PROJECT REPORT

UGC SPONSORED MINOR RESEARCH PROJECT

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On

A STUDY OF MARKET ANALYSIS OF DOMESTIC SOLAR WATER HEATER WITH SPECIAL REFERENCE TO SATARA DISTRICT

Submitted by

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DECLARATION

I hereby declare that the Minor Research Project entitled ***A STUDY OF MARKET ANALYSIS OF DOMESTIC SOLAR WATER HEATER WITH SPECIAL REFERENCE TO SATARA DISTRICT*** *being submitted to University Grants Commission, Western Regional Office, Ganeshkhind, Pune for the fulfillment of Minor Research Project is my original and bonafide work and the conclusions drawn therein are based on the data and information collected by myself. To the best of my knowledge and belief, this work has not formed the basis for the award of my Degree or Diploma of similar title.*

Place: Satara

Date / /2014

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CERTIFICATE

This is to certify that the Minor Research Project entitled ***A STUDY OF MARKET ANALYSIS OF DOMESTIC SOLAR WATER HEATER WITH SPECIAL REFERENCE TO SATARA DISTRICT*** which is being submitted herewith for the fulfillment of Minor Research Project of University Grants Commission, Western Regional Office, Ganeshkhind, Pune is the result of the original research work completed by Dr. Lokhande Uday Maruti

Place: Satara
Date: / /2014

(**Dr. Y.S. Patne**)
Principal,
Arts and Commerce College,
Satara

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Dr. Lokhande Uday Maruti
Principal Investigator,
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INTRODUCTION AND RESEARCH METHODOLOGY

1.1. INTRODUCTION

Can you imagine life without energy? Answer is no, no, no ……!

Energy is a key factor in process either related to industry, institution, business or education. We need energy to carry out the activities to achieve the goals like running machine to manufacture the products, lighting the appliances for offices, running T.V, video or any other entertainment equipment. After the First World War, growth rate of industrialization was more and the requirement of energy wagon higher side. Indian economy growing as one of the fastest economic in the world naturally has high demand for energy in particular about 8-9% every year.

Coal, petrol, kerosene, diesel or natural sources are the energy sources available in the world which are mostly used to run vehicle, to run the plants, but the availability of this sources depends upon the mines, stocks available under earth, by expert opinion it is expected to deplete those up to year 2020 to 2030. So the developed country had started thinking about the alternative sources like solar, winds, and biomass. Tidal energy is the conventional energy sources available in the world all over.

Solar energy is gift for mankind the sun is the largest source of renewable energy and this energy is abundantly available in all parts of the earth. The sun is the power-house of universe. It is the initial and ultimate source of global energy. It is only energy which can be directly utilized without disturbing the natures cycles. Now you will forget the

old days of woods, coal, oil fired boilers, electric geysers etc. Let us rival the magic of solar energy.

Solar energy has been used since prehistoric times but in a must primitive manner before 1970. Some research and development was carried out in a few counting to exploit solar energy more efficiently but most of this work remained mainly academic. After the dramatic rise in oil prices in the 1970`s several countries began to formulate extensive research and development programmers to exploit solar energy.

India receives solar energy equivalent to over 5000 trillion kiwi/year, which is far more than the total energy consumption of the country. Solar product is very profitable to Consumers. It saves their time and money as well as national resources. When consumers buy this product that means he invest in capital goods. Once he invests he gets profit for long time.

Solar water heaters run on solar energy. It is used for making hot water. Hot water used in every Indian home. For hot water there is required to much energy .For conservation of non renewable energy solar water heater is very good tool. In India solar water heaters use increased but there is requirement to develop solar water heaters market. For promoting solar water heater the role of Government, manufacturing companies and society is very important. Major research done on technical side but there lack in research in marketing side. Solar water heaters market will developed if proper research will carried out. There is most urgent need to do study solar water heaters market.

1.2 REVIEW OF LITERATURE:

Books –

1) Varadarajan D.B.

"Energy Economics" the author firstly described as fuel prices for long reflected only the costs of discovery, extraction, refining and delivery, they failed to include the value of the fuel itself. The world has only a limited stock of fuel and it is only a matter of time before it begins to run out. Unlike finite fuels, sunlight is a flow and not a stock, once a gallon of oils is burned, it is gone forever, but the sun will continue to cast its rays earthward a billion years for human needs, technical improvements in the use of sunlight are lowering real prices permanently. Similar technical improvements in the use of finite fuels could hasten their exhaustion.

Further he described two type of solar energy (i) direct solar energy- In this he discussed about a) solar thermal technology, b) solar thermal power generation. (ii) indirect solar energy – In this he discussed on a) biogas, b) small scale hydropower, c) windmills.

