – 150 students. This information would certainly be treated as valuable to the manufacturers to decide the collector capacity of the solar water heating systems manufactured by them.

4.4.7 Classification by user and non-user category -

The present study is based on the hypothesis that there is under-utilization of solar water heating systems and solar cookers and their market potential in the study area. In order to be able to prove or otherwise this hypothesis, data are collected as regards the present users and non-users of these products from the sample of the respondents selected for the study. Some conclusions could be definitely drawn from the figures of user and non-user institutional respondents. The following pie diagram shows the percentages of users and non-users of solar water heating systems and community solar cooking system.

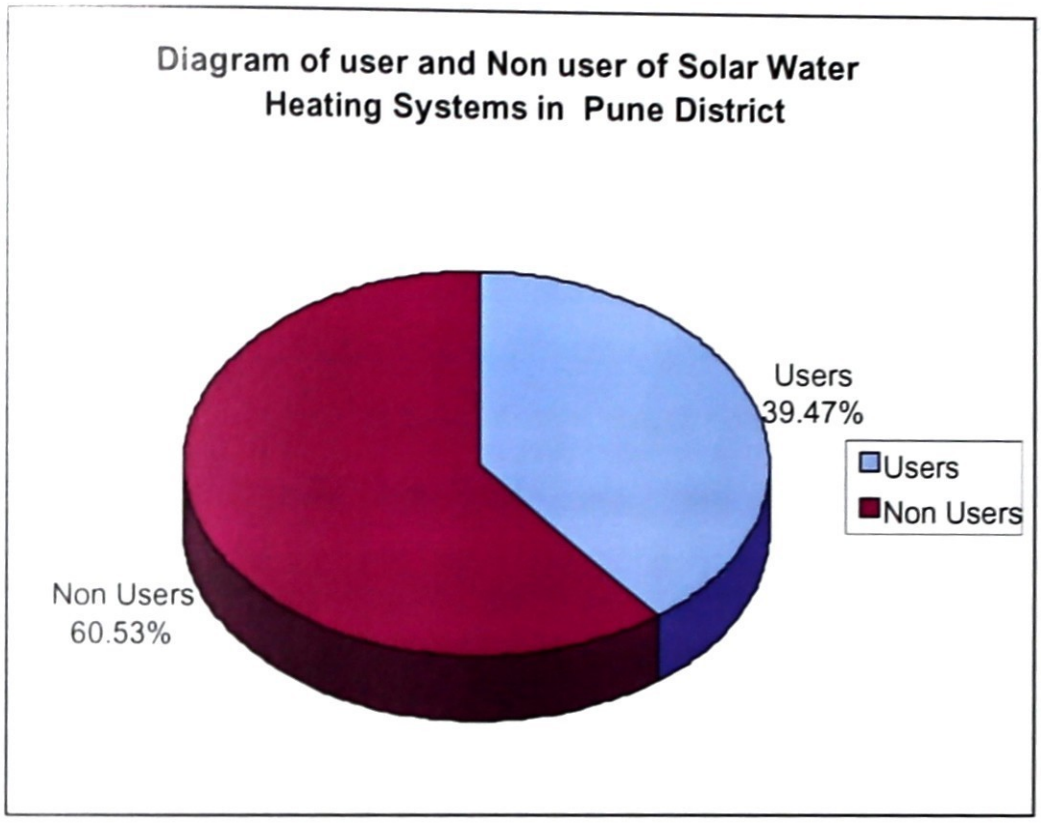


Thus, in the urban area 41 (47.13%) of the institutional respondents have been using solar water heating systems and the remaining 46(52.87%) have not been using solar water heating systems. Manufacturers and dealers of the solar water heating systems should treat the percentage of non-utilization as a business opportunity and should tap this market.



The data of user and non-user for semi-urban area is much valuable for the analysis of the under utilization of market potential of solar water heating systems. In semi-urban area, which is mostly centered around the head quarter of each tahshil, only 19 institutions (29.23%) from the sample respondents have been found as users. Whereas, the remaining 46 i.e. 70.77% have not been using solar water heating systems from a sample of 65 institutional respondents from the study area. These are to be considered as a probable market for the solar water heating systems. In semi-urban area the percentage of non-utilization is much more as compared to the same figure in the urban area. This naturally implies a market niche of solar water heating

systems in the semi-urban area. The same figures for the urban as well semi-urban area in total are shown in the following pie diagram:



Thus, considering Pune District as a whole, only 60 hostels were found to be using the solar water heating systems out of a sample of 152 respondents randomly selected from the population of 249 hostels attached to various institutions as shown in Table 4.1 in the early part of this study. The overall percentage of under utilization is more than 60% (60.53%). Therefore, this trend of under utilization as evidenced from the above pie-diagram should be analyzed into its causes.

It is worth mentioning that none of the sample hostels is found to be the user of the Community Solar Cooking System. Use of community solar cooking system may not totally replace the conventional fuel such as LPG, Kerosene etc. However, it can be treated as a supplement to the conventional fuel used for cooking.

4.4.8 Classification of sample users by category

The sample of user respondents is further classified in their respective category. The following table shows the classification of sample hostels using the solar water heating systems:

Table 4.7

Classification of sample of user hostels by category

Sr. No.	Category Of Hostels	Urban			Semi-Urban			Total		
		Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
01.	Hostels attached to colleges	10	28	38	01	03	04	11	31	42
02.	Hostels run by social welfare department.	00	01	01	00	04	04	00	05	05
03.	Hostels run by women and child welfare department of Govt. of Maharashtra	00	00	00	00	03	03	00	03	03
04.	Hostels run by NGOs.	00	02	02	04	04	08	04	06	10
	Total	**10**	**31**	**41**	**05**	**14**	**19**	**15**	**45**	**60**

The above table can be interpreted as a market segmentation of the solar water heating systems.

4.4.9 Classification by category of sample non-user hostels -

In order to assess the market potential of the products under reference, it is utmost necessary to classify the non-user segment into its category. This will help manufacturers and dealers to unify their efforts of promoting the sale of these products. Therefore, the sample of non-user respondents is classified into different categories, each category representing a separate market segment. Since nature of these non –users differs from each other, separate marketing strategy would be required to be formulated for each category of the respondents. The users are further located in urban as well as semi-urban area, hence the products would be required to be designed according to the specific requirements of each of these areas. The following table shows the classification of non-users into different categories:

Table 4.8

Classification of sample non-users by category

Sr No	Category Of Hostels	Urban			Semi-Urban			Total		
		Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
01	Hostels attached to colleges	24	04	28	10	01	11	34	05	39
02	Hostels run by social welfare department.	06	00	06	12	08	20	18	08	26
03	Hostels run by women and child welfare department of Govt. of Maharashtra	06	05	11	01	01	02	07	06	13
04	Hostels run by NGOs.	01	00	01	09	04	13	10	04	14
	Total	37	09	46	32	14	46	69	23	92

Inference:

The above table helps to understand the absolute number of non-users from the sample data. However, we do not get the percentage of sample of non-users of SWHS to total hostels in the respective category. Hence, the category wise non-users are further compared with their total sample population so as to arrive at under-utilization in each category. The following table provides these details:

Table 4.9

Category wise Non-users of SWHS to total sample respondents in the urban area

Sr. No	Category	Boys Total	Non-users	% of non users	Girls Total	Non-users	% Non Users	Total Hostels	Non Users	% of non users
01.	Hostels attached to colleges	34	24	70.59	32	4	12.5	66	28	42.4
02.	Hostels run by social welfare department.	6	6	100	1	0	--	7	6	85.7
03.	Hostels run by women and child welfare department of Govt. of Maharashtra	6	6	100	5	5	100	11	11	100
04.	Hostels run by NGOs.	1	1	100	2	-	00	3	1	33.33

Table 4.10

Category wise Non-users of SWHS to total sample respondents in the semi-urban area

Sr.No	Category	Boys Total	Non-users	% of non users	Girls Total	Non-users	% Non Users	Total Hostels	Non Users	% of non users
01.	Hostels attached to colleges	11	10	90.90	4	1	25	15	11	73.3
02.	Hostels run by social welfare department.	12	12	100	12	8	66.67	24	20	83.3
03.	Hostels run by women and child welfare department of Govt. of Maharashtra	1	1	100	4	1	25	05	02	40
04.	Hostels run by NGOs.	13	9	69.23	8	4	50	21	13	61.9

Inference:

The above tables will be very much useful for analysis of category-wise under utilization of SWHS. In urban area, for example, 70.59% of the boys' hostels have not installed SWHS. Where as, the same ratio for the semi-urban area is most disappointing (90.90%). However, this adverse ratio of under utilization should be exploited as a business opportunity. The boys hostel as a class of customer seems to be totally out of the coverage of the solar manufacturers. Hence, efforts would be concentrated on that area. The girls' hostels in the urban area show only 12.5% as under utilization ratio. However, it does not mean that girls' hostel as a market segment has achieved a

saturation point. The obvious reason is that Pune City being viewed as an educational center in the State of Maharashtra, there is bound to be growth in the students coming from other parts, not only from India but also from abroad. This factor very much contributes to the potential growth in the market of SWHS.

The proportion of non-users is comparatively more in case of hostels run by the two departments of the Government as indicated in the above table. Manufacturers, therefore, have to observe this and efforts are required to convince the policy makers in the Government Department about maximizing the use of solar energy devices in the hostels run by these departments. The fact that solar water heating system is installed does not mean that the conventional energy is replaced by solar energy, as in case of few hostels, the SWHS was found to have installed but was not found to be in use especially in Government Hostels. The reasons for which are further investigated and presented in the "Cause Wise Analysis" of the later part of this chapter.

It is interesting to observe that, the non-user ratio is much less in the hostels run by NON GOVERNMENT ORGANISATIONS. The researcher has personally visited these hostels and on inquiry it was found that most of the NGOs have been successful in obtaining solar water heating systems as donations.

4.4.10 Classification by hostels by professional and non-professional group

'Capacity to bear the expenses' is the most important criteria in the decision to buy SWHS. Installation of SWHS certainly demands capital expenses, which ultimately are recovered from the end users i.e. from students staying in such hostels. Therefore, the economic stratum of the parents of the hostel students is an

important parameter. Hostels in the study area are also classified on the basis of whether they accommodate professional students such as students of pharmacy, engineering, medical etc. or non-professional students such as the students of arts, commerce and science streams. The students undergoing professional courses are certainly from the upper income class of the society and, therefore, stay in such hostels, which provide all facilities and amenities including solar hot water system. The sample hostels in the study area as classified into professional and non-professional group is shown in the following table:

Table 4.11

Classification of sample hostels by Professional and Non-professional User and Non-User Category.

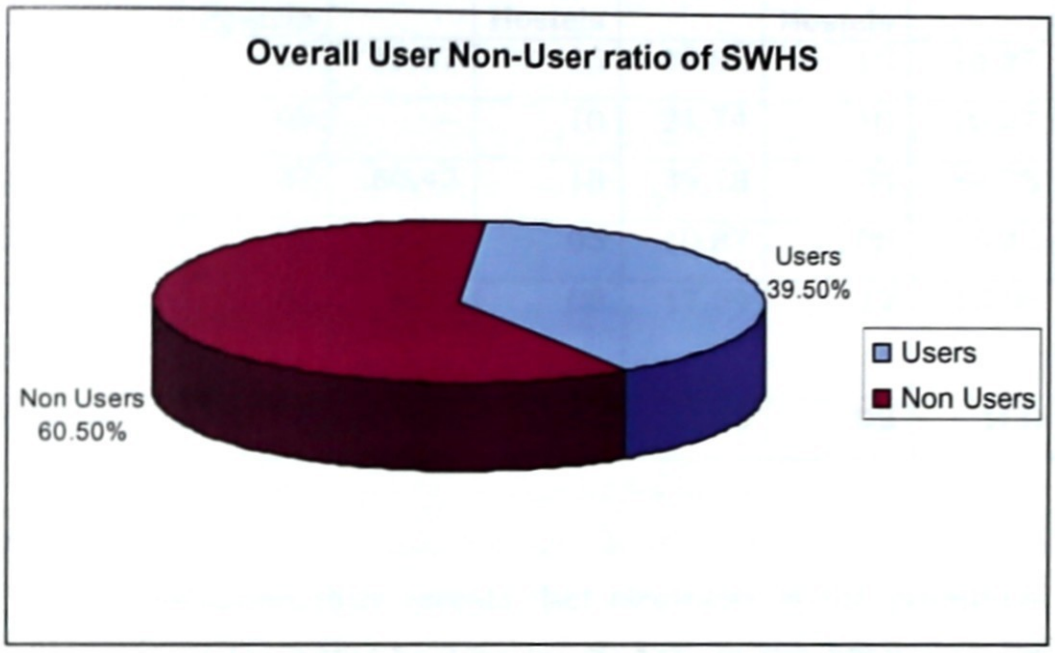
Sr. No.	Category	Urban			Semi-Urban			Total		
		User	Non-user	Total	User	Non-user	Total	User	Non-user	Total
01.	Professional	8	2	10	05	00	05	15	00	15
02.	Non-professional	33	44	77	14	46	60	45	92	137
	Total	41	46	87	19	46	65	60	92	152

Inference:

The figures from the above table give the message that there is 80% utilization of SWHS in the hostels meant for professional students. Except the hostels of Government Engineering College, and B.J. Medical College, solar water heating systems have been installed. However, installation of SWHS by Government establishment is soon becoming a mandatory requirement as the MNES policy on Non-Conventional Energy. Apart from this statutory guidelines manufacturers can select hostels of professional colleges as their market segmentation and tap the market potential.

4.4.11 Overall user and non –user ratio

Having classified hostels by various categories in the earlier table, now the researcher wish to show the overall proportion of SWHS and solar cooking systems by the following pie diagram



4.4.12 Classification of Non-user Sample Hostels by type of fuel used for water heating.

Solar water heating systems replace the conventional fuels such as LPG, Firewood, Electricity, Kerosene, Biomass, Crop residue etc. In order to convince the institutional respondents about the possible savings in the cost of fuel used for water heating, information is collected on the present fuel used by them for heating the bathing water. This information is necessary to find out the extent of use of each type of conventional fuel. The following table shows the classification of sample hostels by type of fuel used for heating the bathing water:

Table 4.12

Classification of Non-User Sample Hostels by type of Fuel used for heating bathing water

Sr. No	Type of Fuel	Urban		Semi-urban		Total	
		No. of Hostels	%	No. of Hostels	%	No. of Hostels	%
01	LPG	05	10.87	05	10.87	10	10.87
02	Firewood	00	--	10	21.74	10	10.87
03	Electricity	37	80.43	18	39.13	55	59.78
04	Kerosene	00	--	05	10.87	05	5.43
05	No Fuel (Cold Water)	04	8.70	08	17.39	12	13.05
	Total	**46**	**100**	**46**	**100**	**92**	**100**

Inference:

The above classification thus reveals that electricity is the prominent source of energy used for water heating by 80.43% of the hostels in the urban and 59.78% of the hostels in the rural area. As Maharashtra State is passing through energy crisis as discussed in the chapter "Review of Energy Sector', consumption of electricity for unproductive purpose such as on water heating should be reduced to the extent possible. And this is possible by installation of SWHS. In semi-urban sector, where firewood or other biomass such as crop residue is available; such fuel is used for water heating. Of course, that creates different problems such as deforestation, environmental disturbances, diseases due to smoke emitted out of traditional chullha etc. LPG has been used as a fuel by 5 hostels from the sample hostels. Use of LPG as a fuel for water heating is possible by the hostels having a limited number of students. LPG used for hostels has to be purchased at commercial rates i.e. at Rs.700 for a commercial cylinder of 19 kgs. As Government of India has been spending very heavily on the imports of LPG. (The figures are included in the chapter "Review of Energy Sector") use of LPG is also not advised. Therefore, the non-users of SWHS

should shift to the users class. And this is possible only through sustained efforts by manufacturers by providing systems at affordable prices to the customers. Government should also adopt policy measures to enhance the use of SWHS.

4.4.13 Classification of non-user sample hostels by cost of fuel used for water heating

As shown in the above Table 4.12, hostels have been using electricity, LPG, and firewood as a fuel for heating water. In order to convince the prospective users of SWHS, it is necessary to first find out the present spending on the fuel used for heating the water. This expenditure will in turn be treated as saving after installation of SWHS.

Actual expenses on heating the water are recorded through a questionnaire prepared for Rectors of the hostels. On the basis of the responses collected from the Rectors a chart showing monthly expenses is prepared and presented below.

Table 4.13

Monthly expenses of water heating

Sr.No	Monthly Expenses	Urban	Semi-urban	Total
01	0-5000	00	02	02
02	5000 – 10,000	02	05	07
03	10,000-15,000	01	06	07
04	15,000 –20,000	18	02	20
05	20,000 – 25,000	09	01	10
06	25,000 – 30,000	00	01	01
07	30,000 – 35,000	06	01	07
08	35,000 – 40,000	01	00	01
	Total	**37**	**18**	**55**

4.4.14 Classification on the basis of mess attached to the hostels or otherwise -

Since the present study also aims at evaluation of the causes of non-utilization of community solar cooking systems by the sample hostels, information is collected on whether mess is attached to the hostel or not. The following data reveals the facts in this respect:

SAMPLE OF HOSTELS IN THE STUDY AREA	:152
MESS ATTACHED TO HOSTELS	:150
MESS NOT ATTACHED TO HOSTELS	: 02

It is thus inferred that almost all the hostels provide mess facility for the students staying in such hostels. In some cases only one mess caters to the number of hostels in the same premises. Thus, the sample of hostel respondents may not reconcile with the sample of messes in the survey area.

4.4.15 Classification of non-user sample hostels by type of fuel used for cooking

Information is collected as regards the type of fuel used for cooking in the mess attached to the sample hostels. It was noticed that the hostel management either runs mess or it is run on contract basis. In either of the situation, however, cooking is a common factor. Therefore, the data of fuel used for cooking is collected to further find out the cost of such fuel. The following table shows the fuel used for cooking by sample of hostels in Pune District:

Table 4.14

Classification of sample hostels by type of fuel used for cooking

Sr. No	Type of Fuel	Urban	% to total	Semi-urban	% to total	Grand total	% to total
01	LPG	87	100	55	84.62	142	93.42
02	Combination of LPG & Firewood/ Kerosene	00	00	10	15.38	10	6.58
	Total	**87**	**100**	**65**	**100.00**	**152**	**100.00**

Inference:

It could be noticed from the above table that all the hostel messes in the urban area use LPG as a fuel for cooking. In semi-urban area along with LPG other fuels are also used. However, supply of such other fuels such as kerosene, firewood is not assured. Therefore, most of the hostels in semi-urban area too have to depend upon LPG as a fuel.

4.4.16 Classification of hostels by cost of fuel use for cooking

As mentioned in the above table, all the hostels in urban area and most of the hostels in semi-urban area use LPG as fuel for cooking. Therefore, data is collected on the average monthly cost of LPG. The cylinders used for the mess are purchased at a commercial rate of Rs.700/- per cylinder of 19 kgs.(The rate prevailing during the period of data collection). The following table gives the classification of hostels on the basis of their monthly average of cost of LPG used for cooking:

Table 4.15

Classification of sample hostels by cost of LPG used for cooking

Sr. No	Average monthly Spending on LPG (Rs.)	No. of Hostels in Urban Area	No. of Hostels in Semi-urban Area	Total no. of Hostels
01	Less than 5,000	03	24	27
02	5001 - 10,000	10	18	28
03	10,001 - 15,000	41	07	48
04	15,001 - 20,000	10	10	20
05	20,001 - 25,000	20	05	25
06	25,001 - 30,000	03	01	04
	Total	**87**	**65**	**152**

Inference:

These figures are arrived at after recording the actual expenses incurred by the sample hostels through the questionnaire. These expenses are further cross checked by standard consumption recorded in an empirical study by established mess owners from Pune City and as per these empirical studies the standard consumption of LPG is as follows:

50 persons taking meals two times a day required 1 cylinder of 19 kgs. for four days. The price of the cylinder purchased at commercial rate is Rs.700. Thus, the fuel cost component per meal works out to be Rs.1.75.

As inferred from the above table, most of the hostels have been using LPG as a cooking fuel that is going to be dearer year after year. Hence, there is an urgent need to develop alternative sources of energy for a cooking fuel. In this respect the current research reveals that none of these hostels owners were aware about

Community Solar Cooking System as an alternative source of cooking fuel. As mentioned in the later part of this study, manufacturers have also not been able to develop market communication with the mess owners so as to introduce Community Solar Cooking Model for the hostels.

4.4.17 Cause wise analysis of non-utilization of SWHS by the sample of hostels in the study area.

This part of the analysis of the responses collected from the respondents is said to be the core part of the present research. The central theme of this research is to first find out the basic reasons of non-utilization of SWHS and Solar Cookers. Questions in the questionnaire are, therefore, structured to fulfill this basic objective of the study. The possible causes of non-utilization were first identified by observations recorded in the pilot study undertaken before this research. On the basis of that, some common causes of non-utilization were selected and provided as alternatives to the respondents. Respondents were given freedom to record their responses. The responses were collected from the managements of the hostels as well as from the end users of the SWHS. Based on these responses, statements showing cause wise analysis of non-utilization by each category of respondents are prepared. These causes of non-utilization of SWHS may prove as guidelines for framing the marketing strategy by the manufacturers and dealers of SWHS.

Under utilization vis-à-vis non-utilization

Title of the present thesis uses the term "Under-utilization". And in this part of the analysis the researcher has used the phrase "Non-utilization". The researcher needs to justify this term in the context of analysis presented in this chapter. The term "Under-

utilization" refers to the proportion of non-users of SWHS in relation to the total number of respondents. Whereas the term "Non-utilization refers to the absolute number of respondents who are not the users of SWHS.

The cause-wise analysis of the non-utilization by various categories of the respondents is presented according to the serial number of a question appeared in the questionnaire. The following tables presents data in this regard:

The first and the foremost cause of non-utilization was identified as: 'Unaffordable Price of SWHS.'

Table 4.16:

UNAFFORDABLE PRICE BEING THE CAUSE OF NON-UTILIZATION: URBAN AREA

Sr. No.	Category of Hostel	Urban Area			
		Boys	%	Girls	%
01	Hostels attached to the Colleges	24 (10)	42	04 (1)	25
02	Hostels run by Social Welfare Dept. Govt. of Maharashtra	06 (NA)	--	--	--
03	Hostels run by Women and Child Welfare Dept. Government of Maharashtra	06 (NA)	--	05 (NA)	--
04	Hostels run by NGOs	01 (01)	100	--	--

Note: Figures in bracket indicate the number of responses received from the respective hostels.

Table 4.17

UNAFFORDABLE PRICE BEING THE CAUSE OF NON-UTILIZATION: SEMI-URBAN AREA

Sr. No.	Category of Hostel	Semi-urban Area			
		Boys	%	Girls	%
01	Hostels attached to the Colleges	10 (8)	80	01 (0)	0
02	Hostels run by Social Welfare Dept. Govt. of Maharashtra	12 (NA)	--	08 (NA)	--
03	Hostels run by Women and Child Welfare Dept. Government of Maharashtra	01 (NA)	--	01 (NA)	--
04	Hostels run by NGOs	09 (07)	78	04 (03)	75

Note: Figures in bracket indicate the number of responses received from the respective hostels.

Inference :

The above table thus indicates that the main reason for non-utilization of SWHS is the unaffordable price. This is particularly applicable in the case of boys' hostels in the urban as well as semi-urban area where 42%and 80% of the sample hostels respectively have quoted "Unaffordable Price" as the reason for non-installation of SWHS. The hostels mainly run for the boys and girls pursuing conventional graduate courses cannot afford the prices of SWHS. This is because ultimately the price paid for SWHS has to be recovered from the end users. In hostels providing hot water to the students, normally a special charge for solar water is recovered from the hostel students. Such charge is included in the annual hostel fees. Therefore, ultimately financial condition of the parents of the students staying in the hostels determines whether the solar water can be affordable by the users or not. This cause is not applicable to the hostels run by

Government Departments, where the hostel fees are mostly subsidized as a welfare measure. The heads of such hostels, therefore, showed neutral reaction to this question. It is observed that the functional heads in the governmental hierarchy such as superintendents of the sample hostels in the study area had some reservations about offering their own comments on the questionnaire prepared for them. Therefore, the researcher has met the policy-framing authorities in the respective departments and the responses are collected. In most of the NGOs the proportion of users of SWHS was found to be satisfactory. In only one hostel in the urban area the response to this question was affirmative. Whereas in semi-urban area 78% of the hostels run by NGOs have not installed the SWHS due to unaffordable price of the equipment. It is further observed that many NGOs using SWHS have been able to receive either financial assistance from any funding agency or the SWHS have been donated to them by some other organizations.

The price of SWHS is thus found to be the dominating factor in the decision-making on acquisition of SWHS.

Cause No. 02

RIGID SANCTION PROCEDURE BY THE MANAGEMENTS OF THE HOSTELS.

Decision to buy SWHS is capital expenditure decision. Therefore, the operational staff cannot take this decision. The top management of any hostel must accept the proposal forwarded to them by the middle management staff viz. Rector of the hostel and then only finally any equipment can be purchased. SWHS, being capital equipment, the same process is followed in almost all the hostels. Decision making process is very rigid in many organizations and, therefore, decision to buy SWHS is delayed. Responses recorded in the hostels of various categories are tabulated below:

Table 4.18

CAUSE OF RIGID SANCTION PROCEDURE AS A CAUSE OF NON-UTILISATION

Sr. No	Category	Urban				Semi-Urban				Total			
		Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
01	Hostels attached to the Colleges	24 (9)	38	04 (1)	25	10 (3)	30	01 (RNR)	--	34 (12)	35	05 (1)	20%
02	Hostels run by Social Welfare Dept. Maharashtra Govt.	06 (4)	67	--		12 (10)	83%	08 (4)	50	18 (14)	78	08 (4)	50
03	Hostels run by Women and Child Welfare Dept. Maharashtra Govt.	06 (5)	83	05 (3)	60%	01 (RNR)	--	01 (RNR)	--	07 (5)	71%	06 (3)	50
04	Hostels run by NGOs	01 (1)	100	--		09 (6)	67	04 (3)	75%	10 (7)	70	04 (3)	75

RNR= Response not received
Note: Figures in bracket indicate the number of responses received from the respective hostels.

Inference :

From the above figures it is inferred that the decision to buy SWHS is dominated by the decision making process by the top managements. And the researcher observed that this is particularly true in case of Government Organizations. These decisions are either not taken or delayed due to administrative lethargy. It is observed that 67% of the respondent hostels in the urban area and 83% from the semi-urban have remarked about the rigidity in the sanction procedure as a reason for non-utilization of SWHS. Only one hostel run by NGO was found to be non-user of SWHS and the Rector of such hostel assigned the reason for not using SWHS as the delay in the decision-making. Hence, statistically it appears to be 100%, but it has to be related to the practical situation and then only conclusion can be drawn. The overall impression is that the delay in decision making, administrative lethargy are the causes attributed to only Government run hostels.

CAUSE NO 03

UNSUITABLE ROOF

Generally it is understood that RCC structure and a plain roof is required for installation of SWHS. The concept of Solar Passive Architecture is still in its infancy in India. Therefore, the researcher has observed that especially in semi-urban area some respondents attributed the non-use of SWHS to the cause of unsuitable roof. However, this cause of "Unsuitable Roof" for non-installation of SWHS cannot be generalized, as in the study area it is observed that some manufacturers have installed SWHS even where roof is not of RCC structure. By providing additional steel structure, SWHS can be installed even where roof is of galvanized

sheets or of asbestos sheets. Installers of SWHS, therefore, have to be technically sound and must convince the proposed customers to install SWHS even where roof is slanted, and not RCC structure.

The responses received for this question are from the hostels located in the Semi-urban area of the study. These responses are recorded in the following table:

Table 4.19

UNSUITABLE ROOF AS A CAUSE OF NON-INSTALLATION OF SWHS

Sr. No	Category of the Hostel	Urban				Semi-Urban				Total			
		Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
01	Hostels attached to the Colleges	24 (0)	--	04 (0)		10 (2)	20	01 (0)	00	34 (2)	6	05 (0)	00
02	Hostels run by Social Welfare Dept. Maharashtra Govt.	06 (0)	--	--		12 (6)	50	08 (6)	75	18 (6)	33	08 (6)	75
03	Hostels run by Women and Child Welfare Dept. Maharashtra Govt.	06 (0)	--	05 (0)		01 (0)	00	01 (0)	00	07 (0)	00	06 (0)	00
04	Hostels run by NGOs	01 (0)	--	--		09 (3)	33	04 (2)	50	10 (3)	30	04 (2)	50

Note: Figures in bracket indicate the number of responses received from the respective hostels.

Inference:

It is observed that hostels run by Social Welfare Department and by Women and Child Welfare departments are housed in old buildings of slanted roofs with galvanized steel sheets or asbestos sheets as roofs. Therefore, solar water installation becomes a costly matter as additional cost of the steel structure for mounting the solar water tank and collector has to be incurred. However, with technical advancements now it has become possible to install SWHS even where roof is slanted, as observed in many of the houses in the hilly areas in Himachal Pradesh SWHS installations have been made on the slanted roofs only.

As indicated in the above table overall 75% of the hostels run by Social Welfare Department have recorded "Unsuitable Roof" as a cause of non-installation of SWHS. Hostel managements of such hostels must be convinced about the fact that SWHS can be installed with little adjustments even where roof is slanted with either galvanized sheets or made of asbestos sheets.

CAUSE NO 04

NO PRIORITY TO THIS ISSUE

The researcher wanted to test whether installation of SWHS is a priority decision of the hostel managements or not. It was evidenced that managements of the hostels where responses are recorded negatively have not seriously thought of the issue of cost reduction by installation of SWHS. This observation is more particularly applicable to hostels owned and controlled by Governments, for example, Government Engineering College and Government Medical College in Pune.

It is also observed that when no other cause is applicable, many respondents have attributed non-utilization of SWHS to this

cause of "NO PRIORITY". It would not be out of place to mention that even banks financing for SWHS, treat loans to SWHS as LOP i.e. Loan Other Priority items.

Observations to this question as collected from the non-users are recorded in the following table:

Table 4.20

NO PRIORITY GIVEN: THE CAUSE OF NON-INSTALLATION OF SWHS

Sr. No	Category of the Hostel	Urban				Semi-Urban				Total			
		Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
01	Hostels attached to the Colleges	24 (8)	33	04 (1)	25	10 (8)	80	01 (0)	00	34 (16)	47	05 (1)	20
02	Hostels run by Social Welfare Dept. Maharashtra Govt.	06 (3)	50	--	--	12 (8)	67	08 (2)	25	18 (11)	61	08 (2)	25
03	Hostels run by Women and Child Dept. Maharashtra Govt.	06 (3)	50	05 (1)	20	01 (1)	100	01 (0)	--	07 (4)	57	06 (1)	17
04	Hostels run by NGOs	01 (0)	0	--	--	09 (2)	22	04 (0)	00	10 (2)	20	04 (0)	00

Note: Figures in bracket indicate the number of responses received from the respective hostels.

Inference:

Generally it is observed that the heads of the institutions do not want to commit to any cause for non installation of SWHS, and that this cause has helped them to say that "we don't give priority to this issue". In fact, this opinion has to be taken seriously as the "No-priority" or "Low -priority" reasons could be treated as passive attitude on the part of the hostel respondents. The proposal to install SWHS communicated by the Rector of the hostel to the top management may not be seriously considered, and therefore SWHS installation is postponed. Thus, there is a need to improve bottom to top dialogue in this connection.

The above observation is mainly applicable in the case of hostels run by Government Departments where 67% of the respondents from the semi-urban area running boys hostels have remarked that, it is not their priority to install solar water heating systems.

CAUSE NO 05

EXTENSION WORK/CONSTRUCTION IN PROGRESS: THE CAUSE OF NON-INSTALLATION OF SWHS

In the survey it is found that some hostel buildings were either under construction, or extension work to the existing hostel building was in progress. The number of respondents in each category, though very small but such responses are important as manufacturers can access to such hostels even during the period of construction or extension.

Responses to this question are recorded in the table given below:

Table 4.21

EXTENSION WORK IS IN PROGRESS/HOSTEL UNDER CONSTRUCTION

Sr. No	Category of the Hostel	Urban				Semi-Urban				Total			
		Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
01	Hostels attached to the Colleges	24 (1)	4	O4 (1)	25	10 (1)	10	01 (0)		34 (2)	6	05 (1)	20
02	Hostels run by Social Welfare Dept. Maharashtra Govt.	06 (0)	--	--	--	12 (2)	17	08 (1)	13	18 (2)	11	08 (1)	13
03	Hostels run by Women and Child Welfare Dept. Maharashtra Govt.	06 (0)	--	05 (0)	--	01 (0)	--	01 (0)	--	07 (0)	--	06 (0)	--
04	Hostels run by NGOs	01 (0)	--	--	--	09 (1)	11	04 (1)	25	10 (1)	10	04 (1)	25

Note: Figures in bracket indicate the number of responses received from the respective hostels.

Inference:

The above figures though statistically are non-cognizable it is necessary to note that tie-up of builder and installer of SWHS during the construction phase would be more convenient approach in installation of SWHS. During the stage of construction only appropriate arrangement for solar plumbing can be made so as to facilitate installation of SWHS on completion of the building.

CAUSE NO 06

Cold water for bath is insisted particularly in boys' hostels

Hostels surveyed in the study area include both, hostels meant for college students as well as hostels for primary as well as high school students. It is observed, particularly in the semi-urban area that the hostel students have to take only cold-water bath. Therefore, the proposal of installation of SWHS is irrelevant in case of such hostels. Though the number of such hostels is small but still it is considered as a cause of non-installation of SWHS. The hostels, where cold water for bath is insisted are shown in the table 4.22:

Table 4.22

COLD WATER FOR BATHING HENCE NON-INSTALLATION OF SWHS

Sr. No	Category of the Hostel	Urban				Semi-Urban				Total			
		Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
01	Hostels attached to the Colleges	24 (2)	8	04 (0)	0	10 (2)	20	01 (0)	0	34 (4)	12	05 (0)	0
02	Hostels run by Social Welfare Dept. Maharashtra Govt.	06 (2)	33	--	--	12 (2)	17	08 (0)	0	18 (4)	22	08 (0)	0
03	Hostels run by Women and Child Welfare Dept. Maharashtra Govt.	06 (0)	--	05 (0)	--	01 (0)	0	01 (0)	0	07 (0)	0	06 (0)	0
04	Hostels run by NGOs	01 (0)	--	--	--	09 (0)	--	04 (0)	--	10 (0)	--	04 (0)	--

Note: Figures in bracket indicate the number of responses received from the respective hostels.

Inference:

These responses can be treated as rejection criteria for decision as to installation of SWHS. Therefore, manufacturers should not waste their energy and cost on this market segment. The information given in the above table may at least be treated as an elimination process of selecting the prospective consumers of SWHS.

Cause No 07

Unsuitable Climate

Since the study is spread over the whole of Pune District, the physical set up of the study area has to be considered to find out the causes of non-installation of SWHS. From geographical point of view Pune District can be classified on the basis of rainfall in a particular area. This information is necessary to arrive at the proportion of rainy days in a year as compared to the total number of days in the whole year. Thus, we found that Tahshils in Pune District such as Velhe, Mulshi , Bhor and Maval have been identified as Tahshils where rainy days are more as compared to rainy days in the remaining Tahshils. Information on the physical set up and climate etc. of Pune District has already been provided in Chapter II of the present thesis. Thus, out of 14 Tahshil in Pune District 4 Tahshils are segmented separately as numbers of rainy days in a year in these places are around 100 as per the District Census Book. Thus, the productive solar days in these places are around 250-260 in one year. Moreover, rainfall in the hilly areas is also more requiring slanted roofs at most of these places. Thus, this becomes the physical limitation on the installation of SWHS. The hostels that have recorded that the cause of non-installation of SWHS is unsuitable climate are indicated below:

Table 4.23

CAUSE OF NON-INSTALLATION OF SWHS BEING UNSUITABLE CLIMATE

Sr. No	Category of the Hostel	Urban				Semi-Urban				Total			
		Boys	%	Girls	%	Boys	%	Girls	%	Boys	%	Girls	%
01	Hostels attached to the Colleges	24 (0)	0	04 (0)	0	10 (1)	10	01 (0)	0	34 (1)	3	05 (0)	0
02	Hostels run by Social Welfare Dept. Maharashtra Govt.	06 (0)	0	--	--	12 (2)	17	08 (2)	25	18 (2)	11	08 (2)	25
03	Hostels run by Women and Child Welfare Dept. Maharashtra Govt.	06 (0)	0	05 (0)	0	01 (0)	0	01 (0)	0	07 (0)	0	06 (0)	0
04	Hostels run by NGOs	01 (0)	0	--	--	09 (1)	11	04 (0)	0	10 (1)	10	04 (0)	0

Note: Figures in bracket indicate the number of responses received from the respective hostels.

Inference:

The above table thus shows the climatic limitations on the installation of SWHS. Through the constant R & D manufacturers should develop solar devices that could be operated even in foggy climate. Such experiments are being conducted in European Countries and have become successful. We should experiment and develop products suitable for such areas where adverse climatic conditions prevail.

These Tahshils are on the Western part of Pune District where hilly areas and mountains are there. Hence, it may be a limiting factor for installation of SWHS. However, manufacturers should concentrate on the Eastern part of Pune District where solar days are more than 320 in a year, as per the information provided in the Census Book of Pune District.

Cause No 08

Not aware of soft loan for SWHS

Access to credit for institutional respondents can be a problem in purchasing of SWHS. A scheme of financing for SWHS has been prepared by MNES whereby a soft loan at a subsidized interest of 5% (2% from September, 2005) is provided for purchase of SWHS. The obvious purpose of the scheme is to encourage utilization of SWHS among all the categories of the users. However, it was observed that the scheme has not been properly communicated to the prospective buyers as is evidenced from the following responses recorded for this question. These responses are not category specific and therefore are presented for all the categories of hostels. However, awareness percentage is area specific.

Therefore, responses are presented separately for the non-users of SWHS in the urban and semi-urban area:

A – Urban Area

TOTAL OF NON-USER RESPONDENTS :		46
NOT AWARE OF THE SCHEME:	:	5 (11%)

B- Semi Urban Area

TOTAL OF NON-USER RESPONDENTS :		46
NOT AWARE OF THE SCHEME	:	12 (26%)

From the above data it is indicated that 11% of the hostel respondents in the urban area and 26% in the semi-urban area were not aware of the "Soft Loan Scheme" of the MNES, Govt. Of India. Thus, it is required to improve market communication in this regard. While conducting survey of manufacturers it was observed that most of the manufacturers do not spend even 1% of their income on the advertisement. Therefore, publicity of such schemes seems to be inadequate resulting into under-utilization of the solar products. In fact, nationalized banks act as government representatives so as to execute the policies of the Government. Banks should also promote these schemes as their normal banking products.

Cause No. 09

WATER SCARCITY IN SPECIFIC SEMI-URBAN AREAS

Scarcity of water is a common feature of Indian villages. The present study of under-utilization of SWHS covers urban as well as semi-urban areas. It is observed that SWHS could not be installed due to lack of continuous water supply. The following figures will throw light on this cause:

Non-users in the semi-urban area:	46 Hostels
Non-utilization because water is not available on continuous basis	06 Hostels (13 %)

This problem can, however, be solved by providing a separate storage tank for cold water. However, solution to this problem is site-specific.

Cause No. 10

Hard Water – water not suitable for circulation system in SWHS

The core part of SWHS system is copper tubes and copper sheets. For successful operation of SWHS, soft water is required. Hard water causes corrosion in the inner side of copper tubes. These tubes are chocked when hard water is circulated through these tubes. In the study area it is observed that in some places, in spite of all other favourable factors SWHS could not be installed due to hard water in circulation. The proportion of such hostels are mostly found in the semi-urban area of the study as shown by the following data:

Non-users in the semi-urban area: **46**

Non-utilization due to hard water: **5 (10.9%)**

This problem can, however, be solved by providing a separate system to convert hard water into soft water. But it demands additional expenditure.

Conclusion:

Above causes can be treated as a market feed back from the prospective customers. These causes are only the representative responses; each respondent was free to record multiplicity of the causes from the questionnaire supplied. Based on these responses a table showing weighted average of each of these causes is prepared and presented below:

Table 4.24

TABLE SHOWING WEIGHTED AVERAGE OF THE CAUSES OF NON-UTILIZATION OF SWHS

Sr.No	Cause of non-utilization of SWHS	% Weight of the cause
01	Unaffordable Price of SWHS	58%
02	Rigid Sanction Procedure	53%
03	No priority to this issue	40%
04	Unsuitable Roof for installation of SWHS	21%
05	Not aware of 'Soft Loan Scheme'	18%
06	Water scarcity:	13%
07	Cold water for bath is insisted in boys' hostels	12%
08	Hard Water	11%
09	Extension work is in progress	9%
10	Unsuitable Climate	7%

Source: 1. Cause wise percentages calculated in the earlier part of the thesis.

Inference:

Thus, the main hurdle in the installation of SWHS is the unaffordable price of the system. And, therefore, it gets the first priority. In case of institutional respondents, however, weightage to this factor is only 58% as compared to the weightage given to the individual non-users of the SWHS where about 70% of the non-users attribute the cause of 'Unaffordable Price' for not using SWHS. The cause of "Rigid Sanction Procedure' implies a passive attitude by the management on the decision making. Manufacturers in that case have to pursue the matter with the managements of the respective hostels and convince them about the benefits of SWHS. There seems to be gaps in the market intermediaries when consumers record the fact that they are not aware of schemes of MNES for financing of SWHS. If it is

improved, then consumers who are willing to buy the system will certainly proceed further and will install the system. Providing for a separate cold storage tank can solve the problem of intermittent water supply. Manufacturers should arrange specific site visits so as to overcome this problem. Even the problem of unsuitable roof really cannot be considered as a cause of non-utilization. As observed in the survey, one of the sample respondents in Bhor tahshil has installed SWHS even where the roof is slanted and made of galvanized sheets. Therefore, manufacturers should depute technical personnel with basic skills so as to overcome such problems. The other causes of non-installation such as – cold water for bath, extension work is in progress etc. cannot be generalized and therefore can be ignored and efforts should be concentrated on those hostels where there is high potential to install the Solar Water Heating Systems.

4.4.18 Cause wise analysis of non-utilization of Community Solar Cooking System by the sample of hostels from the study area.

Cooking is a common activity whether the hostel mess is located in urban area or semi-urban area. As mentioned earlier in point no. 4.4.14, out of 152 hostels in the study area 150 hostels have attached mess. Observations are also recorded on the type of fuel used for cooking in such sample hostels. And it is found that majority of the hostels use LPG as a cooking fuel. Community Solar Cooking Systems was not found to have installed in the hostel mess in the study area.

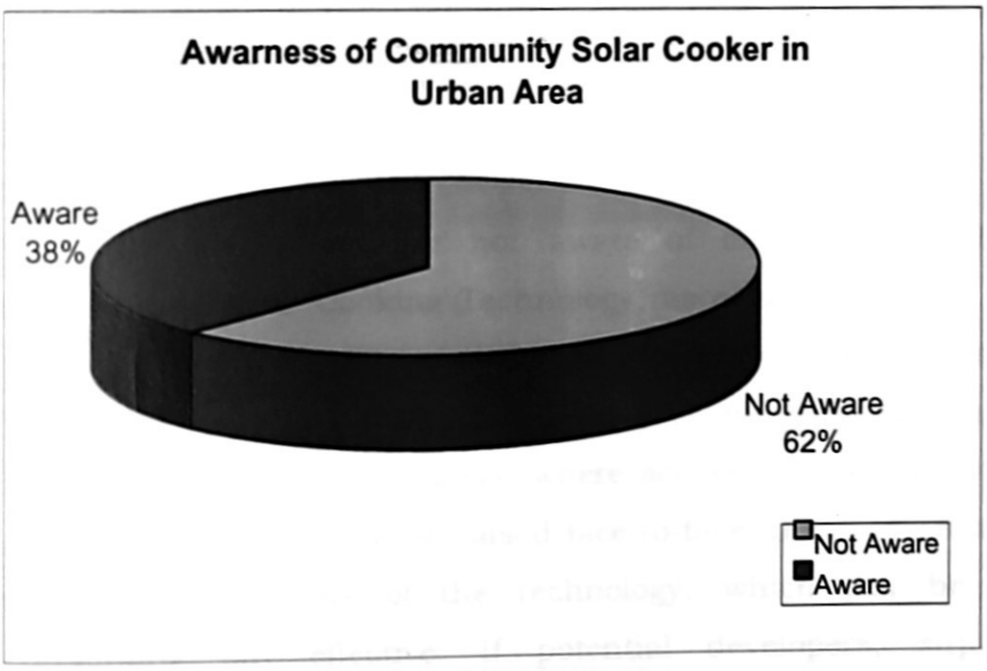
The present study also aims at finding out causes of under-utilization of solar cookers for individual respondents and of Community Solar Cooking Systems where a common kitchen is used for cooking the food for the persons staying in the hostels.

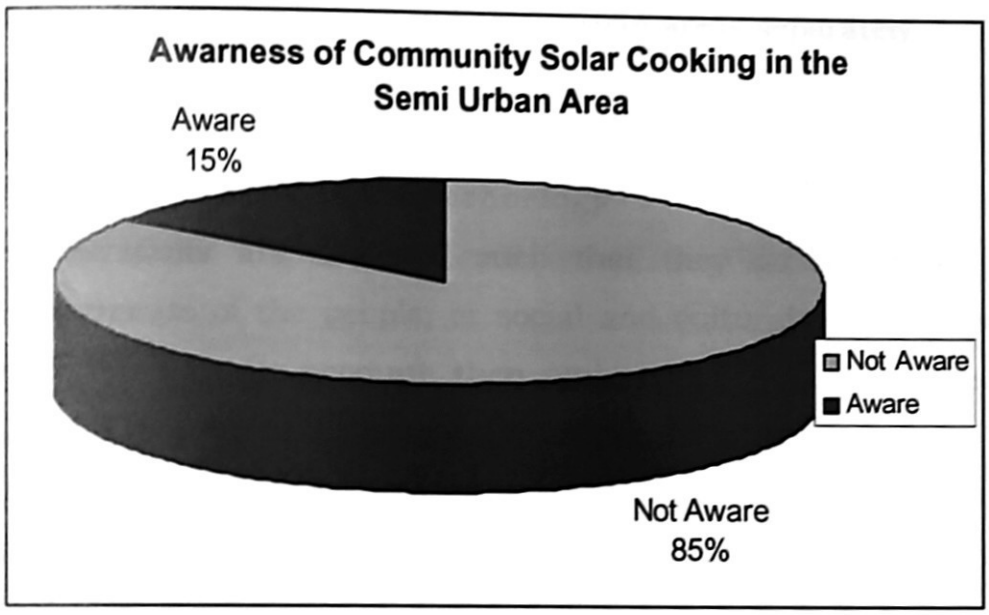
Hence, a separate questionnaire is prepared for the mess of the hostels and cooking fuel pattern and cost of such fuel used is recorded. Cooking fuel pattern and cost of such fuel are already tabulated in the earlier part of this chapter. The researcher now wishes to present the analysis of causes of non-utilization of Community Solar Cooking Systems by the mess attached to sample of institutional respondents.

Cause 01

Lack of awareness

The following pie diagram shows responses collected for this cause of non-use:





Thus, out of 85 respondent hostels from the urban area 32 hostels, representing 38% and 55 respondent hostels out of a total of 65 respondent hostels from the semi-urban area of the study were not aware of the Community Solar Cooking System. It was found that most of the hostel rectors have not even seen the picture of Community Solar Cooking Systems.

If potential users are not aware of or familiar with the Community Solar Cooking Technology, as observed in the above pie diagrams there will be no demand for systems and no market for the technology. Marketing is a key problem, especially in rural and even in semi-urban areas, where access to media is limited. Awareness often has to be raised face-to-face in the communities with demonstrations of the technology, which can be time-consuming but effective. If potential developers, suppliers, manufacturers, financers etc. are not aware of the market opportunities for Community Solar Cooking systems, they will not participate in the market development. In the study area, responses collected for this question from the hostels are as

recorded separately for urban and semi-urban area to test awareness level for urban and semi-urban areas separately.

Cause No 02

Lack of confidence in the technology

If systems are designed such that they do not meet the requirements of the people, or social and cultural considerations are not taken into account, then projects will not be successful. Also, if poor-quality technology is used or systems are not maintained regularly, then technical failure will occur. Lack of confidence in the technology will prevent financers from providing funds and the market will be damaged.

As observed in the survey, more than 50% of the mess owners were found not aware of Community Solar Cooking Systems and had no faith in the technology that the sunlight can be converted as a cooking fuel. Hence, demonstrations have to be arranged by the manufacturers and convince the potential users about the usefulness of the system.

Cause No 03

Non-availability in the local market

It was observed that some hostels were prepared to install the Community Solar Cooking Systems, but the systems were not available in the local market. Out of 85 hostels in the urban area 25 respondents (30%) showed their willingness to install the system but the system was not available in the local market. The same figures for the semi-urban area were 11 out of the sample hostels 65 (17%).

Cause No 04

Lack of Research and Development in the Community Solar Cooking Technology.

The level of R & D in the Community Solar Cooking Technology is either very low or the visible benefits of the research are not being passed on to the potential users. As recorded in the observation, most of the respondents (More than 60%) have assigned a cause of "Lengthy cooking time" for not using the Community Solar Cooking Systems. This mainly is attributed to low level of research and development in this product line.

Cause No 05

Prompt availability of LPG

It is interesting to note that about 10% of the respondents in the urban as well semi-urban area have assigned this cause of 'prompt availability of LPG' for not using Community Solar Cooking Devices. LPG is available merely by one telephone to the nearest LPG dealer. Therefore, the inverse of the saying "Necessity is the mother of invention" is true in this case. (No necessity no invention!). People do not feel to find out the alternative fuel, as the conventional fuel is easily available even in the semi-urban areas.

Cause No 06

Cost considerations

On the basis of price quotations obtained from MEDA (Maharashtra Energy Development Agency) the price of

Community Solar Cooker for a group of 50 persons is estimated at Rs.65, 000/- (Price prevailing in September, 2005). Therefore, this price seems to be on the higher side for the probable investors in Community Solar Cooking Systems. This may be probably one of the reasons for non-installation. However, the actual responses from the respondents could not be recorded for this question as the price and other particulars are not communicated through advertisement or other media to the prospective users of the system.

Conclusion:

In conclusion we may say that the concept of Community Solar Cooking is yet not been widely circulated among the prospective users of the system. In fact, this is probably the most neglected area in the marketing of solar energy devices. Even manufacturers have also not found to be keen in manufacturing and marketing of solar cooking devices. It is really surprised to note that not even a single institution was found to be the users of Community Solar Cooking Systems. However, only one manufacturer in Pune District from the sample of manufacturers selected for the study was observed doing R & D on solar cooking devices.

Though the use of Community Solar Cooking System was not found in any of the hostels in Pune District, that does not under estimates the usefulness of the device. Community Solar Cooking Systems have been effectively in use elsewhere (Though not in Pune District) as studied in the process of collection of secondary data for the purpose of this research. The researcher, therefore, would like to include success stories of TWO organizations that have been using Community Solar Cooking Devices. These success stories are based on the information collected from MEDA.

SUCCESS STORY - 01

SUCCESS STORY FOR PARABOLIC COMMUNITY COOKER 2.3M DIA. AT " MATOSHRI VRIDHASHRAM" DHULE –

1) **Trust Profile -**

S.K.Dugal Pratisthan's Matoshri Vridhashram is near Nakane Dam in a scenic location. The Vridhashram has a capacity to house 200 aged persons while normal operating strength is around 70.

2) **Status of the energy supply in the campus -**

Domestic Electrical supply is available.

3) **Technical Details of Renewable Energy Project -**

Community Parabolic cooker of 2.3 m diaameter with manual tracking and polished, hardened aluminium reflector (Alanode, Germany make)

4) **Date of project commissioning -**

8th March 2002

5) **Total cost of the project – Rs. 15,000/-**

6) **Project financing -**

i)	Donation by Khandelwal family and Jankibai Trust	12,500/-
ii)	MENS Grant	2,500/-

7) **Details of Energy services from Renewable Energy -**

i) Lighting
ii) Drinking water
iii) Cooking food
iv) Fan
v) Commercial uses.

8) **System Operation Mechanism -**

The system consists of a single community parabolic cooker of 2.3 m diameter designed by Prof. Ajay Chandak of

PRINCE (Promoters and Researchers in Non-Conventional Energy). The pressure cooker and other cooking pots are to be kept at the focus of the parabolic dish. Tracking is manual. The cooker needs to reset after every 20 to 30 minutes to face the sun. Biaxial manual tracking mechanism with a clutch is provided. Reflectors comprise of "Polished hardened anodizes aluminum sheet" (Alamode, Germany make) with more than 85 % reflectivity and reflective life over 5 years. Dry temperature at the focus reaches 300^0 C. For cooking pot pressure cooker is recommended.

9) System Repair and Maintenance -

a) Operation of the system is extremely easy. Just 10 minutes training for focusing the solar cooker is sufficient. Manual tracking every 20 to 30 minutes is to be carried out.

b) Use of goggles and hand gloves is recommended for safety.

c) Soap-wash the reflectors when it goes dusty or food material spills over the reflector sheets. Do not scrub with metallic brush. Use of soft cotton for wiping the sheets is recommended.

d) Annual maintenance cost negligible. Approx. Rs.100/- for soap and cloth.

10) Revenue Collection Mechanism -

The Vridhashram runs on donations from people and partly sustenance amount is charged to the beneficiaries.

11) Project benefit -

a) Social aspects –

i) To show concern for the environment by exploiting solar energy abundantly available with us.

ii) Promotion of solar cooking technology through demonstration to the regular staff and visitors.

b) Health Aspect –

Ancient Indian literature and modern sciences indicate that the solar cooked food is good for health. Rigvedas have mentioned solar food as "Surya Pakvanna Maha Aushadham". Modern science research shows that solar food reduces the possibility of heart diseases, cancer and diabetes. More over solar food is good in taste and aroma.

c) Environment Aspects –

Solar thermal energy technologies are non-polluting, emission free. It reduces the fossil fuel burning and hence saves the pollution. Even one such small system is expected to reduce carbon di oxide emission by 1.5 to 2 tones per year.

d) Economic Aspects –

As no maintenance cost is associated with the project and it provides low cost alternative for community cooking. The system is protected from the expected cost of price rise of the cooking gas. With simple payback period of just about a year, solar cooker is excellent financial viable

Actual annual saving in LPF is 600 Kg.

Actual annual saving in ruppes is Rs. 12,000/-

12) **Project Financial Viability -**

User's contribution	-	Rs. 12,500/-
Annual LPG Saving	-	Rs. 12,000/-
Simple payback period	-	13 months.

13) **Overall impact of the project -**

It is an excellent demonstration project for utilization in social organizations and vridhashrams with social, health, and environmental and economic benefits.

14) **Any other relevant information –**

Unlike other renewable technologies this unit shows excellent financial viability. There is excellent potential for acceptance by small community users (up to 200 persons) with proper demonstration.

SUCCESS STORY – 02

SUCCESS STORY FOR PARABOLIC COMMUNITY COOKER 2.3M DIA. AT " DHANVANTARY AYURVEDIC PHARMACY" DHULE –

1) **Trust Profile -**

Dhanvantary Ayurvedic Pharmacy is a reputed ayurvedic medicine manufacturing concern run by renowned Doctor Ayurved Pravin – Shri. P.T.Joshi. This pharmacy is famour for its low cost and extremely effective medicines.

2) **Status of the energy supply in the campus -**

Domestic Electrical supply is available in the campus. No electrical energy is required for manufacturing syrups.

3) **Technical Details of Renewable Energy Project -**

Community Parabolic cooker of 2.3 m dia with manual tracking and polished, hardened aluminium reflector (Alanode, Germany make)

4) **Date of project commissioning -**

17th October 2002

5) **Total cost of the project – Rs. 15,000/-**

6) **Project financing -**

i)	Company contribution	12,500/-
ii)	MENS Grant	2,500/-

7) **Details of Energy services from Renewable Energy -**

i) Lighting
ii) Drinking water
iii) Cooking food
iv) Fan
v) Commercial uses.

8) **System Operation Mechanism -**

The system consists of a single community parabolic cooker of 2.3 m diameter designed by Prof. Ajay Chandak of PRINCE (Promoters and Researchers in Non-Conventional Energy). The vessel for boiling the medicinal syrup (Ayurvedic Kadhas) is kept at the focus of the system. Biaxial manual tracking mechanism with a clutch is provided. Reflectors comprise of "Polished hardened anodizes aluminium sheet" (Alanode, Germany make) with more than 85 % reflectivity and reflective life over 5 years. Dry temperature at the focus reaches 300° C. Black coloured open pot is recommended for the operation.

9) System Repair and Maintenance -

a) Operation of the system is extremely easy. Just 10 minutes training for focusing the solar cooker is sufficient. Manual tracking every 20 to 30 minutes is to be carried out.

b) Use of goggles and hand gloves is recommended for safety.

c) Soap-wash the reflectors when it goes dusty or food material spills over the reflector sheets. Do not scrub with metallic brush. Use of soft cotton for wiping the sheets is recommended.

d) Annual maintenance cost negligible. Approx. Rs.100/- for soap and cloth.

10) Revenue Collection Mechanism -

The syrup (Kadha) so manufactured by the pharmacy is sold in the market with its brand name and also used by the owner Ayurved Pravin Shri. P.T.Joshi.

11) Project benefit -

a) Social aspects –

a. To show concern for the environment by exploiting solar energy abundantly available with us.

b. Promotion of solar cooking technology through demonstration to the regular staff and visitors.

b) Health Aspect –

i) Trials by Shri. P.T.Joshi indicate that the efficacy (potency) of the medicine increases to a great extent when the syrups are prepared on solar heating system.

ii) Rigvedas have mentioned solar food as "Surya Pakvanna Maha Aushadham"..

c) Environment Aspects –

One small system at this pharmacy is expected to reduce carbon-di-oxide emission by 3 to 4 tonnes per year.

d) Economic Aspects –

As no maintenance cost is associated with the project and it provides low cost alternative for community cooking. The system is protected from the expected cost of price rise of the cooking gas. With simple payback period of just about a year, solar cooker is excellent financial viable

Actual annual saving in LPF is 1200 Kg.

Actual annual saving in ruppes is Rs. 24,000/-

12) Project Financial Viability -

User's contribution	-	Rs. 12,500/-
Annual LPG Saving	-	Rs. 24,000/-
Simple payback period	-	7 months.

13) Overall impact of the project -

It is an excellent demonstration project for utilization in Ayurvedic Pharmacies in India.

14) Any other relevant information –

Most important finding of this application is that the efficacy of the medicine increases to a very large extent by using solar energy. This fact should motivate use of solar applications in ayurvedic pharmacies all over India apart from the excellent economies the system offers.

For Ayurvedic Pharmacies designs of solar concentrators for syrups, dryers for drying herbs, bottles and tablets are available.

4.5 Analysis of the responses collected from Government Guest Houses in Pune District

4.5.1 Location and suit capacity of guesthouses

Various departments of the Government viz, Central as well as State governments have maintained guesthouses for its officers. These guesthouses are located at various parts of the State. Hot bathing water is provided to the officers staying in such guesthouses. Food is also provided as and when required. These guesthouses thus, represent separate market segmentation for SWHS and Solar Cooking Systems. Therefore, government guesthouses have been included in the present study. Guesthouses are enlisted in the District Statistical Abstract for Pune District are given in following table:

Table 4.25

LIST OF GOVERNMENT GUEST HOUSES IN PUNE DISTRICT

Sr.No.	Tahashil	Name of the Guest House	Suits (Nos)
01	Junnar	PWD Guest House, Junnar	02
02		Z.P. Guest House, Junnar	02
03		Forest Bungalow, Junnar	02
04		Irrigation Bungalow, Narayangaon	04
05		N. H. Rest House,Narayangaon	02

06	**Ambegaon**	PWD Guest House, Ghodegaon	02
07		Forest Bungalow, Bhimashankar	02
08		PWD Guest House, Dimbhe	04
09		PWD Bungalow, Manchar	01
10	**Shirur**	PWD Bungalow, Shirur	01
11		PWD Bungalow, Kondhapur	01
12		PWD Bungalow, Vadhu	01
13		ZP. Rest House, Ghodnadi	01
14		Rest House, Chaskaman Colony	01
15		Observation Home, Chaskaman	01
16	**Khed**	PWD Bungalow, Rajgurunagar	02
17		PWD Bungalow, Alandi	04
18		Rest House, Zilla Parishad, Pune	01
19	**Maval**	NH Rest House, Vadgaon	02
20		NH Rest House, Khandala	04
21		PWD Bungalow, Pawana Dam	03
22		Rest House, Z. P.	02
23		Forest Bungalow, Khandala	04
24		PWD Rest House, Vadgaon	02

25	**Mulshi**	PWD Bungalow, Paud	02
26		Forest Bungalow, Ambavane	02

27		Z.P. Rest House, Sinhagad Fort	02
28		Z.P. Rest House, Wagholi	01
29		PWD Bungalow, Lonikand	02
30	**Haveli**	Forest Bungalow, Golewadi	02
31		PWD Bungalow, Khadakwasala	04
32		NH Rest House, Loni Kalbhor	02
33		Forest Bungalow, Sinhagad	04
34		PWD Guest House, Swargate	04
35		Government Rest House, Pune	21
36	**Pune City**	New Govt. Rest House, Pune	08
37		Govt. Rest House, Queens Garden	56
38		HUDCO Guest House	07
39		PWD Bungalow, Daund	02
40		Irrigation Bungalow, Daund	02
41	**Daund**	Irrigation Bungalow, Patas	02
42		Z.P. Rest House, Daund	01
43		Z. P. Rest House, Rahu	02
44		PWD Bungalow, Saswad	02
45		PWD Bungalow, Jejuri	02
46		Irrigation Bungalow, Pimpre	01
47	**Purandhar**	Irrigation Bungalow, Nazare Dam	01
48		Z.P. Rest House, Saswad	02
49		Z.P. Rest House, Purandhar Fort	01

50	**Velhe**	Irrigation Bungalow, Panshet	04
51		Z.P. Rest House, Velhe	02
52		PWD Bungalow, Bhatghat	02
53	**Bhor**	Z.P. Rest House, Bhor	02
54		NH Rest House, Kamthadi	01
55		NH Rest House No. 06 Shirwal	02
56		PWD Bungalow, Baramati	06
57		Z.P. Rest House, Baramati	02
58	**Baramati**	PWD Bungalow, Supa	02
59		PWD Bungalow, Bhigwan Road	04
60		PWD Bungalow, Vadgaon	02
61		Z.P. Rest House, Indapur	02
62		PWD Bungalow, Indapur	04
63		PWD Bungalow, Sansar	02
64		Irrigation Bungalow, Anthurne	02
65	**Indapur**	Irrigation Bungalow, Nimgaon	02
66		Irrigation Bungalow, Pandare	01
67		Irrigation Bungalow, Vadgaon	02
68		NH 06 Bungalow, Bhigwan	03
69		Forest Bungalow, Bhigwan	01
Total suit capacity in the guest houses in Pune District: 234			

Source: Pune District, Statistical Abstract, 2003-04

4.5.2 User/Non-user Segmentation of the Guest Houses

Administration of these guesthouses is mostly controlled through the head offices in Pune City. Therefore, information on utilization or otherwise of the SWHS and Solar Cooking Systems was collected through the controlling head offices of these guesthouses. In addition to this, actual site visits were also made to some guesthouses during the collection of primary data from individual households. Information could be obtained from 35 guesthouses out of 69 guesthouses in Pune District. Out of the 35 Government Guest Houses only six were from the user category, resulting into only 17% utilization of SWHS.

Since area of the present research is divided into two segments viz. urban and semi-urban; utilization of SWHS by the sample of respondent guesthouses in the respective area is recorded. The observations are tabled below:

Table 4.26

AREA WISE UTILIZATION OF SWHS BY SAMPLE OF GOVT. GUEST HOUSES

Area	Total	Users of SWHS	% of users to total
Urban	07	01	14.29
Semi-urban	28	05	17.86
Total	**35**	**6**	**17.14**

It is thus observed that the overall under utilization of the SWHS by the Govt. guesthouses is 83%. Manufacturers should accordingly focus their marketing efforts on Govt. as a customer. In the analysis of manufacturers' customer profile it was revealed that manufacturers were found to be reluctant to supply SWHS to

government departments due to many factors such as insisting only on low price without giving importance to the quality factor, long credit terms etc. However, dialogue must be improved with government officials and 83% under utilization of SWHS should be treated as a business opportunity.

Solar cooking system is nowhere used in the study area.

4.5.3 Bifurcation of suit capacity into urban and semi-urban region

While studying the percentage of non-utilization of SWHS it is equally important to study the suit capacity of the guesthouses so that the percentage of suit capacity not covered by SWHS can be arrived at. Accordingly the suit capacity of the guesthouses in Pune District is bifurcated into urban and semi-urban regions. In the Urban area out of 234 suits only 92 suits (39.32%) are covered by SWHS whereas in the semi urban areas out of 183 suits only 21 suits (11.48%) were covered by SWHS.

Inference

The above data reveal an important fact that it is not the number of guesthouses but the suit capacity of such guesthouses should be considered while determining the percentages of under utilization of SWHS. Suit capacity implies the actual number of users of SWHS. This data will certainly be useful to manufactures to determine the capacity of SWHS to be supplied to a particular guesthouse.

4.5.4 Average occupancy in the guesthouses

In determining the fuel consumption data it was necessary to collect information on the average occupancy of the guesthouses. No specific data could be collected as regards the occupancy of the guesthouses in semi-urban area. However, it was told by the guesthouse managers in the Pune City that the guesthouses are mostly occupied up to 80 –90% of their capacities. During some special occasions such as visits of VVIPS the guesthouses remain fully occupied.

4.5.5 Personal Interview of The Chief Engineer, PWD, Maharashtra Government, Central Building, Pune – 411 001

In an attempt to find out the causes of under utilization of SWHS by government guesthouses, the guesthouse managers at the local level were unable to provide the proper justification for not buying the SWHS and Solar Cooking Systems. As these guesthouses are administered centrally by the head office, the researcher had visited the office of The Chief Engineer, Public Works Department (PWD), Maharashtra Government, Central Building, Pune 411001. The causes of under –utilization of SWHS and solar cooking systems were discussed at length. The summary of the discussion is presented below:

- **Non-occupancy:** As most of the guesthouses are located in the semi-urban area and the average distance of such place from Pune City, being headquarter is not more than 100 kms. the officers tend to commute to Pune after they finish their duties at such semi-urban place where government has provided guest house facilities.

- **Paucity of funds:** Expenditure on maintenance of guesthouses is treated as low priority item in the budget. Therefore, funds are not allocated on priority basis for purchasing of SWHS.
- **End user orientation:** These guest houses, being a public place it is difficult to provide end user orientation as the end users cannot be identified. Hence, the SWHS if not operated properly is likely to fail.
- **Old building structures:** Most of the government guesthouses presently in use had been constructed during the British regime. Hence, they require substantial budget allocation on renovation. This naturally limits the decision of purchasing SWHS again due to priority in spending decisions by the government authorities.
- **Implementation of the Energy Conservation Act, 2001**
  Energy Conservation Act, 2001 is passed by Central Government. The Act has embodied many provisions relating to energy efficiency. The authorities have fixed a target of 30% savings in the conventional energy bills by providing for energy efficient systems and use of renewable energy devices. These proposals in Maharashtra are routed through MEDA, the State Nodal Agency. MEDA has directed all government departments in Maharashtra to prepare proposal for Solar Passive Architecture. MNES, Govt. of India has allowed grant of Rs.1, 00,000 or 50% of the project cost, whichever is less for preparation of Project Report and Rs.10, 00,000 or 10% of the project cost, whichever is less for installation of Solar Systems in the entire department.

From the above discussion it is concluded that Government departments are now geared up to maximize the solar energy potential, which was, hitherto most neglected agenda.

Manufacturers and marketers, therefore have to keep liaison with various departments of the government and view this situation as a business opportunity.

4.6 Analysis of the responses collected from Public Hospitals in Pune District

This is another market segment for marketing of SWHS and Community Solar Cooking Systems. Hospital needs hot water for varied applications such as – sterilization, desalination, cleaning bed covers, and of course for bathing. Hence, a case study of public hospitals was made as regards utilization/non utilization of SWHS and Community Solar Cooking Systems by such hospitals. Out of a total of 126 public hospitals in Pune District, including Pune City data could be obtained from 41 hospitals. Information collected through questionnaires and personal interviews of Chief Medical Officers of some public hospitals is presented in the further part of this thesis.

4.6.1 Bed capacity of important public hospitals

A sample of forty-one public hospitals selected for the present study is chosen from urban as well as semi-urban area of Pune District. The public hospitals located in the urban area are the hospitals with a large bed capacity. Whereas hospitals in the semi-urban area are mostly the rural hospitals where limited number patients (up to 10 patients) can be admitted as causality. Classification of sample hostels by bed capacity, therefore, has been done separately for urban and semi-urban area.

Table 4.27

(I)CLASSIFICATION OF SAMPLE HOSPITALS IN THE URBAN AREA BY BED CAPACITY

Sr. No.	Bed Capacity	Number of Hospitals
01	Less than 50	12
02	50 -150	03
03	150-250	02
04	250-500	00
05	500-600	02
06	800-900	01
07	1300-1400	01
	Total	**21**

(ii) Classification of sample hospitals in the semi-urban area by bed capacity

In the semi-urban area Primary Health Centres are provided almost at all important places in the District. The Primary Health Centres are located not only at the Tahshil head quarter; but also at other places in the tahshil too. In addition to this the Rural Hospitals are provided for each tahshil which is located at the headquarter of each tahshil.

In the semi-urban area the sample of hospitals for the study was 14 hospitals, which were the Rural Hospitals at the headquarter of each tahshils, where average bed capacity of all the hospitals is 50 patients. Hence no classification is required to be done.

4.6.2 User/Non-user Segmentation of the Public Hospitals

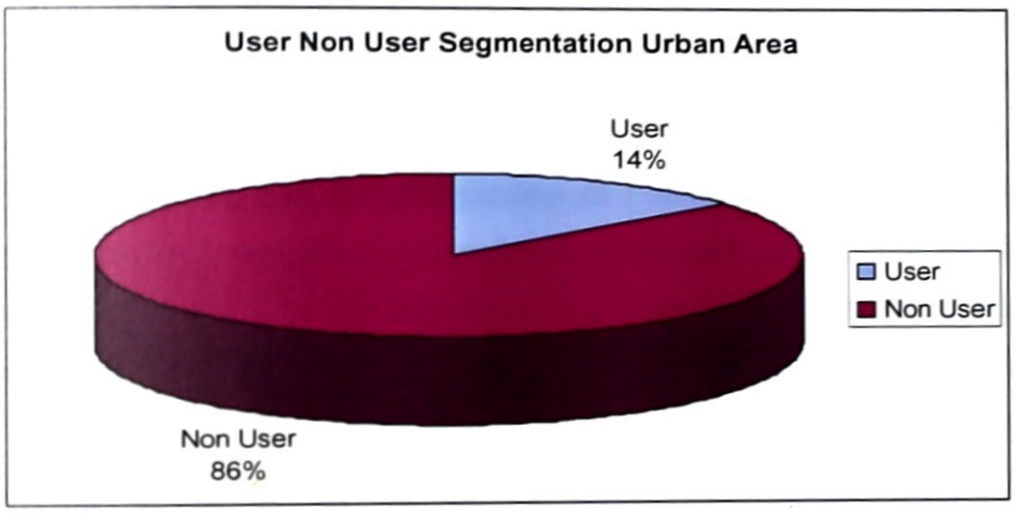
The following pie diagrams indicate use of SWHS and Community Solar Cooking system:

(A)Urban Area:

Total Respondent Hospitals: 21

(i) Users of SWHS : 3

(ii) Non –users of SWHS : 18

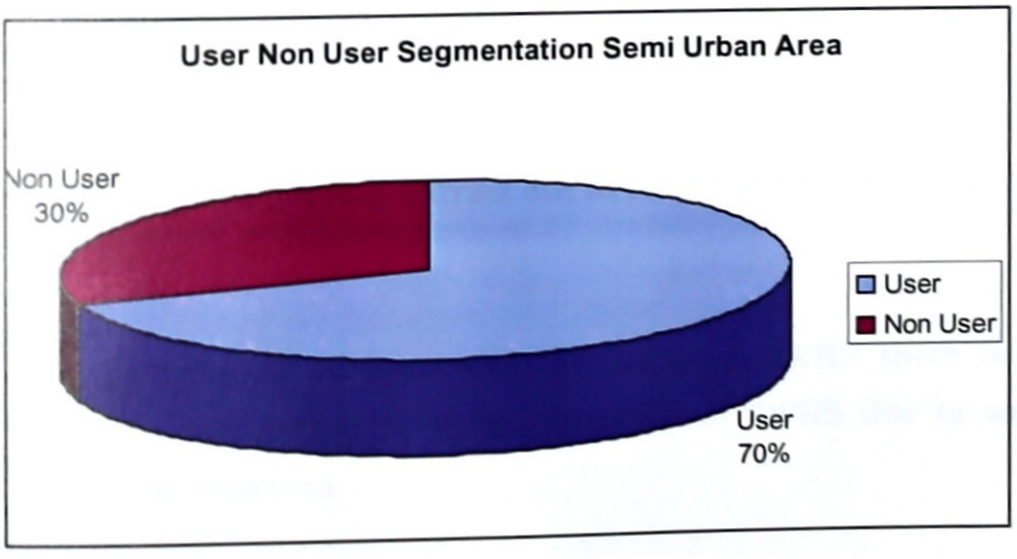


(B)Semi-urban Area :

Total Respondent Hospitals : 20

(i) Users of SWHS : 14

(ii)Non-users of SWHS : 6



Inference

Surprisingly the utilization of SWHS was found to be the highest as compared to utilization percentages of all the other categories of the institutional respondents. This is due the fact that all the Primary Health Centers and Rural Hospital in Pune District are now supplied with SWHS through Zilla Parishad, Pune. This is worth noting that this could be made possible through a special grant from SWISS Government.

4.6.3 Interaction with CMO's of such hospitals

In order to find out the causes of non-utilization of SWHS in the public hospitals, the research had met the Chief Medical Officers of some of the hospitals. A personal discussion also had with the Chief Medical Offier, Pune Municipal Corporation. Accordingly, all the CMOs have principally agreed about installation of SWHS. However, the financial provision in the Municipal Budget has to be made on priority basis. Now, this could be made due to some statutory compulsions by Electricity Act, 2004.

4.7 Testing of Hypotheses

Hypotheses framed at the conceptual stage of the study are reproduced below for the purpose of testing the validity of the statements:

The present study is carried out in furtherance of the following hypotheses:

(i) Irrespective of perception of the prices of SWHS there is an under- utilization of market potential of SWHS due to some unidentified reasons.

(ii) Under-utilization of market potential of Solar Cooker is due to its low product performance.

Test for hypothesis (i)

'Underutilization' as clarified in 1.4 of the present study means: 'Less than 50% utilization of SWHS and Solar Cooker by a sample of institutional respondents.'

Hypothesis (i) is tested by using 'Z Test'

To test:

Ho: P = 0.5 against H1: P <0.5

Level of significance 1%

We apply Z test to test above hypothesis and the results are tabulated below:

Table 4.28

TESTING OF HYPOTHESIS (I) FOR URBAN INSTITUTIONAL RESPONDENTS

Sr.No	Category	Z Value	Decision	Conclusion
01	College attached Hostels	1.2315	Accept Ho	No Under - utilization
02	Hostels of SW Depts.	-1.8894	Reject Ho	Under utilization
03	Hostels of Women & Child Welfare Dept.	-3.3156	Reject Ho	Under utilization
04	Hostels run by NGOs	0.5575	Accept Ho	No under utilization
05	Govt. Guest Houses	-1.8894	Reject Ho	Under utilization
06	Public Hospitals	-3.2731	Reject Ho	Under utilization

Note: Working calculation of Z value has been shown in the Appendix

Inference:

Reject Hypothesis (i)(which implies that the utilization of SWHS is more than 50%) for the following categories:

College attached Hostels

Hostels run by NGOs

Accept Hypothesis (i) (which implies that the utilization of SWHS is less than 50%) for the following categories:

Hostels of SW Depts

Hostels of Women & Child Welfare Dept.

Govt. Guest Houses

Public Hospitals

Table 4.29

TESTING OF HYPOTHESIS (I) IN RESPECT OF INSTITUTIONAL RESPONDENTS OF SEMI URBAN AREA:

Sr. No.	Category	Z Value	Decision	Conclusion
01	College attached Hostels	-1.8071	Reject Ho	Under - utilization
02	Hostels of SW Depts.	-3.2644	Reject Ho	Under utilization
03	Hostels of Women & Child Welfare Dept.	0.4472	Accept Ho	No Under utilization
04	Hostels run by NGOs	-1.0907	Accept Ho	No under utilization
05	Govt. Guest Houses	-3.4014	Reject Ho	Under utilization
06	Public Hospitals	1.7873	Accept Ho	No Under utilization

Note: Working calculation of Z value has been shown in the Appendix

Z value for the overall study area: -4.1087 (Reject Ho) Overall underutilization.

Inference:

Reject Hypothesis (i) (which implies that the utilization of SWHS is more than 50%) for the following categories:

Hostels of Women & Child Welfare Dept.
Hostels run by NGOs
Public Hospitals

Accept Hypothesis (i))(which implies that the utilization of SWHS is less than 50%) for the following categories:

College attached hostels.
Hostels of Social Welfare Depts.
Government guesthouses

Since Z value for the overall study area is -4.1087 (Reject Ho) Overall underutilization. Hence, Hypothesis (i) is accepted on overall basis.

Testing of Hypothesis (ii)

Hypothesis (ii) deals with the causes of under-utilization of Solar Cooker, which is based on feedback from the users. The fact that no single institution is the user of Solar Cookers itself proves that the hypothesis (ii) is accepted. On taking a review of the causes of under-utilization of solar cooker by individuals, most of the users have expressed their dissatisfaction about the performance of solar cooker; this fact has further supplemented that institutions do not use community solar cooker mainly because of low product performance, thus accepting hypothesis (ii) framed for the present study.

4.8 Conclusion

Analysis of the responses collected from the six categories of the Institutional Respondents has been dealt with at length. The degree of utilization of SWHS is found to be category specific, whereas the Solar Cooker was not found to be in use by any of the hostels from the sample of hostels in the study area. Accordingly, the causes of non-utilization of SWHS and Solar Cooker were discussed in detail. We also have discussed various components of the market segmentation of SWHS and Solar Cooker through various parameters in the first part on the analysis of the Sample Hostels by various parameters. This analysis will certainly prove useful to design appropriate strategy in marketing of SWHS and Solar Cooker.

CHAPTER – V

ANALYSIS OF PRIMARY DATA - II
[Individual Households]

CHAPTER V

Analysis of primary data – Part II

[Analysis of household respondents]

Introduction

The present study aims to analyze the causes of under-utilization of SWHS and Solar Cookers by the two categories of the sample respondents viz. institutional respondents and individual households in the study area. The family is a major influence on the consumer behavior of its members. Decisions relating to installation of SWHS are also not an exception to this, as these decisions are made within the context of a family setting. The family commonly provides the opportunity for product exposure and trial, and imparts consumption values to its members. As a major consumption unit, the family is also a prime target for the marketing of many products and services. In order to understand the causes of under-utilization of SWHS and Solar Cooker, therefore, data are also collected from the present as well as prospective users of these two products. Before we proceed to present the analysis of these data; it is necessary to have fundamental understanding of the concept of 'family' or 'household'.

5.1 Definition of 'family' and 'household'

Since the response is collected from 'family' or 'household' it is necessary first to have conceptual understanding of these two basic concepts. Although the term 'family' is a basic concept, it is not easy to define it because family structure and the role-played by family members vary considerably from society to society. Traditionally, however, **'family'** is defined as **'two or more**

persons related by blood, marriage, or adoption who reside together.' In a more dynamic sense, the individuals who constitute a family might be described as members of the most basic social group who live together and interact to satisfy their personal and mutual needs.

'Household' as per the terminology used in the Census Book of India, *"is usually a group of persons who normally live together and take their meals from a common kitchen unless the exigencies of work prevent any one of them from doing so. Persons in a household may be related or unrelated or a mix of both. The important link in finding out whether it is household or not is a common kitchen. There may be one member households, two member households or multi-member households."*

Though families sometimes are referred to as *households*, not all households are families. For example, a household might include individuals who are not related by blood, marriage, or adoption, such as family friends, *roommates*, or boarder. **However, within the context of analysis of individual consumer behavior in this topic, households and families are treated as synonymous.**

5.2 Selection of 'household respondents'

The present study covers the geographical territories of Pune District; including Pune City. Since the consumer responses in urban and semi-urban areas are likely to be different, the sample of households from 'urban' and 'semi-urban' area is drawn separately by a 'Stratified Random Sample Basis'. It is ensured that the sample selected for the study shall be representative of the universe. A questionnaire is prepared for both, users as well as non-users of SWHS and Solar Cooker. It is targeted to record the

causes of not buying SWHS and Solar Cooker, the products under reference of the present study.

5.3 Sample Size

A sample of 500 'households' each, from 'urban' and 'semi-urban' area of the study was planned for conducting the present research. The response was over-whelming from the households from semi-urban area and, therefore, the researcher could collect questionnaires from 614 households from semi-urban area as against 444 households from the urban area covering Pune city, including Pimpri Chinchwad (Pune Metropolitan Region). Since the population for the purpose of the present study covers total households in Pune District (covering a population of 72 lacks as per 2001 census) the analysis of the sample of household respondents may not reconcile with the population. This may be treated as the main limitation of the present study. However, care has been taken to ensure that the sample of respondents, which is selected on 'stratified random sample' basis, represents to a major extent the population in the study area.

5.4 User/Non-user Segmentation of the Sample Households

Since the present study is related to the causes of under-utilization of SWHS and Solar Cooker in Pune District, it is necessary first to segregate the sample of respondents into user and non-user category. The current non-users represent a special challenge and marketing opportunity. Marketers have to decide whether non-users are a potentially worthwhile segment, or whether the resources needed to convert them into users (thus enlarging the market) can be better spent in trying to lure present users away from competitive products (i.e. increasing their own market share)

Awareness status encompasses the notion of consumer awareness, interest level, or buyer readiness. Marketers have to determine whether potential consumers are aware of the product, interested in the product, or need to be informed about the product.

The following tables explain the segmentation of respondents into user and non-users groups.

Table 5.1(A)
Classification of sample individual households by user and non-user of SWHS

Sr. No	Particulars	Urban	Semi-Urban	Total
01	Number of households	444	614	1058
02	Users of Solar Water Heating Systems	44	25	69
03	% of users to total households	9.90%	4.07	6.52%
04	% of non-users to total households	90.10%	95.93%	93.48%

Table 5.1 (B)
Users of Solar Cookers only

Sr.No	Particulars	Urban	Semi-Urban	Total
01	Total households	444	614	1058
02	Users of Solar Cookers Only	10	04	14
03	% of users to the total households	2.25%	0.65%	1.32%

Table 5.1[C]
Users of Solar Water Heating Systems and Solar Cookers

Sr.No	Particulars	Urban	Semi-Urban	Total
01	Total households	444	614	1058
02	Users of both SWH and Solar Cooker	06	02	08
03	% of Users to the total households	1.35%	0.32%	0.76%

Inference

Since the present study aims at finding out the causes of under-utilization of SWHS and Solar Cooker, the basic assumption is that there is under-utilization. However, the term 'under-utilization is relative as it is based on the percentage of non-users to the total members in the population. In the study, therefore, percentage of non-users as compared to the total of sample households in the study area is found out. As there are three categories of users viz users of SWHS only, users of both SWHS and Solar Cooker and users of Solar Cooker only, the data is analyzed by preparing three separate tables. From the above tables it is evident that only 9.9% of the sample respondents from urban area and 4.07% from semi-urban area respectively were using SWHS. This leaves a great scope for the marketers to reach to the prospective users by devising appropriate marketing strategy. It is surprised to note that hardly 2.25% of the respondents from urban and 0.65% from the semi-urban area were found to be the users of solar cookers. The sample of respondents using both SWHS and Solar Cooker are 1.35% and 0.32% from urban and semi-urban area respectively. These figures are indicative of the

low level of awareness about these products among the prospective users.

5.5 Demographic Classification of the sample 'Households'

Demographic characteristics, such as income, age, sex, marital status, occupation, and education, are most often used as the basis for market segmentation. Demography refers to the vital and measurable statistics of the population. Demographics help to locate a target market. Demographic information is the most accessible and cost-effective way to identify a target market. Therefore, the 'households' in the study area are analyzed on the basis of demographic set-up. The further part this analysis deals with presentation of the demographic analysis of the sample 'individual households' from the study area.

5.5.1 Classification of 'sample household' by income

Income has long been an important variable for distinguishing market segments. Income indicates the ability [or inability] to pay for a product. The products for which the causes of under-utilization are to be evaluated includes Solar Water Heating systems, (and of course solar cooker requiring no much investment) requiring an average investment in the range of Rs.20, 000 – Rs.25, 000. This decision certainly would depend upon the capacity of the household to bear such expenditure. Therefore, the sample of household is first classified on the basis of 'total family income'. The following table presents the data in this regard:

Table 5.2

Classification of sample households on the basis of monthly income

Sr. No	Income Range	Urban House holds	% to total	Semi-urban House holds	% to total	Total	% to total
01	Less than Rs.5,000	62	13.96	240	39.08	302	28.54
02	5,000 - 10,000	124	27.92	210	34.20	334	31.56
03	10,000-15,000	82	18.50	63	10.27	145	13.71
04	15,000 - 20,000	26	5.85	30	4.88	56	5.29
05	Above Rs.25,000	62	13.96	25	4.08	87	8.23
	Total	**444**	**100**	**614**	**100**	**1058**	**100**

Inference

We observe that 27.92% respondents in the urban area and 34.20% in the semi-urban belong to the income range of Rs.5,000 to Rs.10,000. It is also noted that the % of households in the upper income group category is more [13.96] in the urban area where as [8.23] in the semi-urban area as compared to the same percentages for an income range of Rs.20,000 - Rs.25,000. Therefore, marketing efforts could be concentrated on this high-income group segment, which can be perceived as potential users of SWHS.

5.5.2 Income group-wise classification of the sample of users and non-users

Table 5.2 in the above paragraphs classifies the sample of respondents on the basis of their monthly income. However, in order to devise an appropriate marketing strategy, it is necessary to collect the data on the users and non-users of SWHS and Solar Cookers from each income group. This exercise has been done and presented as follows separately for urban and semi-urban area of the study. Table 5.3(A) shows the segregation in the urban area and Table 5.3 (B) shows the same in semi-urban area.

Table 5.3(A)

Income group-wise classification of the sample of users and non-users of SWHS in the Urban Area.

Sr.No	Income Range (Rs. Per month)	Total	Users	%	Non-Users	%
01	Less than 5,000	62	--	--	62	100.00
02	5,000 - 10,000	124	08	6.45	116	93.55
03	10,000 - 15,000	82	05	6.10	77	93.90
04	15,000 - 20,000	88	05	5.68	83	94.32
05	20,000 - 25,000	26	05	19.23	21	80.77
06	25,000 and above	62	21	33.87	41	66.13
	Total	**444**	**44**		**400**	

Table 5.3(B)

Income group-wise classification of the sample of users and non-users of SWHS in the semi- urban area.

Sr.No	Income Group (Rs. Per month)	Total	Users	%	Non-Users	%
01	Less than 5,000	240	--	--	240	100.00
02	5,000 - 10,000	210	--	--	210	100.00
03	10,000 - 15,000	63	01	1.59	62	98.41
04	15,000 - 20,000	46	03	6.52	43	93.48
05	20,000 - 25,000	30	07	23.33	23	76.67
06	25,000 and above	25	14	56.00	11	44.00
	Total	**614**	**25**		**589**	

Note: Since income cannot be a criteria (due to its very low price) for a decision to purchase Solar Cooker, the income group wise classification of users and non-users has been made only for SWHS.

Inference

The main hurdle in the decision to purchase SWHS as is evidenced from the above table seems to be the income level of the respondents. This is supported by the inference that user % increases with the increase in the level of monthly income of the respondents.

5.5.3.Classification of households by educational background

The level of a person's formal education is a commonly accepted approximation of social class standing. Generally speaking, the more education a person has, the more likely it is

that the person is well paid. When targeting specific products or services, marketers frequently speak in terms of occupational groups based on the educational pattern. Use or non-use of RETs (Renewable energy technologies) does not depend only upon the income level of the respondents. The qualitative attributes of spending depend certainly on the educational background and the awareness about the recent happenings in the science and technology fields. Therefore, in order to assess the relationship between the educational background and the usage of SWHS or Solar Cooker the respondents are segregated on the basis of their educational background. Again, a separate table is prepared for urban and semi-urban area. The results are tabulated below:

Table 5.4(A)

Classification of the respondents by educational background (Urban Area)

SR No	Educational Background	Total Respon-Dents	Users of SWH	% to total	Non-users of SWH	% to total
01	Below SSC	59	01	1.69	58	98.31
02	SSC and Above upto under-graduation	125	05	4.00	120	96.00
03	Graduation	146	14	9.59	132	90.41
04	Post Graduation and Above	114	24	21.05	90	78.95
	Total	**444**	**44**		**400**	

Table 5.4(B)
Classification of the respondents by educational background (Semi- Urban Area)

SR No	Educational Background	Total Respon-dents	Users of SWHS	% to total	Non-users of SWHS	% to total
01	Below SSC	158	--	--	158	100.00
02	SSC and Above upto under-graduation	306	06	1.96	300	98.04
03	Graduation	104	10	9.62	94	90.38
04	Post Graduation and Above	46	09	19.56	37	80.44
	Total	**614**	**25**		**589**	

Inference

The object of this classification of respondents by educational background was to test whether there is any relationship between educational background and the use of SWHS and Solar Cookers. It is revealed from the above figures that higher is the educational background of the respondents higher is the ratio of users of the devices. Of course, awareness among the highly educated respondents may not result into buying of the solar devices. Other factors such as, not only ability to pay but also willingness to spend, technical feasibility, site-specific problems etc. do also contribute to this decision-making.

5.5.4. Classification of sample households by age

People buy different goods and services over their lifetime. Peoples' taste in cloths, furniture and recreation is also age related. Consumption is also determined by the stage of the household in the family life cycle. Decision to buy (Or not to buy)

SWHS is, along with other factors also related decision. Age factor also controls the decision-making capacity of individuals. In urban area it is found that households in the age group of 30-40 exercise decision-making. Youth, thus, dominates the decisions in their families mostly because of nuclear structure of the family. In semi-urban area, however, households in the post parenthood stage do have power to decide whether or not to go for capital expenditure decisions such as installation of SWHS. Age factor, thus dominates the decision-making. Therefore the individual households are classified by their age and analysis is made for urban and semi-urban area separately.

Table 5.5 (A)

Classification of sample households in the urban area by age group

Sr No	Age Group (In years)	Total House holds	Users	% of users to total house holds	Non-users	% to total house holds
01	Less than 30	32	2	6.25	30	93.75
02	In between 30 –40	118	8	6.78	110	93.22
03	In between 40-50	197	23	11.68	174	88.32
04	In between 50-60	71	10	14.08	61	85.92
05	Above 60	26	1	3.84	25	96.15
	Total	**444**	**44**		**400**	

Table 5.5 (B)

Classification of sample households in the semi- urban area by age group

Sr. No	Age Group (In years)	Total House holds	Users	% of users to total house holds	Non-users	% to total house holds
01	Less than 30	127	01	0.79	126	99.21
02	In between 30 –40	117	04	3.42	113	96.58
03	In between 40-50	96	07	7.29	89	92.71
04	In between 50-60	123	11	8.94	112	91.06
05	Above 60	151	02	1.32	149	98.68
	Total	**614**	**25**		**589**	

Inference

From the above tables it is revealed that utilization of SWHS is maximum i.e. 14.08% in the urban area and 8.94% in the semi-urban area in the post parenthood stage in the family life cycle. This is the stage where a family has stabilized earnings, and the outcome is that it enjoys comfortable living. A product like SWHS is best suited to such class of families. Thus, marketers should target post parenthood stage family as market segmentation for SWHS.

5.5.5. Classification by size of household

This is another important parameter for the study of sample households from the study area. In order to determine the collector capacity, daily requirement of hot water of each family is first to be determined. Therefore, the number of members in the family i.e. size of household needs to be studied. The information obtained from the sample of households is tabulated below:

Table 5.6(A)
Classification by size of household in the urban area

Sr. No.	Size of House hold	Total House holds	Users of SWH	% to total	Non-users	% to total
01	Less than 5	346	37	10.69	309	89.31
02	5 – 10	56	04	7.14	52	92.86
03	Above 10	42	03	7.14	39	92.86
	Total	**444**	**44**		**400**	

Table 5.6(B)
Classification by size of household in the semi- urban area

Sr. No.	Size of House hold	Total House holds	Users of SWH	% to total	Non-users	% to total
01	Less than 5	67	02	2.99	65	97.01
02	5 – 10	434	19	4.38	415	95.62
03	Above 10	113	04	3.54	109	96.46
	Total	**614**	**25**		**589**	

Inference

The above information is most useful to determine the capacity of SWHS for a prospective user family. In urban area 346 out of 444 (77.92%) sample respondents were observed to have less than 5 members in each family as against 67 out of 614 (10.91%) in the semi-urban area. The percentage of utilization of SWHS was found to be 10.69% in the first category (Less than 5) of sample respondents in the urban area. In semi-urban area utilization % was found to be more in the second category (5 to 10 members) of

the households. These figures indicate the trends in the usage of SWHS among the household in the urban and semi-urban area of the study.

5.5.6 Classification of households by fuel used for heating the bathing water

SWHS is a replacement of the conventional fuels used for heating the water. Therefore, the present pattern of fuel used for heating the bath water must be studied. The following table highlights the classification of non-users of SWHS in the urban as well as semi-urban area of the study.

Table 5.7

Classification by fuel used for heating the water by non-users in urban and semi-urban area

Sr. No.	Type of Fuel	Urban	%	Semi-Urban	%	Total	%
01	LPG	282	70.50	307	52.12	589	59.56
02	Electricity	87	21.75	81	13.75	168	16.99
03	Any Other	31	7.75	201	34.13	232	23.45
	Total	**400**	**100**	**589**	**100**	**989**	**100**

Inference

LPG is a predominant fuel in both urban as well as semi-urban area. It is observed that mostly the families from the upper income groups use electric geysers. In semi-urban area 34.13% of the sample household use fuels such as crop residue, biomass, kerosene etc. Even the census data reveals the fact that 46% of the census houses in Pune District use biomass, cow dung cakes etc, as a fuel. The obvious reason for maximum use of LPG must be the immediate availability of LPG even in the semi-urban area

of the study (Except the period when there is temporary shortage of cylinders). Electricity as a fuel is really a costly affair for the lower income and middle-income family. Therefore, most of the households resort to LPG as a fuel for heating the water.

5.5.7 Classification by cost of fuel for heating the bathing water

Having ascertained the fuel consumption pattern it is now necessary to record the average monthly cost of such fuel. This is necessary to determine the financial viability of the proposal to install SWHS. Cost of fuel for water heating depends of course, on the type of fuel used. Households have various options such as LPG, Electricity, Kerosene, and Firewood etc. It is also observed that families use either one type of fuel or combination of various options. This analysis is applicable only to the non-users of SWHS. The following table summarizes the observations recorded on the monthly fuel costs of sample households.

Table 5.8
Classification of non-user households in urban and semi-urban area by cost of fuel used for heating the water for bathing.

Sr No	Monthly Expenses (Rs.)	Urban House holds	% to total house holds	Semi-Urban House holds	% total house holds	Total in the study area	% to total house-holds
01	<200	318	79.50	423	71.81	741	74.92
02	200- 400	10	2.50	67	11.37	77	7.78
03	400- 600	17	4.25	31	5.26	48	4.85
04	600- 800	40	10.00	27	4.59	67	6.78
05	800-1000	09	2.25	22	3.74	31	3.14
06	>1000	06	1.50	19	3.23	25	2.53
	Total	**400**	**100**	**589**	**100**	**989**	**100**

Inference

The above table segregates the sample households in the study area on the basis of the monthly expenses on heating the water. It is found that the type of fuel used for heating the water determines monthly cost on water heating. Manufacturers should carefully note the average cost of individual household on heating the water and efforts are required to make available the SWHS at a price comparable to the present level of spending by the potential users. 79.50% from the urban area, 71.81% from the semi-urban area and overall 74.92% of the households spend less than Rs.200/- on cost of hot water. This naturally implies that the price of SWHS should be fixed at such a level that the opportunity cost of such investment should be less than Rs.200 per month.

5.6 Cause wise analysis of under-utilization of SWHS and Solar Cooker

The present research finally aims at finding out the causes of under-utilization of Solar Water Heating Systems and Solar Cookers by various categories of the respondents. In this part of the thesis the causes of under-utilization as evidenced from the observations recorded by the individual households are analyzed. These causes could be perceived as marketing feedback from the prospective users of the SWHS and Solar Cookers. In the study it is observed that individuals are keen on buying solar devices but the proper advice from the manufacturers and marketers is lacking. Therefore, marketers should probe into these causes and design their marketing strategy for developing the market for SWHS and Solar Cookers. The causes, as enlisted in the questionnaire administered on the individual households are presented in the further part of this chapter. Since the nature of the products under reference is different from each other these

causes are analyzed in two parts, the first part being devoted to SWHS and the second part to Solar Cooker.

5.6 (A) Causes of under-utilization of SWHS

This analysis is of the responses received from 400 non-users of SWHS in the urban area and 589 non-users of SWHS in the semi-urban area. The respondents who have been using these devices are excluded for the purpose of analysis of the causes of under utilization of SWHS.

Cause 01: UNAFFORDABLE PRICE OF THE EQUIPMENT

SWHS is perceived as a product for elite customers. While recording the responses from the individual households particularly in the middle-income group it was observed that the price of SWHS is dominating factor in the consumer decision-making. Another important factor is that spending around 20,000-25,000 rupees on making provision for hot water is unjustified for the middle-income group household. Therefore, manufacturers should respect the demand from the individual consumers and try to bring down the cost of SWHS at such a level that can be affordable to the common man. The table below presents facts about the household reactions to the "Unaffordable Price" option for not buying SWHS

Table 5.9
Unaffordable Price: Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	265	66.25
Semi-urban	589	463	78.60

Inference

The figures clearly indicate that the 66.25% of the sample households from the urban area and 78.6% from the semi-urban area have recorded that "Unaffordable Price" is the main hurdle in their decision to buy SWHS. These responses have been recorded even by the households from the upper income range. The problem is further aggravated when other fuels options like LPG is available to the consumers. Thus, marketers should take a proper message and efforts are required to enhance the cost reduction drive by constant Research and Development, Import Substitution of key inputs required for SWHS.

Cause 02: Lack of continuous water supply –

Cause for non-utilization of SWHS

Availability of continuous water is the basic pre-requisite for installation of SWHS. It could, therefore, be one of the reasons for non-installation. Therefore, response was collected on the water availability on continuous basis. Table 5.10 records these responses collected from urban as well as semi-urban households

Table 5.10
No continuous water supply: Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	34	8.50
Semi-urban	589	332	56.36

Inference

The above table clearly shows that the problem of non-availability of water on continuous basis is more serious in the semi-urban area of the study. More than 50% of the sample respondents from semi urban area have attributed this cause to non-utilization of SWHS along with other causes of non-use of SWHS. Manufacturers, however, have to find out site-specific solutions to overcome this problem by providing additional cold-water storage tank.

Cause 03: Unsuitable Roof - Cause for non-utilization of SWHS

The respondents who have assigned "Unsuitable Roof" as the cause of non-utilization is given below in Table 5.11

Table 5.11
Unsuitable Roof: Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	29	7.25
Semi-urban	589	58	9.85

Inference

The Census data on this parameter speaks of many things. As per 2001 Census, in Pune District of the total 14,39,610 households 4,35,695 houses are made with Concrete Roof. Thus, only 30% of the total households in Pune District have permanent concrete structures. However, while selecting respondents for the present study the respondents with concrete structures have been included in the present analysis. Since the aim of the analysis is to explore the marketing potential of SWHS, the households with

potential to buy the SWHS are randomly selected. Hence, very insignificant portion of the households have recorded this cause. Less than 10% of the households both from urban as well as semi-urban area have assigned 'Unsuitable Roof' as a cause of non-installation of SWHS. In fact, this problem can be solved by designing a separate fabricated frame for mounting the hot and cold-water tank of SWHS.

Cause 04: Unsuitable Climate - Cause for non-utilization of SWHS

Suitable climate and adequate number of solar days is the utmost necessity for a fuller efficiency of any SWHS system. Out of the 14 tahshils of Pune District, four tahshils fall in the area with heavy rainfall and cloudy atmosphere. Hence, SWHS systems may not work throughout the year (Or at least for 300 solar days as compared to the other parts of the District.) Responses collected for this cause are tabled below:

Table 5.12
Unsuitable Climate: Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	--	--
Semi-urban	589	74	12.56

Inference

Thus, as seen from the above table 'Unsuitable Climate' cannot be a general cause of non-installation of SWHS. The problem is confined to such places where rainfall is heavy. In Pune District, Tahshils, - Maval, Velhe, Mulshi and Bhor can be categorized into such area, which are within the boundaries of Western Ghats.

This is the natural limitation on the use of SWHS and the constant R & D in the field may give solution to such problem.

Cause 05: Unsuitable Water - Cause for non-utilization of SWHS

Hard water circulated through the copper tubes in the solar collector may damage the system. The individual households who have assigned non-installation of SWHS to the hard water are shown in the following table.

Table 5.13
Unsuitable Water: Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total house holds
Urban	400	--	--
Semi-urban	589	86	14.60

Inference

In some parts of Pune District, the available water is not suitable for circulation through Solar Collector. Such households are 14.6% of the total sample of households in the semi-urban area. Households in the urban area of the study recorded no such problem. This problem can, however, be solved by providing Solar Desalination System, of course with additional cost.

Cause 06: Not aware of bank finance at concessional rate. -Cause for non-utilization of SWHS

Soft Loan Scheme by MNES is designed to enable the households to buy SWHS. The rate of interest charged for financing SWHS is 5% of the cost of SWHS. (2% from September,2005) It is however, observed in the primary survey

that the consumers in the semi-urban area were not aware of such schemes. The responses collected from urban and semi-urban households are recorded below in Table 5.14

Table 5.14
Not Aware of Soft Loan Scheme: Cause of Non-utilization of SWHS

Area	Sample of Non user households	No. of respondents	% to total households
Urban	400	27	6.75
Semi-urban	589	386	65.53

Inference

Thus, 65.53% of the sample households in the semi-urban area were not aware of 'Soft Loan Scheme'. Whereas, only 6.75% of the sample households from the urban area were ignorant about the 'Soft Loan Scheme' for purchase of SWHS. Thus, market communication system needs to be improved by proper advertisement through exhibitions, trade fairs etc.

Cause 07: Cold bathing water - Cause for non-utilization of SWHS

The households who have recorded that they don't need SWHS as they use only cold bathing water are shown in the following table:

Table 5.15
Cold bathing water: Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	07	1.75
Semi-urban	589	18	3.06

Inference

The percentages of households who have been using cold water for bathing is really non-cognizable as evidenced from the above sample of households. Only 1.75% from urban area and 3.06% of the households from the semi-urban area have assigned the cause of Non-use to the use of cold bathing water. It is observed that even poorest of the poor families have been using hot water for bathing. Therefore, 'Cold Water' may not be given much importance as a limitation in installation of SWHS.

Clause 08: Easy availability of LPG.

It is observed that households prefer to follow a routine path. People do not want to go in for non-conventional way. When LPG is easily available people do not want to try another fuels. Households who have recorded that they do not want to go for SWHS as LPG is easily available is given below:

Table 5.16

Easy availability of LPG : Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	63	15.75
Semi-urban	589	202	34.30

Inference

The fact is that SWHS cannot be a total substitute to the traditional fuels. At the most it could be treated as a supplement to the conventional energy systems. Fuel used for heating the bating water is conventionally LPG in the urban area and LPG and

other fuel combinations in the semi-urban area. 15.75% of the sample households in the urban area and 34.30% of the sample households in the semi-urban area are found to be reluctant to buy SWHS due to easy availability of LPG.

Clause 09: No priority to this issue

Questionnaire for recording the responses for the individual households was designed in such a way that most of the possible causes of non-installation of SWHS could be covered. However, the respondents were given free option to indicate any one or multiplicity of the possible causes of not buying SWHS. The last cause in the questionnaire was "NO PRIORITY TO THIS ISSUE IS GIVEN" The responses collected to this option are tabled below:

Table 5.17
No priority to this issue: Cause for non-utilization of SWHS

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	37	9.25
Semi-urban	589	422	71.65

Inference

It is found that 9.25% of the sample households from the urban area and 71.65% of the sample households from the semi-urban have not given priority to the decision to install SWHS. For them fuel pattern for bathing water may be a "No Priority or Low Priority" issue. This might be due to lack of marketing communication system in the form of product advertisement convincing about the possible benefits by using SWHS. Therefore, a strong marketing campaign is tobe designed as a part of aggressive marketing strategy of SWHS.

5.6 (B) Causes of non-utilization of Solar Cookers by sample of individual households.

The census survey of India 2001 clearly brought out our poor record of performance in the energy sector. Nearly 57% of our rural population today does not have access to electricity while firewood accounts for around 70% of the total primary fuel consumption for cooking in these area. The over dependence on fire wood for cooking has affected the health of the people in these areas. Approximately half a million premature deaths and nearly 500 million cases of illness are estimated to occur annually as a result of exposure to smoke emissions from biomass use by households in India, making indoor air pollution the third leading health risk factor.

On this background, the present study also includes recording the causes of non-utilization of Solar Cooking systems by the sample of individual non-user households. One has to accept the fact that though solar cooking system may not be a total substitute to the conventional fuel like LPG, Kerosene, and Crop Residue, it may be a good supplement to it. Hence, along with the causes of under-utilization of SWHS a problem of non-utilization of Solar Cooking Systems was also taken up for analysis. The analysis of the causes recorded by the sample of households from urban as well as from semi-urban area of the study are tabled below:

Cause 01: Not Aware of Solar Cooking System

Marketers should first assess the acquaintance of the consumers to the product under review. The responses received for this option are tabled in Table 5.18:

Table 5.18
Not Aware of the Solar Cooking System

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	23	5.75
Semi-urban	589	167	28.35

Inference

General awareness of 'Solar Cooking' as a cooking media is found absent among 5.75% of the sample households in the urban area and among the 28.35% of the sample households in the semi-urban area of the study. These percentages certainly reconcile with the level of literacy in the urban and semi-urban area. In order to increase awareness about the solar energy devices in general marketers should plan their strategy so as to reach to the final consumers. Various medias such as radio, cable television, farmers' meet should be chosen for mass scale sales promotion schemes.

Cause 02: Solar Cooker is not available in the local market.

Responses collected to this cause of non-utilization are given in table below:

Table 5.19
Non-availability of solar cooker in the local market

Area	Sample of non user households	No. Of respondents	% To total households
Urban	400	13	3.25
Semi-urban	589	377	64.00

Inference

In the survey it was found that people were ready to buy solar cooker; but it was not available in the nearby local market. And since the time gap between the desire to buy solar cooker and its availability is substantial, the intensity to buy gets reduced if the product is not made available in the local market. This problem is more relevant especially in the semi-urban area, where 64% of the sample respondents in the present survey have remarked the non-availability of Solar Cooker in the local market. Marketers, therefore, should expand their market even to semi-urban areas by appointing either dealers or distributors for their products.

Cause 3: Bulky Design

The following table gives the responses of the individual household for the cause of 'bulky design' of the solar cooker:

Table 5.20
Bulky Design

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	263	65.75
Semi-urban	589	398	67.58

Inference

This is the most serious objection on 'Box Type Solar Cooker'. Design of the product certainly plays an important role in the consumer decision-making. Housewives have complained about the bulky design of the solar cooker. It is most inconvenient to load the food for cooking due to many factors such as – Heavy weight of the mirror, awkward position required to operate solar

cooker, difficulty in carrying from one place to other even in the terrace where solar cooker is kept, inconvenience in taking out the cooked food out from the solar cooker etc. Thus, more than 60% of the households from urban as well as semi-urban area have responded to this question have strongly expressed their dissatisfaction about the design of the 'solar cooker'. Hence, manufacturers should probe into such causes and improve the product design to suit the requirements of households.

Cause 4: Lengthy Cooking Time

This is another important cause of non-utilization of solar cooker by the individual households. Responses for this cause are given in the following table:

Table 5.21
Lengthy Cooking Hours

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	282	70.50
Semi-urban	589	302	51.27

Inference

This problem is related to the life style of the household. In urban area for example, 70.50% of the households have expressed that the solar cooker is inconvenient for them as it takes more time for cooking. The same ratio for the semi-urban area is 51.27%. Again cooking time depends upon so many factors, such as climate, intensity of the sunlight, wind velocity during cooking hours etc. Therefore, extensive research in this area is required to collect maximum heat so to reduce the cooking time.

Cause 5: Easy availability of LPG/Free Biomass etc.

The other reason for non-use of solar cooker is easy availability of conventional fuel such as LPG, firewood etc. Accordingly the respondents have given their responses to this question which are recorded in the following table:

Table 5.22
Easy availability of LPG/Free Biomass etc.

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	197	49.25
Semi-urban	589	278	47.20

Inference

This is another interesting reason for non-utilization of solar cooker. The easy availability of LPG has made difficult the task of marketers of solar cookers. This is particularly applicable in urban area and its peripherals. In the semi-urban area where households reside nearby their farms, the crop wood or any other biomass is used as a fuel; which is freely available. Thus, 49.25% of the urban and 47.20% of the semi-urban respondents have assigned this cause for non-utilization of solar cookers.

These figures correspond to the Census data, where 46.6% of the households use 'Firewood' and 29.7% use LPG as a cooking fuel. Thus, use of 'Firewood' as a fuel is a concern from environmental as well as from health hazard point of view. Therefore, there is an urgent need of social marketing in this area so to convince masses about the use of 'solar cooker' as eco-friendly energy device.

Cause 6: Not matched with the cooking schedule

Every family has its own cooking schedule to suit the individuals and their life styles. The families who have given negative responses to this question are indicated in the following table:

Table 5.23
Not matched with the cooking schedule

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	281	70.25
Semi-urban	589	337	57.21

Inference

Since this is purely an individual family problem marketers can hardly do anything to overcome this problem. As observed above 70.25% of the urban households and 57.21% of the semi-urban families were such families where both husband and wife were found to be working. Hence, solar cooker may not suit to their daily busy schedule.

Cause 07: Less number of members in the family

Media used for cooking is also determined by the size of the family. Hence, if number of members in the family is very less usually other cooking medias are not used. The following table shows the responses by individual households to this option for not using solar cooker:

Table 5.24

Less number in the family

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	263	65.75
Semi-urban	589	231	39.21

Inference

A concept of nuclear family seems to be the practice of this age. As evidenced from the above table 65.75% respondents from the urban area and 39.21% from the semi-urban area are the nuclear families. This naturally limits their cooking fuel needs, requiring no thought on the alternative fuel for cooking.

Cause 8: Not matched with family food style

Cooking style also governs the consumer decisions on Solar Cooking Devices. The families with a pure vegetarian diet were found to be the users of solar cookers. Whereas, the families with mix food habits were found reluctant to go in for Solar Cookers. As shared with the user group, solar cooker is found to be not much useful for non-vegetarian cooking style.(Though manufacturers claim that solar cooker can be used even for non-vegetarian food). The responses collected from individual households are presented below:

Table 5.25
Not matched with family food style

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	197	49.25
Semi-urban	589	225	38.20

Inference

The above table thus shows that 49.25% of households from urban and 38.20% from the semi-urban area have remarked about their inability to buy solar cooker for not suitable to their cooking style. The criteria of vegetarian and non-vegetarian food is one important criteria along with other factors such as proportion of rice vis-à-vis chapatti as a staple food, usual meal timings etc. Hence, a solar cooker to suit to the family food style should be designed to family-specific needs.

Cause 9: No suitable place for keeping Solar Cooker

This is another valid justification for not buying solar cooker. Since the solar cooker requires sufficiency larger space to keep when not in use, the household with non-availability of such place do not want to buy solar cooker even other things are favorable to them. The observations recorded from individual households to this cause are presented in the following table:

Table 5.26
No suitable place for keeping solar cooker

Area	Sample of non user households	No. of respondents	% to total households
Urban	400	321	80.25
Semi-urban	589	77	13.07

Inference

In urban households storage is a bigger problem, as evidenced from the above table, where 80.25% of the sample of urban households have no place to store the solar cooker when not in use. A sample of 13.07% respondents from semi-urban area has

given negative response to this option. This problem cannot be immediately resolved unless there is a basic research on the design on the solar cooker.

5.7 FEEDBACK FROM THE USERS OF SOLAR COOKER

Along with collection of responses from the non-users of solar cooker, the present survey has also recorded the responses from the users of the solar cookers. And it was found that on an average the users were not totally happy about the performance of the solar cooker. The common problems faced by the sample of 22 respondent users of solar cooker may be summed up as:

- Lack of repairs and maintenance network by the manufacturers - ***15/22** (#68%)
- Low performance during cloudy atmosphere – **16/22** (73%)
- Inconvenience in handling the solar cooker - **13/22** (59%)
- Outside disturbance during cooking time – **10/22** (45%)
- Passive attitude of the manufacturers in dealing with consumers of the solar cookers - **16/22** (73%)
- Due to heavy weight of the mirror loading and unloading the cooking vessels is difficult - **17/22** (77%)
- An awkward sitting position in which cooking vessels are to be put into solar cooker and removed from the solar cooker. – **16/22** (73%)

Note: *These represents the number of respondents giving response to a particular question from the feedback sheet.

The percentages in the bracket represents the percentages recorded for a particular comment by the respondent user of solar cooker.

Inference

From the above response statement it is beyond doubt that manufacturers have to pay serious attention on the user-friendly design of the solar cooker for use in the future. The various problems associated with the present models have to be treated as lessons in designing an innovative product.

5.8 Testing of Hypotheses

Hypotheses framed at the conceptual stage of the study are reproduced below for the purpose of testing the validity of the statements:

The present study is carried out in furtherance of the following hypotheses:

(i) Irrespective of perception of the prices of SWHS there is an under- utilization of market potential of SWHS due to some unidentified reasons.

(ii) Under-utilization of market potential of Solar Cooker is due to its low product performance.

Test for Hypothesis (i)

'Underutilization' as clarified in 1.4 of the present study means:

'Less than 10% utilization of SWHS and Solar Cooker by a sample of individual households.'

Hypothesis (i) is tested by using 'Z Test'

To test:

Ho: $P = 0.5$ against H1: $P < 0.5$

Level of significance 1%

We apply Z test to test above hypothesis and the results are tabulated below:

Table 5.27

Testing of hypothesis

Category	Z value	Decision	Conclusion
Urban	-0.07	Accept Ho	No under-utilization
Semi-urban	-4.9	Reject Ho	Under utilization
Overall	-3.78	Reject Ho	Under utilization

Note: The working notes for 'Z Value' are shown in the Appendix to the present thesis.

Inference:

Hypothesis (i) is rejected for urban households where as it is accepted for semi-urban households and for the overall study area.

Test for hypothesis (ii)

Hypothesis (ii) deals with the causes of under-utilization of Solar Cooker, which is based on feedback from the users. On taking a review of the causes of under-utilization of solar cooker by individuals, most of the users have expressed their dissatisfaction about the performance of solar cooker; this fact has further supplemented that institutions also do not use community solar cooker mainly because of low product performance, thus accepting hypothesis (ii) framed for the present study.

Inference:

Hypothesis (ii) is accepted in respect of both urban as well as semi-urban households.

5.9 Research & Development in Solar: A case study of Akson's Solar Equipments Pvt. Ltd. Pune

Having dealt with causes of non-utilization of SWH and Solar Cookers the conclusion is that improvement in the product performance should be the agenda before the solar manufacturers. In the collection of data from the solar manufacturers research came across with a manufacture who has a high degree of concern for the R & D in the solar business. The further part of this analysis deals with a case study of Akson's Solar Equipments Pvt. Ltd. Pune.

Solar energy is the most abundantly available free & clean source of energy available to the mankind. The earth receives nearly 2.9 X 10 ^{15} kW of energy every day in the form of electromagnetic radiation from the sun. This is about hundred times the total energy consumption of the world in a year.

An idea of the magnitude of energy reaching the earth's surface on clear day can be had from the fact that the solar energy falling on an area equal to the size of the tennis court per day is roughly equal to the energy obtained from 35 liters of petrol or 80 kg. of coal.

However this has been not tapped for want of research & development for efficient conversion of this energy. Many Universities and academicians have been conducting R & D in this field. However the solar industry in India has ignored this critical aspect and the R & D efforts by the Indian solar industry to develop products at commercial level have been negligible.

This is where M/s Akson's Solar Equipments Pvt. Ltd., Pune stand out as a unique company working on solar R & D, founded in 1997 by a visionary technocrat exclusively for promotion of solar energy, the beginning was with R & D project in solar selective coating.

Solar selectively coated absorber enhances the performance of any solar heating system as compared to traditionally used black surface. In India there have been two processes for manufacturing of solar selectively coated absorber surface using electroplating techniques. This process itself generates effluents harmful to the ecology. Akson's worked upon and developed a 100% green-Physical Vapor Deposition process & obtained a patent in 1998. This process is not only 100% non-polluting but also results in better performance and extremely long service life of the absorber surface. This will benefit the end users for any solar heating systems (water / air). Co-incidentally this process is now adopted by the leading manufacturers in Europe and other advanced countries. The innovative models of SWHS developed by M/s Akson's Solar Equipments Pvt. Ltd., Pune are shown on the following pages:

COMBINED COLLECTOR STORAGE SYSTEM

Ideal for rural areas

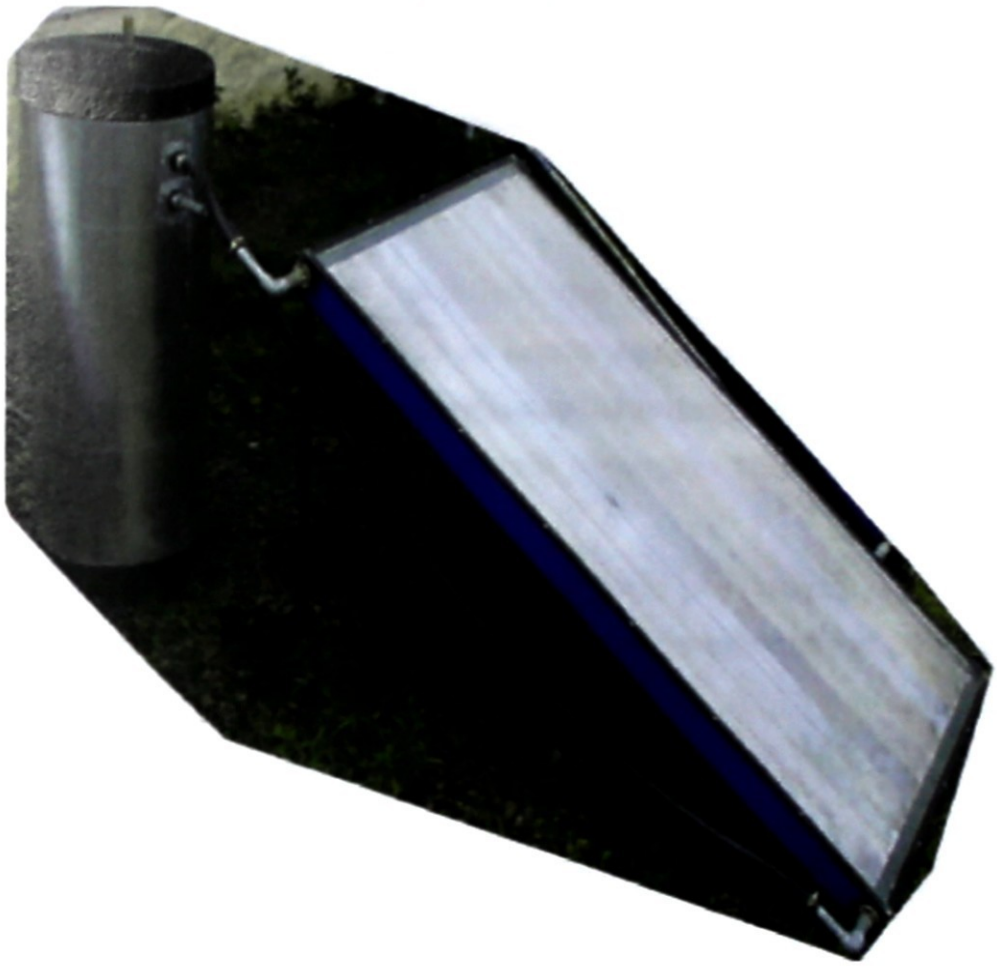
Does not require overhead tank or water supply

Truly portable

Water hardness no bar

Low cost

REVERSE THERMOSIPHON SYSTEM



Does not require an over head tank reducing cost

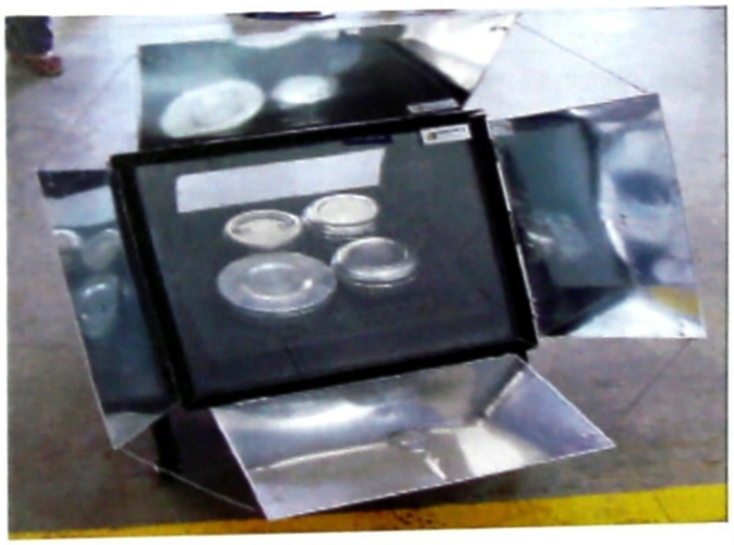
Aesthetically better

Reliable performance

The second most important use of solar heat is for cooking. The traditional solar box cooker is slow and has low efficiency on account of the design limitations. Though most popular, it requires maintenance on account of breakage of glass / mirror and this service is not available. As a result the end user has to spend more money and the final cost of the cooker is quite high or most of the users have to scrap the product. Also non-veg cooking is not possible.

M/s Akson's Solar studied the problems carefully and developed solar oven, which is highly efficient resulting in faster cooking and easy cooking of non-veg. The design results in virtual maintenance free and user-friendly product. The materials used are 100% metal (aluminium) and M S stand. Powder coating in attractive colour scheme makes it a pride possession. The height results in less strain on the lower back while using. This is a classic example of customer oriented R & D commercially developed. The models of Solar Cooker developed by M/s Akson's Solar are shown below:

Solar Cooking Process is ongoing



The above model has been developed specially to overcome the problems faced by the users of Box Type Solar Cooker. This model is user friendly in that it is convenient to load and unload cooking vessels. Height of the model has been in such a way that operating becomes more easy. The model is improvisation over the traditional box type cooker.

Second notable R & D by Akson's Solar is development of a Concentrator Plate Collector (CPC) "QUASAR" in place of conventional Flat Plate Collector (FPC). This invention again overcomes all the demerits of the conventional collector and results in highly efficient product. The main advantages being requirement of less place and suitability for high temperature outputs without loss of efficiency. Apart from this it reduces the pollution and use of energy for production of aluminium, copper, glass and rock wool material etc. required for manufacturing of a collector. For the identified potential of 140 million sq. mtr. Collector area (MNES estimate), this invention will result in saving of approx. 20,000 crore rupees of capital investment). Also will it result in high temperature application in industries not feasible with the Conventional Flat Plate Collector.

The Government of Maharashtra has by a regulation made the installation of solar water heating system mandatory for all multistoried housing buildings. Pune Municipal Corporation adopted this in 2004. M/s Akson's solar studied the problems associated with such projects and have developed a design "Delta" of solar water heating system for multistoried residential buildings. The merits of this design clubbed with the advantage of CPC can alone make the Government directly, successfully implemented.

As of today the following three (PATENTED) inventions are testimony of Akson's R & D commercially employed.

1. PVDSunselect™ PVD coated solar absorber surface.
2. "QUASAR" the Concentrator Plate Collector.
3. "DELTA" the ideal solar water heating system for multistoried housing buildings.

Akson's solar is presently working on R & D in the field of thermal energy storage for use in kitchen and electricity generation using solar heat.

Such efforts will certainly result in better solar products and make it more popular.

5.10 Conclusion

Analysis of the individual households in this chapter would certainly be considered as guidelines to the manufacturers as well to the dealers or installers of SWHS and solar cookers. Manufacturers have to concentrate on development of SWHS, which would be best suitable to cater to the requirement of particular customer. The site-specific solutions have tobe provided during installation of SWHS. The price of SWHS should also be set as to be affordable to the consumers. The cost of other alternative fuels should be compared and efforts are tobe made to ensure that SWHS could be economically viable proposal to the prospective users.

As regards Solar Cooker, it is observed that the users are not overall satisfactory about the performance of the product. A case of R & D in the development of Solar Cooker as quoted above was to strengthen the claim that R & D would certainly be beneficial to the ultimate end users of the products. However, such R & D

should not be confined to the laboratories of the industries; it must be properly communicated in the market through proper media planning.

The researcher finally concludes that, there is a tremendous market potential for SWHS and Solar Cooker. Manufacturers have to do systematic efforts and design appropriate marketing strategy, backed by sound technical support and then the days are not far off where one can establish market leadership in SWHS and Solar Cookers.

CHAPTER – VI

ANALYSIS OF PRIMARY DATA - III
[Analysis of Solar Business Houses]

6.1 Selection of Respondents

6.2 Sample Size

6.3 Profile of Manufacturers/Installers/Dealers

6.4 Personal Interview of Mr. Revankar, M.D. Bipin Engineering Pvt. Ltd.

6.5 A case study of M/s Sudarshan Saur Pvt. Ltd.

CHAPTER VI

ANALYSIS OF PRIMARY DATA – PART III

(Analysis of Solar Business Houses)

Introduction

The present study aims at exploring the causes of under-utilization of market potential of Solar Water Heating Systems(SWHS) and Solar Cookers in Pune District. For the purpose of this study, questionnaires have been administered and data are collected from individual households, hostels attached to educational institutions, Government guest houses and Government hospitals. These respondents represent the end users of these equipments i.e. the demand side of the problem under review. Study of market potential would be incomplete if supply side of the products under review is neglected. Therefore, a separate questionnaire has been prepared to collect data from the manufacturers of Solar Water Heating Systems and Solar Cookers.

6.1 Selection of respondents

During the field visits it was observed that the respondents representing the supply side were primarily from the following three categories –

i) Manufacturers
ii) Manufacturers cum installers or assemblers
iii) Dealers

The data was collected by choosing respondents from each category. Information as is available from Maharashtra Energy Development Agency (MEDA) and TATA Yellow Page Directory was used for selection of respondents.

6.2 Sample Size

In Pune District (which is the study area) there are about 40 manufacturers / installers / dealers of SWHS. Questionnaires were sent to these respondents and data are obtained by personal interaction with 22 respondents, which accounts for about 50% of the total population of manufacturers – dealers. Manufacturers from Pune District were selected with an exception of Ms. Sudarshan Saur Pvt. Ltd, a company based at Aurangabad District but has dealer network in Pune District. The said company has been chosen as a case study as it has bagged the BEST MANUFACTURER PRIZE awarded by MEDA in the year 2003.

6.3 Profile of Manufacturers/Installers/Dealers

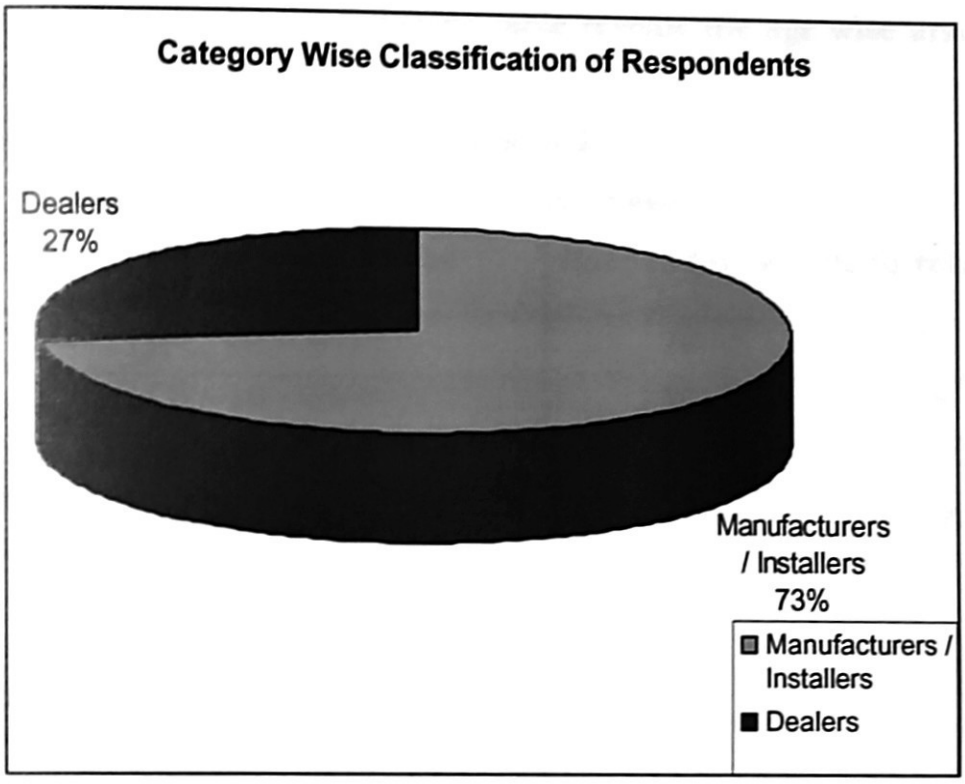
6.3.1Category wise classification

On the basis of the activity carried on, the respondents are classifed into two categories viz. Manufacturers and Dealers. It was also found that some respondents partly manufacture and partly assemble the SWHS. The following table will show the respondents in each category

Table 6 - 1

Categorywise classification of respondents

Sr. No.	Particulars	No. Of Respondents	% to total
01	Manufacturers-Installers	16	73
02	Dealers	06	27
	Total No. Of Respondents	**22**	**100**



Inference

It is thus observed that 73% of the sample respondents manufacture solar water heating systems and the remaining 27% are the dealers of SWHS.

It is worth noting that only two manufacturers in Pune District are engaged in manufacturing of solar cookers. Solar cookers are mostly re-sold by the manufacturers. Solar cookers are purchased by most of the manufacturers from Indore based company.

6.3.2Age of the business

The business of manufacturing solar energy devices is comparatively young business. Growth and prosperity in any business depend among several other factors upon the number of years entrepreneur has spent in a particular business line. From

this point of view the following table reveals the age wise analysis of solar busines houses:

Table 6-2

Age of the business

Sr. No.	No. of years in the business	Respondents	% to total
01	00 - 05	10	45
02	05 – 10	04	18
03	10 and above	08	37
	Total	**22**	**100**

Inference:

From the above table it is clear that 45% respondents have yet to complete the first phase of 5 years in their business. They are said to be in the infancy stage of their business. Manufacturers who have completed 10 years or more were found to be 37%. Thus, the solar business is expected to be controlled by those who have establised themselves in the market.

6.3.3 Ownership Pattern

Ownership pattern of any enterprise is an important criteria to judge the size of the business, risk bearing capacity of entrepreneurs etc. Solar manufacturers are classified on this criteria in the following table:

Table 6-3

Classification of manufacturers on the basis of ownership Pattern

Sr. No.	Type of ownership pattern	No. Of Respondents	% to total
01	Sole proprietorships	12	54.55
02	Partnership firms	03	13.63
03	Private limited companies	07	31.82
	Total	**22**	**100**

Inference:

Ownership pattern determines the size of the business, the capital invested in the business, limitations on the business expansion etc. From this point of view it is evidenced that in Pune District, 54.55% of the entrepreneurs are still following sole proprietorship pattern. It is worth noting that not a single manufacturer is a listed public limited company engaged in manufacturing of SWHS and Solar Cookers in the study area.

6.3.4 Registration with Maharashtra Energy Development Agency - MEDA

Maharashtra Energy Development Agency – MEDA a Govt. Of Maharashtra undertaking created in 1985, is the nodal agency of MNES to promote renewable energy devices in Maharashtra. Since inception, MEDA has propagated, promoted the use and distributed a large number of non-conventional and renewable devices. Manufacturers engaged in manufacturing of solar thermal devices and solar photovoltaic system may register their unit with

MEDA. This will certainly help them foster their business growth. The important terms of registration can be summed up as below

- The product must be approved by MNES. Manufacturers will have to produce a valid certificate issued by MNES test centre.

- The dealers of MNES approved manufacturer, who agrees to supply and install the solar water heating systems as per MNES guidelines and in MNES declared cost will be eligible to get registration. The dealer should have arrangement of repairs and maintenance of the system.
- The dealer should produce a copy of valid agreement between him and the manufacturer for supply of solar water heating systems.

- The manufacturers – dealers shall produce copy of latest Income – Tax Clearance Certificate issued by the competent authority with six months time.

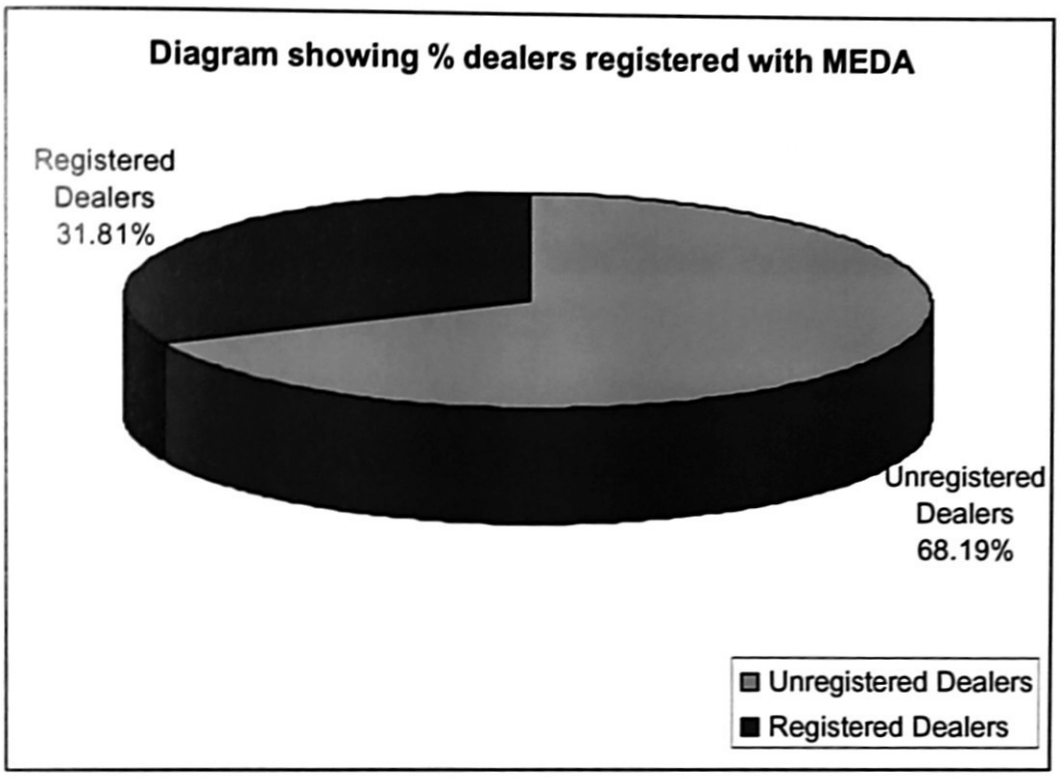
- MEDA shall check facilities available with manufacturer for production of solar water heating systems.

- The manufacturer – dealer shall submit all relevant details as is mentioned in Registration Form.

On the basis of this criteria the manufacturers – dealers are divided into two categories viz

I) Registered with MEDA and
II) Not Registered with MEDA

The following pie diagram shows the percentage of dealers registered with MEDA.



Inference

Thus, out of 22 sample manufacturers from Pune District only 7 manufacturers(31.81%) have registered with MEDA. More and more manufacturers should register their unit with MEDA so as to avail of all the incentives and facilities.

6.3.5 Turnoverwise Classification

Turnover is one of the important parameters for measurement of growth of any business. Not a single manufacturer in the study area is a public limited company and, therefore, the information about turnover was not available in the form of a publised document. Manufacturers, being sole proprietors, partners or private limited companies, were reluctant to share with the details of their turnover. However, researcher could convince them about the academic importance of authentic data and, therefore,

proactive manufacturers provided the financial data to the researcher.

Since the turnover of manufacturers is very wide ranging from Rs.21,000 per annum to Rs. 5.50 crorers per annum, the manufacturers were classifieded into three categories for this purpose viz.

A Class - Small Enterprises upto annual turnover of Rs.10 lakhs

B Class- Medium Size Enterpises upto annual turnover in the range of 10 to 50 lakhs.

C Class- Large Size Enterprises where annual turnover is more than 50 lakhs.

An average of turnover made in the financial years 2001- 02, 2002 -03 and 2003 –2004 is obtained from each respondent and the results are tabulated as below :

Table 6-4

Turnover wise classification of small size enterprises

Sr.No.	Turnover (Rs. in lacs)	No. of manufacturers
01	0 - 5	05
02	5 - 10	02
	Total	**07**

Table 6-5

Turnoverwise classification of medium size enterprises

Sr.No.	Turnover (Rs. in lacs)	No. of manufacturers
01	10-15	04
02	15-20	01
03	20-25	01
04	25-30	01
05	30-35	00
06	35-40	01
07	40-45	00
08	45-50	00
	Total	**08**

Table 6-6

Turnoverwise classification of large size enterprises

Sr.No.	Turnover (Rs. in lacs)	No. of manufacturers
01	50-150	04
02	150-250	02
03	250-350	00
04	350-400	01
	Total	**07**

Inference

From the above tables, it is clear that solar manufacturers fall into three categories viz small, medium and large. The manufacturers who have just started their business are yet to

settle and, therefore, their market share is very low resulting into an annual turnover below Rs.10 lakhs. Most of these entrepreneurs do not have their own plant, they do not have their own set up and the labourers are hired on need based criteria.

Manufacturers who have been in the business for more than 5 years have recorded an average turnover in the range of Rs. 10 lakhs to Rs.50 lakhs. These manufacturers are mostly carrying on their business in the form of partnerships, they have their own manufacturing plant and the organization is usually registered as SSI unit with District Industrial Centre of Maharashtra Government.

The third group of manufacturers can be termed as Solar Business Houses, as these manufacturers have established themselves in the solar thermal as well as solar photovoltaic products. These organizations are functioning as Private Limited Companies.

One more point to be mentioned is that many solar manufacturers do not focus only on the solar water heating, solar cookers and related solar products, but they have their other business lines such as fabrication, dairy equipment manufacturing etc. Therefore, the turnover mentioned above is arrived at after separating turnover achieved from other business lines.

6.3.6 Analysis of Gross Margin of SWHS

For assessment of the profitability of solar business, an attempt is to made to collect the figures of turnover and the net profit so as to arrive the net profit/turnover ratio. But none of these manufacturers is a public limited company and hence the figure of net profit could not be obtained from any published documents such as Annual Report in the case of a listed public

company. However, one manufacturer agreed to provide the model wise cost structure and selling prices. Thus, the gross margin in this business could be calculated. The following table shows the component wise cost, total manufacturing cost and the average selling price of the SWHS ranging from 125 LPD to 500 LPD.

Table 6-7

Gross Margin on SWHS

Sr. No	Components of SWHS	125LPD Rs.	250LPD Rs.	375LPD Rs.	500LPD Rs.
01	Collector	7,576	14,561	21,631	28,616
02	SS Tank	3,310	5,050	6,896	8,342
03	Insulation	2,119	3,099	4,316	5,702
04	MS Stand	1,128	1,143	1,259	1,259
05	Factory Cost	14,133	23,853	34,102	43,919
06	MRP	19,000	32,500	48,500	63,000
07	Gross Margin	4,867	8,647	14398	19,081
08	**GM % on Cost**	**34.44**	**36.25**	**42.22**	**43.45**

Inference

From the earlier table it is thus concluded that the Gross Margin of 125 LPD system is 34.44% , on 250 LPD system is 36.25% whereas 375 LPD is 42.22% and on 500 LPD is 43.45%.

However, it is to be noted that the above gross margins are just indicative of the profitability of solar manufacturing business. These costs include all the expenses only upto the manufacturing stage. The other overheads such as packing expenses, transportation, advertisement and sales promotion etc. have to be added to the the ex-factory cost to arrive at the net profit ratio

which is the real paramater for testing the viability of solar business.

6.3.7 Average Investment in Fixed Assets

Manufaucturers have to make investment in land, plant and machinery, testing equipments, factory building, furniture etc. On the basis of this criteria solar manufacturers found to have investment in fixed assets in the range of 1 lakh to 1 crore. The following table highlights the investment in fixed assets -

Table 6-8

Average Investment in Fixed Assets

Sr.No.	Investment in Rs. in lacs	No. of Manufacturers
01	0-10	08
02	10-20	02
03	20-30	01
04	30-40	01
05	40-50	01
06	50-60	01
07	60-70	02
08	70-80	02
09	80-90	02
10	90-100	02
	Total	**22**

Inference:

It was also observed that in the initital stages, manufacturers get their jobs off loaded from other establised business units. As

mentioned in Table 6.1, 27% of the entrepreneurs are dealers of SWHS and other solar products and therefore they require almost no investment in the fixed assets. In Pune District, hardly five manufacturers totally manufacture the solar systems and, therefore, huge investment is needed by such manufacturers.

6.3.8 Advertisement Expenses as a percentage of Turnover

This is the study of assessment of market potential of solar water heating systems and solar cookers. The study also aims at finding out the reasons for under-utilisation of market potential of these equipments. Advertisement plays the most important role in creating and maintaining the demand for any product. In an attempt to explore the causes of under utilisation of market potential, therefore, information on the advertisement expenses and other marketing costs was collected from the manufacturers and the data are presented in the following table:

Table 6-9

Classification of business houses on the basis of advertisement expenses as a % of turnover

Sr. No.	Advertisement Expenses as % of average turnover	No. of manufacturers	% to Total
01	0 – 0.5	6	27
02	0.5 – 1.0	9	40
03	1.0 – 1.5	3	14
04	1.5 – 2.0	3	14
05	2.0 – 2.5	1	5
	Total	**22**	**100**

Inference:

From the above table it is evidenced that only one manufacturer allocates upto 2.5% for the advertisement budget. This is probably the most important factor responsible for low growth rate in the solar business. An awareness can be created only through marketing campaign. 27% of the manufacturers do not spend any amount on the marketing activity; whereas 9 out of 22 that is 40 % have been spending upto 0.5% on the advertisement budget, followed by 3 manufacturers spending upto 1% and upto 1.5% of their average annual turnover on the advertisement.

Information was also collected on the media chosen for the advertisement. Usually trade exhibitions and yellow pages was resorted to as advertisement media by most of the manufacturers.

6.3.9 Man Power Employed in solar business houses

Information was also collected as regards employment generation in the solar business. It is found that very few manufacturers have permanent employees on their pay roll. Laborers are hired as and when need arises due to the pressure of orders in the peak seasons. However, multiplier effect of employment is possible and direct and indirect employment through the dealers, agents etc. has created in this business. The following table provides information on the employees employed with manufacturer respondents

Table 6-10

Manpower employed in the solar business houses

Sr.No.	No. of employees	No. of Respondents
01	0-5	09
02	5-10	03
03	10-15	01
04	15-20	04
05	20-25	02
06	25-30	03
	Total	**22**

Inference:

In sole proprietorship concern the business is managed only by single individual and, therefore, they have not appointed any employee.

Solar water heating systems are installed through the labour contractors and technical supervision is looked after by the proprietor himself. However, this factor needs to be looked from its broder perspective. Solar business creates direct as well as indirect employment in the area of manufacturing as well as maintenance of solar water heating systems.

6.3.10 After Sales Service

Generally it is said that solar water heating systems and solar cooker do not require after sales service. But is is not true. The nature of after sales service required for solar products is different as compared to the after sales required for consumer durables such as washing machines, friedge etc. Since there are no electronic components, nor any rotating parts in the solar water heating systems, expenses on its maintenance are very low as

compared to other electronic equipments. However, routine cleanliness of pannels, protecting stand against corosion etc. are the minor precautions an user is expected to observe.

Very few respondent manufacturers provide after sales service to the end users. In the survey it is found that only 2 out of 22 respondents emphasised the need of after sales service. Remaining 90% of the respondents do not feel need of any after sales service. If product performance is to be maintained, manufacturers should provide maintenance warranty to the end users.

6.3.11 Categories of end users

Information was also collected from the manufacturers as to the types of customers they have served in Pune District. The end users are in a varied range covering individual households, lodges, hospitals and maternity homes, guest houses, hostels, milk dairy farms , industrial canteens, wedding halls even upto crematorium where solar water heating systems have been installed. It is found that about 90% of the sale is made to private individual households, 5% to educational institutions, and remaining 5% to other customers including Government. Since the present research focuses on use of solar water heating systems by institutional respondents and the individual households the data have helped to conclude that still there is a tremendous scope for expansion in the solar business.

6.3.12 Area of Operation

The study area covers the whole of Pune District. However, for the purpose of convenience, this area is divided into two segments, viz urban and semi-urban area. The urban area includes the customes served in Pune Metropolitan Region PMR and the semi – urban area includes the place of head quarter of each tahshil.

It was observed from the study that manufacturers effect almost more than 50% of their business in the urban area, followed by 25% in the semi – urban area and the remaining 25% outside the jurisduction of Pune District. Thus, there is scope for business expansion in both urban and semi – urban areas of Pune District.

6.3.13 Research and Development Activity

It is said that innovation is the most important managerial function. Solar water heating systems and solar cookers also is not an exception to this. Accordingly, efforts are made to collect data on the Research & Development Activity carried on by the manufacturers. Research is undertaken as regards design of the product, for improvement of product performance, for reduction of cost per unit by change in the design, use of different materials etc. It was found that R & D in this field is still not to the scale as required. Some organizations are really engaged in the R & D, but the commercial exploitation of such R & D efforts would require few more years so as to be ultimately beneficial to the consumers. Solar cooker for domestic purpose is still supplied in the box type, whereas consumers are expecting innovative model for their cooking solution.

6.4 Personal Interview of Mr. Hemant Revankar, Managing Director, Bipin Engineers Pvt. Ltd.

In the process of collection of data from solar manufacturers the researccher had an opportunity to meet Mr. Hemant Revankar, M.D. Bipin Engineers Pvt. Ltd. Bipin Engineers Pvt. Ltd is a company incorporated in 1979, engaged in manufacturing of solar water heating systems along with other products such as dairy equipments, fabrication etc. The company has achieved an annual turnover of Rs.30 millions by the end of March, 2003. Bipin Engineers have manufactured the largest solar water heating system in Asia. As informed by Mr. Revankar the highlights of the system are as below –

- The Largest Solar Water Heating System in Asia.
- Tobe installed on a prestigious project in Pune called as Magarpatta City, covering total area of 160 acres of land.
- The project would require an investment of Rs.7 crs.
- The project would be completed by 2010.
- In the first phase of the project 1,20,000LPD water would be heated per day.
- The total capacity of the project on completion will be 7,27,500 LPD water per day.
- Total number of installation for the total project would be 164 covering all the bunglows and row houses constructed in well planned 160 acres of land.
- On an average 330 days in a year would be productive days as far as solar water heating is concerend. It means that except 35 days in an year solar water would be available.

This implies on an average saving of Rs. 4 crs, annually and emission control of CO2 to the tune of 3,125 tonnes, thus resulting into pollution control drive.

Personal interaction with Mr. Revankar was found to be much fruitful as regards collection of data from established manufacturer of SWHS.

6.5 Case study of Ms. Sudarshan Sour Shakti Pvt. Ltd.

6.5.1 Background

Case study method is considered as one of the modern management techniques for research in social sciences. In the study of profile of manufacturers engaged in the process of manufacturing solar water heating systems and solar cooker the researcher found that some manufacturers have really contributed to the development of solar business. Therefore, an attempt was made to present a manufacturer as a model manufacturer. Sudarshan Saur Shakti Pvt. Ltd was selected for the purpose of Case Study presentation mainly because the said organisation was selected as the best in the financial year 2002-2003 from Non-Grid Connected – NRSE Devices – Commercial Projects by Maharashtra Energy Development Agency)MEDA. Profile of the company is prepared and presented as a role model.

6.5.2 General Information SUDARSHAN SAUR SHAKTI PVT. LTD.

The company is in the field of manufacturing of Solar Water Heating Systems since 1989. Presently company is a topmost leader company manufacturing SUDARSHAN SAUR brand Solar Water Heating System. During last 15 years of successful track

record, company has a steady business growth to emerge as a leader.

At present company manufacturers two types of solar water heating systems. One is Flat Plate Solar Water Heating System and another is Vaccum Tube Solar Water Heating System – VTS. The VTS heaters are manufactured in technical collaboration with foreign company and plant setup is first of its type in India.

Manufacturing unit is situated at Walunj, MIDC Area in Aurangabad District of Maharashtra State – India. The unit has provided for all advanced manufacturing facilities such as Special Lining Plant, Black Chrome Electro-plating plant, Electronic Fin Bonding furnace etc. For flat plate technology and hydro-pneumatic press, hi-tech welding machines, for VTS technology. Company has own Research and Development set up, due to which the products of the company emerges out as the best in comparison with all the competitiors. Company has appointed qualified engineers, supervisors and 35 workmen working in the manufacturing set up. It is the unique company where all the components of of Solar Water Heating System are manufactured and nothing is bought out as sub assembly from other solar manufacturing company. In that sense company is really 100% manufacturer and not a mere assembler of solar system. The typical features of the water heaters manufactured by the company which are otherwise available only with international leaders in the filed are –

a. Special Lined Tanks
b. Silver bonded fins
c. Powder coated sturdy covers
d. Water separator
e. Corrosion Protector
f. Hard Water heat exchanger etc.

Company has a full-fledged well-trained teams of solar plumbers and installation supervisors to install the solar system after throughly analysying the site requirements at users place. This is also supported by trained service technicians situated at various destinations to cover all the market area.

Due to all these special features, it is the company offering maximum guarantee on the products. This itself speaks of the bold confidence the company has in its products. The products manufactured by the company are approved by B.I.S. authorities, so it carries ISI mark on every collector box.

The Company and the Products are approved by many other Government agencies i.e. MEDA, IREDA, MNES, Govt of India etc. The company is also approved by BVQI for quality standard reorganisation i.e. ISO 9001 – 2000.

The company is operating financing intermediary scheme since last 7 years with IREDA. This scheme is specially formulated by Govt. Of India and operated by IREDA for providing soft loan finance at 5% p.a. to the end users of solar water heating system. This scheme is running very successfully due to which the company is awarded as the Best Financial Intermediary by MNES and IREDA.

6.5.3 Organisation Chart

The company is managed by Mr. Sanjay Jinturkar. The organisational hiererchy in the management of the company is given on the next page:

Organisation Chart of Sudarshan Saur Pvt. Ltd.

Managing Director

Director Marketing	Director Finance	Director Manufacturing	Director Administration
Executive Marketing	Executive Finance	Executive Manufacturing	Executive Administration
Marketing Engineer	Finance Officer	Engineers Manufacturing	Senior Officers
Marketing	Assistants	Assistants	Assistants

Total Technical Staff – 11

Total Non-Technical Staff – 08

Total Workers - 31

6.5.4 Details of Factory set up

K – 240 MIDC, WALUJ, AURANGABAD MAHARASHTRA STATE – INDIA

Sr. No.	Particulars	Area	Present Value(Rs)
01	Land	3600 sq.mtrs.	7,03,698/-
02.	Building		31,75,747/-
03.	Plant & Machinery	With plant building	69,68,834/-
	Total Fixed Assets		**1,36,27,795/-**

6.5.5.Office Set up

35, Bhagya Nagar, Aurangabad

Well furnished flat of 750 sq. Ft owned by directors rented by company at above address Another flat on rented in the same premises by company having area of 750 sq. Ft.

6.5.6 Annual Production Capacity

The annual production capacity of the company is given below

Sr. No.	Product	No. Of systems	Area Absored
01.	Solar water heating – Flat plat systems	5000	20,000 Sq.mtrs.
02.	Solar Water Heating - VTS	5000	7,500 sq.mtrs.

6.5.7 Turnover And Other Financial Data

Company's annual turnover and other financial data is produced below. The information is available for two successive years –

(Rs. In lakhs)

Sr.No.	Particulars	2001-02	2002-03
01.	Sales	386.08	409.15
02.	Net Profit	4.71	8.02
03.	Advertisement Expenses	3.61	3.23

6.5.8 Participation in the Exhibitions

Company has participated in various trade fairs and exhibitions. Following is the list of some exhibitions wherein the company had participated as part of its marketing efforts –

Sr. No.	Name of Exhibition	Place	Organizer
01.	Shagun	Nagpur	Creative Event Management
02.	Sarpanch Agro	Kurduwadi	Resource Media
03.	Krishi	Nashik	Media Exhibitors
04.	Preety Home	Amaravati	Mahendra Advertising
05.	Yashwant Krishi Ayodyogik Pradarshan	Satara Karad	Yashwant Krishri Pradarshan
06.	ICORE	Banglore	Solar Energy Society of India
07.	Kisan	Pune	Deccan Exhibitors Pvt. Ltd.
08.	Maha Expo	Aurangabad	Chamber of Marathwada Industries and Agriculture
09.	Vasant Agro Tech	Yevatmal	Yevatmal Zilla Parishad
10.	VIMA	Aurangabad	Women Entrepreneurs

The above list is not exhaustive but inclusive. These are some of the exhibitions and fairs in which the company has participated as a sales promotion drive. It can be noticed that the company is engaged in systematic efforts to promote its products at all corners of the State of Maharashtra.

6.5.9 Advertisement

The yearly advertisements budget covers Maharashtra, Karnataka, Goa, M.P. states. The company regularly advertise in the following medias for publicity of products and its awareness.

1. News papers like Sakal, Lokmat, Pudhari, Indian Express, Loksatta, Gujrat Samkalin, Hindustan, Times of India, Gaonkari, Deshdoot, Tarun Bharat Samana etc.
2. Magazines like Vandant Kasari, Jivan Vikas, Prabdhu Bhrat. Vivek Jyoti, Sapthik Vivek, Tender World Magazine, IREDA Magazine etc.
3. Directories – Telephone directories like BSNL, yellow pages like Tata Yellow Pages, Pooja yellow pages, Krishna Yellow Pages etc., Industrial Directories, Maharashtra Industrial directory.
4. In a social festival occasion like Ganpati (Lord Ganesh), Dasata yatra etc.
5. Website of the company is www.sudarshansaur.com gives a complete information about solar products and its benefits.
6. On cable network in each district in the state of Maharashtra.
7. Company has presented seminar in accordance with BIS authorities in Pune for acknowledgement of new technology solar systems called vaccum tube solar water heating systems. Also company has arranged seminars for dealer development in various districts, bank sale promotion etc.
8. Company has acquired many hoardings in different places of districts for local product publicity

6.5.10 Cost Reduction Drive

In the survey of individual households it is establised that the prices of solar water heating systems are not affordable to a common man in the range of monthly income between Rs.10,000

to 20,000. This fact is well taken care by Sudarshan Saur Pvt. Ltd, by developing solar water heating systems at affordable price range in between Rs. 8,600 to 13,600. As informed by Mr. Nitin Kulkarni, Distributor of Sudarshan Sour Pvt. Ltd for Pune Region the company has developed solar water heating systems for a square family of 4 persons with a capacity of 65, 80 and 100 LPD . The VTS technology has been employed for manufacturing of such systems. These systems are equally useful to small hospitals, clinics, research institutions etc. These systems can provide hot water upto 65 degree celcius and these systems do not require more space. The systems can be installed even in balconies where sun light is available. The systems are light in the weight therefore even flat holdres can install such systems. The systems are warranted for five years.

6.5.11 Conclusion

The present case study reveals the fact that sincere efforts on the part of manufacturer would certainly produce good results. Manufacturers should constantly pay attention to the product development, research and development and strengthen the marketing wing of their unit. Proper media should be chosen for the advertisements. Positioning of the systems on the eve of festivals such Ganesh Festivals, Dashhara and Divali seasons should be chosen for product compaigning. Aggressive marketing efforts on the part of the manufacturers backed by constant efforts for product innovation are required for development of solar market.

CHAPTER – VII

CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

7.2 Conclusions along with recommendations

7.3 Success Stories of Solar Villages

7.4 Epilogue

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

After the study of causes of under-utilization of SWHS and Solar Cooker the researcher wants to present conclusions drawn from the study and suggest recommendations. These conclusions are mostly in the nature of barriers to extend the market for SWHS and Solar Cooker.

It is an attempt to probe into causes of under-utilization of SWHS and Solar Cooker (the products under reference of the present study). Conclusions drawn from the present study are in the form of barriers. The term 'Barrier' is often used to refer to factors that impede the adoption of a new technology. The term 'Barrier' is used broadly in this research to refer to any technical, economic, institutional, legal, political, social or environmental factors impeding the deployment of SWHS and Solar Cooker, being the part of RETs(Renewable Energy Technologies). Barriers tend to be interrelated, so it is often difficult to isolate the impact of one barrier in particular. There is a multitude of factors that influence the success or failure of performance of SWHS and Solar Cookers (Being the components of RETs). In fact, these barriers are in the form of conclusions drawn from the present study. Therefore, these barriers along with the suggestions and recommendations to overcome them are discussed below:

7.2 CONCLUSIONS ALONGWITH RECOMMENDATIONS

(1) UNAFFORDABLE PRICE OF SWHS/HIGH CAPITAL COST

As observed from the present study, the high initial cost of SWHS is certainly a matter of concern of the prospective users. This makes the product unaffordable to the potential users. The high production cost of SWHS might be due to many factors such as heavy input prices, higher transportation cost and site-specific charges. The potential consumers were found ready to install SWHS provided the notional interest on the investment in SWHS is equated with their present fuel cost. Research and Development is required for Cost Reduction of SWHS by using various modern Cost Reduction and Value Engineering Techniques.

RECOMMENDATION

Manufacturers in the study area should create facilities for total manufacturing of SWHS in their own manufacturing unit. At present, very few manufacturers have created such infrastructure. Other players in the solar business are mostly assemblers/installers. Thus, more intermediaries in the business make the product unviable to the consumers. Moreover, indigenisation of components would certainly cut down the existing cost. Cost would certainly come down with large-scale production of SWHS.

The SWHS and Solar Cooker have to compete with conventional energy resources as regards cost of fuel, operational and maintenance cost of operating the system. Since the conventional energy is subsidized to the end users, renewable energy technologies have to prove their worth by making available to the

consumers at a price cheaper than the cost of conventional energy sources.

(2) LACK OF FAITH IN THE TECHNOLOGY

Success of any product is that it should perform the designated objective for which it is designed. As is found in the study that, people lack faith in the technology, this is especially true in case of Solar Cooker. Renewable energy technologies from foreign countries are not always directly suitable for the local conditions in the developing countries. The present level of technology is not sufficiently proven in local conditions to be attractive to the prospective users. Potential consumers are not confident of the economic, commercial or technical viability of the product. Thus, lack of faith about product performance is treated as a barrier in an attempt to expand the market potential. Confidence in the technology is important in order to establish a market. If confidence is destroyed, then financers, dealers, installers and end users will be unwilling to invest in the technology.

RECOMMENDATION

Continuous R & D to improve product performance is required. The research and development should focus on the following aspects:

- **Product Design**

As is found in the present survey, end-users are not satisfied with the present level of designs of SWHS and Solar Cooker. They require more space and, space being the major problem for the individual respondents, limits the market scope to the individual user market segment. Standardization is required in respect of materials. The glass mirror used is Solar Cooker should be long lasting; otherwise replacement of mirror in future becomes very costly due to high transportation cost. The standard insulating

material and absorptive coating should be used. The fact is that attempts to select the best design have been made since 1960s, but the best design is still elusive.

- **Adaptability to local physical factors such as climate, humidity etc.**

These products are manufactured in factory at one place and are to be installed at a location, where the physical conditions at the place of manufacturing may not prevail. Hence, manufacturers should ensure, that the product would perform even if the physical conditions at the local level may change. This calls for an extensive amount of research work as regards material used in the manufacturing of SWHS and Solar Cooker.

- **Cost Reduction**

R & D should also focus on Cost Reduction by use of substitute material without impairing the quality and performance of the product.

- **Design of devices with multi-purpose applications**

As pointed out earlier, the renewable energy technologies have to compete with conventional fuel, which have multi-purpose applications. LPG for example, is used for varied applications such as heating the water, as a cooking fuel, in laboratories etc. Thus, the same source of energy caters to various uses. In renewable energy technology this aspect must be brought into while designing appropriate R & D strategy.

(3) LACK OF AFTER SALES SERVICE

SWHS and Solar Cooker are the consumer durable products. They do require After Sales Service. However, it is found that there is no mechanism designed to provide after sales service to the end users. It is based on the misconception that these products do not

require after sales service, which is not true. If the product is to perform throughout the life cycle, which is estimated to be 15-20 years, then after sales service such as, anti-corrosion applications to the stand, which is made of MS, proper re-fitting of nuts and bolts has to be done once in a year. Though, these are minor aspects, but are overlooked by the manufacturers. The problem becomes more serious as the dealer net work is absent in the area where SWHS or Solar Cooker is supplied.

RECOMMENDATION

Ready availability of the product with assured after-sales service is an important pre-requisite in the market development of any product. This is particularly relevant in case of SWHS and Solar Cooker as the products manufactured in the factories are ultimately required to perform to suit local conditions of the places of installation. As the market of SWHS and Solar Cooker is widely scattered, after sales service, by the local dealers is justified.

Manufacturers should make arrangements for providing 'After Sales Service' through dealer network. Annual Maintenance Contract (AMC) has to be provided as is provided by computer dealers. This 'Door Step Service' will ensure continued performance of the product and will solve the problems of the end users.

(4) LACK OF END USER ORIENTATION

As is observed in the survey of institutional respondents, the end users of the devices were not either taken into confidence or no proper training inputs were provided to them necessary for the effective utilization of the system. A successful installation of the system should also result into an effective utilization and serve the

purpose for which a system is installed. Hence, the end users are certainly the most important part of the system propagating the use of SWHS and Solar Cooker. In the survey of some hostels, it was noticed that the end users were totally unaware of the modus operandi as to utilization of the system.

RECOMMENDATION

Marketers should arrange training programmes for specific end-user groups or for the potential buyers of the systems. The training inputs should provide for the operating instructions under various conditions, tips for better and effective utilization of devices should be explained to the present as well as the prospective end users of the equipment. Gaining confidence of the end users is thus required for successful operation of the system. If the decisions are taken centrally without orientation of end users, the desired result may not be achieved.

(5) LACK OF AWARENESS ABOUT SOFT LOAN SCHEMES

It was noticed in the present survey that potential buyers were not aware or had inadequate information about the 'Soft Loan Scheme' for purchase of SWHS. The 'Soft Loan Scheme' operated through banks was found not be hassle free. The beneficiaries of the scheme were also interviewed and in the feedback they had remarked about the hassles they faced in sanction and disbursements of loan from the designated banks operating the 'Soft Loan Scheme' of MNES.

RECOMMENDATION

(i) Financing through Consumer Credit Co-operative Societies

Solar Financing Mechanism should be routed through Consumer Credit Co-operative Societies located at urban as well as at semi-urban area and are the most popular institutions among the middle-income group respondents. The finance through consumer credit co-operative societies would certainly widen the market of SWHS and Solar Cookers. In fact, such 'Door Step Financing Scheme' would prove beneficial not only to the individual household but it will also be most useful to other market segment from the co-operative sector such as co-operative dairy societies, cooperative sugar factories etc.

(ii) Solar Finance Capacity Building Alliance

SFCBA is an alliance of all the financing intermediaries engaged in financing of SWHS. It is an input partnership between a number of alliance partners and stakeholders, each fulfilling specific roles and responsibilities as mentioned in the table on the next page:

Table 7-1

SFCBA partners and their role

Alliance Partners	**Role/Responsibilities**
United States Agency for International Development (USAID)	Convener of the Alliance. Responsible for co-financing the cost and overall monitoring of the Programme.
Syndicate Bank	Lead Bank representing Indian commercial, co-operative and rural banks. Also ensures participation of its bank officials for training programmes.
Winrock International India	Responsible for coordination and implementation of the Program activities.
Bharatiya Vikas Trust	Responsible for conducting various training programmes in coordination with WII.
Centre for Technology Development – NGO Resource Centre	Responsible for monitoring and evaluation of training programmes in coordination with WII.

The SFCBA shall be sponsored by The United States Agency for International Development. (USAID).SFCBA's goal is to create awareness among the bankers about the potential of solar energy as a business opportunity, aiming at mobilization of at least Rs. 750 million toward lending for the solar energy sector in India.

SFCBA Activities

The SFCBA Programme was designed to implement training programmes in four phases:

1. Four apex conferences to sensitize senior and top management of Indian banks to be drivers of this initiative.
2. Twenty Training of Trainer (TOT) programmes to create 400 Master Trainers who will further impart training to branch managers.
3. Two hundred Branch Manager Training programmes to train 5,000 managers.
4. Twenty Entrepreneur Development Programmes (EDPs) to develop entrepreneurial skills in youth interested in the

(6) LACK OF APPROPRIATE SOCIO-CULTURAL ENVIRONMENT

Social acceptance of renewable energy technology is very important. This is particularly applicable to Domestic Solar Cookers. If the local community does not accept the technology, there will be no demand for its services. The gender aspect of Domestic Solar Cooker needs to be understood by those supplying the technology. As in India, women prefer to cook inside the kitchen and not outside the kitchen. Solar Cooking calls for cultivating habit of cooking outside the kitchen. Hence, traditional women may not prefer using solar cooker for their domestic cooking needs. The local culture, religion and superstitions need to be understood when projects are planned, in order to avoid problems later in the development stages.

RECOMMENDATION

As mentioned in one of the case studies on R&D in solar cooking, this problem is undertaken by one of the manufacturers;

and the solar reflectors would be used to the cooking stove inside the kitchen. The further research in this field is in offing on storage of solar heat and using it for various applications. Of course, this research is yet in the development stage and will take few more years to reach to the commercialization stage.

(7) LACK OF AWARENESS ABOUT RETs(Renewable Energy Technologies)

It was observed that the respondents in the study area did not have adequate information about – the present energy crises, place of conventional energy sources in that, renewable energy resources, etc. Thus, lack of knowledge on the part of the prospective consumers is also one of the factors contributed to the under utilization. As found in the survey of manufacturers, expenses on advertisement through all the medias are not even one percent of the turnover on an average basis. Some manufacturers do not spend even a penny on advertising their products.

RECOMMENDATION

This is an age of advertisement. Hence, SWHS and Solar Cooker also need extensive sales promotion and advertisement. These can be in the form of the following:

Weekly Bazars: Such Bazars are usually held at the semi-urban places and at all important places in each Tahshil. It is an ideal location to introduce, demonstrate, promote and create a demand for SWHS and Solar Cookers. Usually, a team comprising a marketing assistant, solar plumber and/or a dealer representative demonstrate the working of the products. Banners with the nearest dealers' names should be displayed prominently, and audiocassettes with songs and jingles should be used to attract

crowds. The following photograph shows an example of such participation:

A Corner in the Weekly Bazar: Demonstration of Solar Products is in progress

Trade Fairs: Usually, on the eve of important festivals trade fairs are organized at important urban and semi-urban centers. It may also be labeled as "Melas" in colloquial language. It is an important social event that caters to a very large audience. It is an excellent and low-cost platform for introducing SWHS and Solar Cooker for creating mass awareness about products. One such demonstration is shown in the following photograph where Parabolic Solar Cooker Demonstration is being shown to the participants in the exhibition

Demonstration of Parabolic Solar Cooker

Short campaigns: The objective of short campaigns is to create interest and awareness among prospective users of SWHS and Solar Cookers. Such campaign can be arranged with the help of Cable TV Network.

(8) LACK OF TRAINED TECHNICAL MANPOWER

Manufactures/dealers/installers should have a team of expert technical personnel to encounter the difficulties, which may be faced during installation of SWHS. However, such specially trained and technically sound manpower was not maintained by most of the manufacturers.

RECOMMENDATION

The most important technical person at the operational level is 'Solar Plumber'. System operations to a great extent depend on the plumbing skills. Such plumber must be able to resolve site-specific

problems during installation of SWHS. In fact, this is upcoming area in the entrepreneurship in the solar business.

(9) LACK OF COMMUNITY SPONSARSHIP

Application of RETs would be more successful at semi-urban level if it is accepted by society at large. Participation of each one in the programme would certainly ensure the success of the programme. Though, the present study is confined to urban and semi-urban area of Pune District, the researcher had visited two villages in the close proximity of the tahshil headquarters; where the villagers took up deployment of RETs and other non-conventional energy technologies as a mission. The programmes adopted by the community as a whole has certainly resulted into success. These cases of 'Solar Villages' have been presented as role models:

7.3 SUCCESS STORIES OF SOLAR VILLAGES

7.3.1 INTRODUCTION

In the field visits the researcher observed that there is a wide scope for marketing of solar water heating systems and solar cookers in Pune District. Government of Maharashtra has announced various schemes for promoting the use of solar devices. This naturally has widened the scope for manufacturing and marketing of solar energy devices. Sant Gadgebaba Gramvikas Cleanliness Drive is one of such schemes promoted by the then Rural Development Minister Mr. R. R. Patil. The scheme encourages the rural masses to use various solar energy devices and other non-conventional energy sources. The present chapter narrates the success stories of two villages, which were selected as the Best Village by Government of Maharashtra under Saint Gadgebaba Gramvikas Cleanliness Drive. Such schemes indirectly

promote the entrepreneurship among the manufacturers, dealers and traders of non-conventional energy devices.

7.3.2 Background

The present study aims at exploring the causes of under-utilization of the market potential of solar hot water systems and solar cooker. In fulfillment of the objectives of the study primary data have been collected from various sources such as individual households, hostels run by the Social Welfare Department of The Government of Maharashtra, hostels attached to the colleges in the study area i.e. Pune District, including Pune City and Pimpri Chinchwad, hospitals run by The Zilla Parishad, Pune and run by Pune Municipal Corporation. Interviews were also taken of the Chief Officers of the respective organizations. It is prima facie observed that market potential of solar water heating systems and solar cooker is untapped to a larger extent. However, there are some villages in Pune District, which can be cited as model villages as regards their energy use pattern. These villages have been awarded prizes by Maharashtra Government under Saint Gadgebaba Cleanliness Drive. The objective of the present chapter is to highlight the awareness among the villagers about energy use pattern. Such schemes promoted by Government certainly contribute to the increased utilization of NRSE systems.

7.3.3. Saint Gadgebaba Cleanliness Drive

The main objective of Saint Gadgebaba Cleanliness Drive is to uplift the health standards of rural masses. Saint Gadgebaba was a modern age Saint from Vidarbha Region of the Maharashtra state, who had created awareness among the rural masses about maintaining clean environment. He had attacked on the superstitions among the rural folk. During his discourses, he used to first clean the campus on his own, giving more stress

on eradication of bad habits such as smoking, alcoholism etc. Maharashtra Government decided to promote the cleanliness drive among the rural masses and the scheme of offering prizes to the villages selected under this scheme was started as a motivational tool ultimately to promote the cleanliness programme in the entire State. Accordingly Maharashtra Government issued G.R. to provide the information about the scheme and the parameters under the scheme are informed to the participating villages. The information in the said G.R. can be summed as below:

7.3.4 Government Resolution dated 24th September, 2003

The said G.R. aims at providing information about the booklet to be prepared by the village participating in the Clean Village Competition under Saint Gadgebaba Cleanliness Drive. Every village participating in the said scheme has to prepare a booklet, which should include details about various aspects such as:

* Population of the village
* Total house holds with permanent structures
* The main occupation of the villagers
* Sanitation system in the village
* Water Sources for the village
* System adopted for cleaning the cattle
* Sock Pits
* About Family Planning Programme in the village
* Educational facilities available in the village
* Health facilities available in the village
* Drainage Maintenance System
* Water Cleaning System followed in the said village
* Waste disposal systems
* Toilets in the villages

Of all the parameters evaluated under the scheme one important parameter is the use of NRSE systems in the villages. This is certainly a remarkable point to be noted in the research of this type, where the researcher is evaluating market potential of the NRSE systems. And in this connection the parameters included for evaluation have been circulated among the participant villages well in advance by way of Government Resolution. These specific parameters and the marks reserved for them are listed in the following table:

Table 7-2
NRSE parameters for villages under the cleanliness drive

SR. NO	PARAMATER FOR EVALUATION	MARKS ALLOTTED
01	SOLAR ENERGY FOR STREET LIGHTING	02
02	USE OF SOLAR COOKERS /SOLAR LANTERNS	02
03	OTHER NON-CONVENTIONAL ENERGY DEVICES DEVELOPED BY THE VILLAGE	01
04	EFFECTIVE IMPLEMENTATION OF DEFORESTATION SCHEME	02
05	IMPROVED SMOKE CHULLHA UTILISTION	02
06	GOBAR GAS UTILISATION	02
07	EFFECTIVE UTILIZATION OF BIO-GAS	02
08	TREE PLANTATION DRIVE - EFFECTIVE IMPLEMENTATION	02
	TOTAL MARKS ALLOTTED	**15**

Source: Government of Maharashtra G.R. 278/24.09.2003

7.3.5 SUCCESS STORY OF VILLAGE BASARAPUR: TAHSHIL: BHOR

On 20th February 2005, the researcher visited Village Basarpur, Tahshil Bhor. The said village has been covered under the study area, which extends to the whole of Pune District. The highlights of the village are tabulated below:

Table 7-3
FEATURES OF THE VILLAGE BASARPUR

SR. NO.	PARTICULARS	REMARKS
01	Name of the village	BASARAPUR
02	Tahshil	BHOR
03	Distance from the Tahshil Head Quarter (Bhor)	05 KILOMETERS
04	Total Population	618(2001 census)
05	Male Population	357
06	Female Population	259
07	Households	81
08	Main Occupation	Unorganized Labour
09	Area of the village	54 Hectares
12	Primary School	Upto 4th Standard
13	No. Of Solar Poles	05 (80% of the total poles in the village)
14	Solar Lanterns used by the household	127 households
16	Gobar Gas used by	16 families
17	Solar Cookers used by	45 families

7.3.6 SUCCESS STORY OF VILLAGE KALDARI, TAHSHIL PURANDHAR, DIST. PUNE

This is the another success story of a village in Purandhar Tahshil in Dist. Pune which has bagged the first prize under Saint

Gadgebaba Cleanliness Drive consecutively for five years. The present information is based on article published in Daily Kesari, a local newspaper dated 28th March, 2005.

Table 7.4
FEATURES OF THE VILLAGE KALDARI

SR. NO.	PARTICULARS	REMARKS
01	Name of the village	KALDARI
02	Tahshil	PURANDHAR
03	Distance from the tahshil Head Quarter	30 KILOMETERS
04	Total Population	2250(2001 census)
05	Male Population	1164
06	Female Population	1806
07	Households	436
08	Main Occupation	Farming
09	Area of the village	1387.85 Hectares
10	Area under cultivation	1300 Hectares approx.
11	Main Crop	Pulses, Wheat, Jowar
12	Primary School	Upto 7th Standard
13	No. of Solar Poles	12 (80% of the total poles in the village)
14	Smoke Less Chulhas	127 households
15	Septic Tank : Public Toilets	05 places
16	Gobar Gas used by	104 families
17	Solar Cookers used by	25 families
18	No. Of Toilet Blocks in the village	397
19	Average Rainfall	700 mm
20	Soak Pits	170 (Nos.)
21	Wind Mill	01

MNES, Govt of India gives 50% subsidy for installation of solar poles costing about 22,000 each.

It is thus observed that about 80 % of the energy requirement is fulfilled by the use of NRSE devices. The purpose of the present study is to site an ideal example as a role model for other villages in the Towns and Villages in Pune City. It was understood that the Gadgebaba Cleanliness Drive has certainly played a motivating role in promoting the use of NRSE by villages in their personal capacity as well as us for meeting the street light requirements. The scheme has created awareness among the rural masses about utilization of solar energy potential. Government of Maharashtra has also played a positive role in creating solar energy awarness by allotting 15 marks for NRSE sector in the parameters for evaluation of the villages in the said scheme.

7.3.7 CONCLUSION

Schemes like this promoted by the Maharashtra Government would certainly help to enhance the market potential of NRSE equipments. However, it is utmost necessary that these schemes should be properly communicated to the people. It is always accepted that positive motivators would certainly prove to be more effective than the negative motivators such as compulsion by the Government to use NRSE systems. A scheme would be successful only by the voluntary participation by all the households. Therefore, attempts have to be made to properly communicate the various schemes of the MNES, Government of India, MEDA and other nodal agencies in the energy sector.

Substitution of conventional energy by NRSE systems is one of the parameters under the Cleanliness Drive. However, it is required that there should be a separate drive for promotion of NRSE systems in the State. This would certainly push up the use of NRSE systems in the whole of Maharashtra.

References:

i) Government of Maharashtra G.R. 278/24.09.2003

ii) Personal inverview with the Sarpanch of
Village Basarapur, Tahshil Bhor, Dist Pune.

iii) News Report about Kaldari Village published in Daily Kesri.

7.4 EPILOGUE

"Human civilization faces a crisis as never before. On the one hand, there is hunger for reliable and adequate supply of energy, with increased awareness about pollution; while on the other hand, there is depletion of fossil and nuclear fuels. The challenge is to ensure sustainable development on the plinth of benign energy technologies, with supply assured at an affordable price. This calls for a conscious move from fossil and nuclear fuels to renewable sources of energy." – **Padmashree Dr. V. G. Bhide**

The above are the remarks of Padmashree Dr. V. G. Bhide, Chairman, School of Energy Studies, University of Pune. The shift from conventional energy to non-conventional renewable sources on decentralized basis is the need of the present century. Though the conventional energy systems cannot be totally replaced by non-conventional and renewable energy systems, a combination of a range of conventional as well as non-conventional and renewable technologies such as small wind turbines, fuel cells, solar cells, biomass, ethanol etc. is the need of the hour.

The theme, the researcher chosen for the research was certainly out his concern for environment. It should be ensured that the Mother Earth we have rented from our predecessors must be handed over to our successors in as clean state as it could be. This is the responsibility of everyone who lives on this Earth.

From this point of view the Energy, which we received from the Sun, should be harnessed to its maximum extent.

The benefits of scientific inventions can ultimately be reached to the society at large through various medias, marketing process being one of them. The present research is concentrated on evaluation of the causes of under-utilization of the market potential of the SWHS and Solar Cooker by Institutional Respondents; as well by Individual Households. This is just a small fraction of the Big Solar Market available in this century. The further research in this area is possible and some of the areas identified for further research are:

- Market Potential of Solar Photovoltaic Products
- An industry with Canteen Facilities is a large untapped market segment of Community Solar Cooking Systems. Manufacturers can concentrate on this area and diversify their activities from SWHS to Community Solar Cooking Systems.(Parabolic Concentrating Type Solar Cooker)
- Marketing of Solar Products in the Rural Area is utmost necessary, as the rural market is a market with high potential. This fact is overlooked many a times.

The researcher finally concludes that the Market Potential of SWHS and Solar Cooker is tremendous. Renewable Energy Sector, as such has a tremendous growth potential across the globe. Market intermediary system should evolve an effective strategy to tap this market potential. Manufacturers should also gear up to delight the consumers by supplying them SWHS and Solar Cooker manufactured according to their specific requirement and, of course at the best competitive price.

APPENDICES

Appendix – I **Questionnaires**

Appendix – II **Bibliography**

Appendix – III **Working Notes of 'Z Value'**

Ph.D. Research on Non-Conventional Energy
By Prof. R. W. Kulkarni, Modern College, Pune - 411 005.

QUESTIONNAIRE FOR INSTITUTIONAL RESPONDENTS

PART-1 BASIC INFORMATION

1. Name of the Organisation:	2. Address:
3. Telephone No:	
4. Year of Establishment:	5. Type of Organisation:
6. Capacity of the Students /Residents	
7. Whether mess is attached to your Hostel/Guest House Yes/No	
8. If yes, state the average number of persons for which food is cooked every day _____	
9. Have you installed Solar Hot Water System? Yes ☐ No ☐ (If 'Yes', fill 'Part 2') (If 'No', fill 'Part-3')	
10. Have you installed a community Solar Cooking System? Yes ☐ No ☐ (If 'Yes', fill 'Part 4') (If 'No', fill 'Part-5')	

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PART-2 NON USERS(SWHS)

1. Which fuel do you now use for heating water?

LPG ☐ Electricity ☐ Kerosene ☐ Cow dung cake ☐

Coal and hard coke ☐ Wood ☐ Bumb Foad in traditional bumb ☐

Bio mass such as dry leaves ☐ bagass etc. ☐ Any other ☐

2. State the consumption per month of such Fuel : _____	3. Average monthly expenses on hot water : Rs _____

4. Reasons for not installing hot water system

i)	Unaffordable price of SWHS	☐
ii)	Rigid sanction procedure	☐
iii)	Unsuitability of roof for installation	☐
iv)	We do not give priority to this issue	☐
v)	Extension work is in progress	☐
vi)	Cold water for bathing	☐
vii)	Unsuitable climate	☐
viii)	Not aware of soft loans for SWHS	☐
ix)	Regular water supply is not available on a continuous basis	☐
x)	Hard Water	☐

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PART - 3 USER GROUP(Solar Cooker)

1. Year of Installation of Solar Cooking System ☐	2. Purchase price : Rs _____
3. How the Funds are arranged ? a) Own Contribution b) Bank Finance c) Assistance from any Govt./ Non-Govt. Org. d) Donation if any.	
4. State Expenses on Fuel for cooking per month. i) Before the use of Solar Cooking System _____ Rs. ii) After the use of Solar Cooking System _____ Rs.	
5. Saving in Fuel Cost on Cooking per month _____ Rs.	

PART 4 NON-USER GROUP(Solar Cooker)

1.. Which fuel do you now use for cooking?

Kerosene ☐ LPG ☐ Chullha ☐ Ele.Equ. ☐

2. State your approx. monthly consumption on fuel _____ (Cylinder)

3. Why have you not installed solar cooking system?

i) We do not know anything about Solar Cooking System

ii) Lack of confidence in the technology

iii) It is not easily available in the local market

iv) Lack of R & D in community solar cooking technology

v) Prompt availability of LPG

vi) We feel that it is costly.

Place :
Date :

Signature

Ph.D. Research on Non-Conventional Energy
By Prof. R. W. Kulkarni, Modern College, Pune- 411 005

QUESTIONNAIRE FOR INDIVIDUAL RESPONDENTS

PART-1
BASIC INFORMATION

1. Name :	2. Age :
3. Educational Background	4. Address :
5. Occupation : Service / Business	
6. No of Members in the Family using Hot Water ☐	7. No of Members ☐
8. Monthly income of the family Less than 5000 ☐ 5 to 10000 ☐ 10 to 15000 ☐ 20 to 25000 ☐ Above 25000 ☐	
9. Type of the House : Bunglow/Ownership Flat/Any other	
10. Timing and duration of Sun light availability in the terrace from_____to_____	
11. Have you installed Solar Water Heating System? Yes ☐ No ☐ (If 'Yes', fill 'Part 2') (If 'No', fill 'Part 3')	
12. Do you use Solar Cooker ? Yes ☐ No ☐ (If 'Yes', fill 'Part 4') (If 'No', fill 'Part-5')	

P.T.O

PART - 2
USER GROUP(Solar Water Heating System)

1. Year of installation of SWHS ☐	2. Capacity (in Liters) ☐
3. Total price paid : Rs _____ for the system	4. How the fund are arranged ? a) Own Contribution : Rs _____ b) Bank Finance : Rs _____
5. EMI Per Month ☐	6. Period of Repayment ☐ Months
7. Expenses on Water Heating a) Before Installation : Rs _____ b) After Installation : Rs _____	8. Savings per month ☐
9. Pay back period of the system ☐ Months	10. Any Other Remark

PART-3
NON USERS (SWHS)

1. Which fuel do you now use for heating water ?

LPG ☐ Electricity ☐ Kerosene ☐ Cow dung cake ☐

Coal and hard coke ☐ Wood ☐ bagass etc ☐

Bumb Foad in traditional bumb ☐ Any other ☐

Bio mass such as dry leaves ☐

2. State the consumption per month of such Fuel: _____	3. Average monthly expenses on hot water : Rs _____

4. Have you noticed any advertisement of Solar Product Yes /No

P.T.O

5. If yes, state the media of such advertisement.

   a. News papers

   b. Magazine

   c. Radio/TV

   d. Exhibition/Trade Fair

   e. Any other

6. Reasons for not installing hot water system

   1. Unaffordable price of the SWHS ☐
   2. Regular water supply is not available on a continuous basis ☐
   3. Unsuitability of roof for installation ☐
   4. Unsuitable climate ☐
   5. Unsuitable water ☐
   6. Not aware of Bank Finance at concessional rate. ☐
   7. Majority of the members in the family use Cold Water ☐
   8. Easy availability of LPG/ Bio Mass etc ☐
   9. We do not give priority to this issue ☐

PART - 4
USER GROUP(Solar Cooker)

1. Year of Purchase of Solar Cooker ☐	2.Which Type of Cooker do you use? A. Box Type ☐ B. Parabolic ☐
3. Purchase Price: Rs._____	4. Do you use Solar Cooker regularly ? Yes/No

User Feed back on Solar Cooker

5. As a user of Solar cooker please give your feedback in Yes/ No form about the following comments.

i)	Lack of repairs and maintenance network by the manufacturers	Y / N
ii)	Low performance during cloudy atmosphere	Y / N
iii)	Inconvenience in handling the solar cooker	Y / N
iv)	Outside disturbance during cooking time	Y / N
v)	Passive attitude of the manufacturers in dealing with consumers of the solar cookers	Y / N
vi)	Due to heavy weight of the mirror loading and unloading the cooking vessels is difficult	Y / N
vii)	An awkward sitting position in which cooking vessels are to be put into solar cooker and removed from the solar cooker.	Y / N

PART - 5
NON-USER GROUP(Solar Cooker)

1. Which fuel do you now used for cooking?

   Kerosene/LPG/Chullha/Ele.Equ.

2. One cylinder lasts for how many days? ------

3. Why have you not purchased solar cooker?

i) I do not know anything about Solar Cooker
ii) It is not easily available in the local market
iii) Bulky design for daily handling.
iv) Lengthy cooking time
v) Easy availability of LPG/ Fire Wood/ Other Bio Mass
vi) Our Cooking Schedule does not suit use of solar cooker
vii) Number of members in the family are very few.
viii) Not suitable for our cooking style.
ix) I don't have a suitable place for keeping Solar Cooker

Place :
Date :

Signature

Ph.D. Research on Non-Conventional Energy
By Prof. R. W. Kulkarni, Modern College, Pune - 411 005.

Format of a letter sent to the Respondent Manufacturers/Dealers/Installers of SWHS and Solar Cooker

To

Dear Sir,

I have been doing research from Pune University on 'The causes of under utilization of market potential of Solar Water Heating Systems and Solar Cookers. The area of my study is Pune District.

In connection with this theme of research I wish to collect data from the manufacturers /installers/dealers of SWHS and Solar Cooker who have registered with MEDA. I have accordingly contacted Mr. Vikrant Virvadewakar, Manager- Solar Thermal, MEDA; and as advised by him I am sending a small questionnaire to you which is prepared specially for the manufacturers/installers or dealers.

I sincerely request you to please fill in all the details in the said questionnaire and send it to my address in self addressed and stamped envelop.

I assure you that the information collected shall be strictly used for academic pursuits only.

Thanking you,

Yours faithfully,

(Prof. R. W. Kulkarni)
Modern College of Arts, Science & Commerce,
Shivajinagar,
Pune – 411 005.

CC. Mr. Vikrant Virwadekar,
Manager, Solar Thermal,
MEDA.

Ph.D. Research on Non-Conventional Energy
By Prof. R. W. Kulkarni, Modern College, Pune - 411 005.

QUESTIONNAIRE FOR (MANUFACTURER /INSTALLER /DEALER)

PART-1 BASIC INFORMATION

1. Name of the Organisation:	2. Address:
3. Telephone No.	4. Year of Establishment:

5. Nature of the Organization:
   a) Sole Trader ☐
   b) Partnership Firm ☐
   c) Private Ltd. Co. ☐
   d) A Public Ltd. Co. ☐
   e) Any Other Type ☐

6. If Owner is an individual State:
   a) Name of the Owner _____
   b) Educational Background _____
   c) Technical Qualification _____

7. Whether you are a Manufacturer /Installer/Dealer ?

8. a. State the total investment in your Business.
   i) Land Cost
   ii) Factory Building
   iii)Plant and Machinery
   iv) Furniture
   v) Office Equipments
   vi) Any Other

b. Please give item wise approx. prices of Solar Water Heater Solar Cooker and other products sold by you.

CAPACITY (In Liters)	**Heater (Rs.)**	**Cooker**	
		Box Type	**Parabolic**
125			
250			
375			
500			
1000			
Solar PV Systems/ Solar Lanterns etc.			
1.			
2.			
3.			
4.			
5.			

9. State the average quantitative breakup of the products sold by you per annum.

CAPACITY (In Liters)	**Heater (Qty.)**	**Cooker**	
		Box Type	**Parabolic**
125			
250			
375			
500			
1000			
Solar PV Systems/ Solar Lanterns etc.			
1.			
2.			
3.			
4.			
5.			

10. A) Profile of Customers

State in terms of approx. % – geographical location of customers.

i) Within the limits of Pune City ☐

ii) Within Pune District ☐

iii) Outside Pune District ☐

10. B) State the bifurcation of category wise customers (in %)

i) Private Individuals

ii) Government Hospitals

iii) Government Guest Houses

iv) Educational Institutions

v) Other Private Institutions.

11. Average turnover of your business during 2001-02 to 2003-04.

YEAR	TURNOVER (IN RS.)
2001	
2002	
2003	

12. Do you advertise your products? Yes/No

13. If yes, State the media used for advertisement.

TV ☐ Radio ☐

Business Exhibitions ☐ Newspapers ☐

Magazines ☐ Yellow pages ☐

Any Other ☐

14. Annual Expenses on Advertisement

YEAR	EXPENSES (IN RS.)
2001	
2002	
2003	

15. What additional measures are required to be taken according to you to popularlise solar products?

1

2

3

4

5

Place :
Date :

Signature

APPENDIX - II

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ecosu@vsnl.net
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Appendix – III

Working Calculations of 'Z Value'

(1) 'Z Value' → Institutional Respondents

Sr.No	Category	Urban		Semi Urban	
		Total	Users	Total	Users
1)	College Hostels	66	38	15	04
2)	Hostels of SW Dept	07	01	24	04
3)	Hostels of Women & Child Welfare	11	00	05	03
4)	NGOS	03	02	21	08
5)	Govt-Guest Houses	07	01	28	05
6)	Public Hospitals	21	03	20	14

Category 01

Urban

$$P = \frac{38}{66}$$

$$= 0.5758$$

$$Z = \frac{0.5758 - 0.5}{\sqrt{\frac{0.5 * 0.5}{66}}}$$

$$= 1.2315$$

Semi- Urban

$$P = \frac{4}{15}$$

$$= 0.2667$$

$$Z = \frac{0.2667 - 0.5}{\sqrt{\frac{0.5 * 0.5}{15}}}$$

$$= -1.8071$$

Category 02

Urban

$$P = \frac{1}{7}$$

$$= 0.1429$$

$$Z = \frac{0.1429 - 0.5}{\sqrt{\frac{0.25}{7}}}$$

$$= -1.8894$$

Semi- Urban

$$P = \frac{4}{24}$$

$$= 0.1667$$

$$Z = \frac{0.1667 - 0.5}{\sqrt{\frac{0.25}{24}}}$$

$$= -3.2644$$

Category 03

Urban

$$P = \frac{0}{11}$$

$$Z = \frac{0 - 0.5}{\sqrt{\frac{0.25}{11}}}$$

$$= -3.3156$$

Semi- Urban

$$P = \frac{3}{5}$$

$$Z = \frac{0.6 - 0.5}{\sqrt{\frac{0.25}{5}}}$$

$$= 0.4472$$

Category 04

Urban

$$P = \frac{2}{3}$$

$$Z = \frac{0.6667 - 0.5}{\sqrt{\frac{0.25}{3}}}$$

$$= 0.5575$$

Semi- Urban

$$P = \frac{8}{21}$$

$$Z = \frac{0.3809 - 0.5}{\sqrt{\frac{0.25}{21}}}$$

$$= -1.0907$$

Category 05

Urban

$$P = \frac{1}{7}$$

$$= 0.1429$$

$$Z = \frac{0.1429 - 0.5}{\sqrt{\frac{0.25}{7}}}$$

$$= -1.8894$$

Semi- Urban

$$P = \frac{5}{28}$$

$$= 0.1786$$

$$Z = \frac{0.1786 - 0.5}{\sqrt{\frac{0.25}{28}}}$$

$$= -3.4014$$

Category 06

Urban

$$P = \frac{3}{21}$$

$$= 0.1429$$

$$Z = \frac{0.1429 - 0.5}{\sqrt{\frac{0.25}{21}}}$$

$$= -3.2731$$

Semi- Urban

$$P = \frac{14}{20}$$

$$= 0.70$$

$$Z = \frac{0.70 - 0.50}{\sqrt{\frac{0.25}{20}}}$$

$$= -1.7873$$

(2) 'Z Value' – Individual Households

	Urban	Semi Urban	Overall
Individual Households	444	614	1058
Users of SWHS	44	25	69
P	0.0990	0.0407	0.0652
Z	$=\frac{0.099-0.1}{\sqrt{\frac{0.1*0.9}{444}}}$ Z = -0.07	$=\frac{0.0407-0.1}{\sqrt{\frac{0.1*0.9}{614}}}$ Z = -4.9	$=\frac{0.0652-.01}{\sqrt{\frac{0.1*0.9}{1058}}}$ Z = -3.78