He discussed thoroughly on economics of solar photovoltaics. His thinking such as even though the economics of PV systems greatly depend on the type of application, location where the system is installed and availability of conventional electric power. Since solar PV offers a technology where remote areas as well as regions with power shortages can receive benefits of electricity and several social services like health and literacy in a very short time, investments in PV system installations in hilly area, desert regions and other inaccessible part as well as in electrified villages in the plains, which are more than about 8 km from the grid, can be economically justified even today. There are very large areas

where these conditions are met. Hence it is economically justified for public investment to be put on photovoltaic power on a large scale in these areas rather than in conventional power.

2) Abbasi S.A., Abbasi Naseema

"Renewable Energy Sources and their Environmental Impact" in this book author discussed on various solar equipments. specially author mention here economics of solar heating. The use of solar energy for residential and commercial space heating and domestic hot water certainly can make a substantial contribution to our energy resources. However, this impact will not come about overnight. Even if solar panel units were installed in 90% of our new houses and single storey commercial buildings to supply 80% of each building's heating and cooling requirements, we would reduce contribution form conventional resources by only about 5% by the year 2000 and 10% by 2020. Using a more conservative estimate that solar panels be put into 50% of all new buildings, the savings by the year 2000 would be about 0.2%. This is nothing to be surprised at, as this is equivalent to saving the annual energy output of about twenty 1000 MW electricity generating plants. Solar energy systems usually require a substantial initial investment, compared to conventional systems. System costs are made up of costs of the FPC array, the storage facility, pumps, insulation, and electronic controls. The results of a study conducted by Solar Energy Research Institute (SERI) on typical costs for a contractor installed, residential scale solar space and water heating system. The prices listed are per sq.ft. of collector area. The total system cost is $55 per sq.ft. Of this cost, 56% goes for equipment, 17% for labour and 27% for overheads and profit. This translates to FPC costs between $10 and $25 per sq.ft. the lower prices being for do-it-yourself versions. To decide whether such an

investment is economically justified, the “acceptable” payback time must be decided. The payback time is computed as the time in which first cost plus annual operating expenses will equal the total energy savings. High fuel prices decrease the payback time. Higher interest rates mean longer payback time. To many home owners, 10 years might be the upper limit for an acceptable payback time. Industry typically uses a 2 to 3 years payback time in evaluating investments. In many areas of the United States, if already is more economical to use solar space heating than electricity if a 10 year payback time is taken, while in even more area solar energy used for domestic hot water is competitive with electricity and oil.

3) Tiwari G.N.

“Solar Energy Fundamentals, Design, Modeling and Applications”, in this book author give economic analysis of solar products. He stated here as Techno-economic analysis is the area of engineering judgment and experience are utilized in the application of scientific principles and technique to problems of project cost control, profitability analysis, planning, scheduling and optimization of operational research etc. This study covers a wide range of topics such as time value of money, maintenance, organizational structures, integrated projects control, quality and resource management, life cycle and risk analysis etc.

Further author discussed on payback period. His view is on this topic such as profitability is a measure of the total income for a project compared to the total outlay. Money going into the project is taken as negative and money coming back from the project as positive. Payout time is one of the criteria for profitability.

4) Gordon Jeffrey

Edited ISES Position Papers of ISES International Solar Energy Society namely “Solar Energy the State of the Art”. He discussed solar water heater markets and remarked as comparison of markets in different countries is difficult, due to the wide range of designs used for different climates, and different demand requirements.

In Japan the number of solar domestic water heating systems is large. However, most installations are simple integral preheating systems. The market in Israel is large due to a favourable climate and to regulations mandating installation of solar water heaters. The largest market is in China, where there is widespread adoption of advanced evacuated tubular solar collectors.

The largest exporters of solar water heaters are Australia, Greece and the USA. The majority of exports from Greece are to Cyprus and the ner Mediterranean area. France also exports a substantial number of systems to its overseas territories. The majority of US exports are to the Caribbean area. Australian companies export approximately 50% of production (mainly thermosyphon system with external horizontal tanks) to most of the area of the world that do not have hard freeze conditions.

5) Rao S., Dr.Parulekar B.B.

“Energy Technology, Nonconventional, Renewable and Conventional” discussed on energy and economy. The energy is the essential economic commodity for industry, commerce, agriculture, transport, defense and domestic sectors. The economics of other sectors is influenced by the cost of production and transport of energy commodities.

Per capita energy consumption is an indicator to the standard of living of people.

Energy is essential for sustaining the civilizations. The economic prosperity of a nation/region/state/individual consumer is directly influenced by effective energy management.

Expenditure on energy processing and energy conservation measures is justified in terms of the increased productivity and comforts.

6) Purohit, Shammi and Agrawal

Authors discussed on solar energy world wide market and their utility in the book “Environmental Sciences A New Approach”. It is inexhaustible nonconventional energy source. It is perennial, non-polluting and cheap source of energy. Energy from sun represents a potentially enormous source for a variety of uses. Solar energy equivalent to almost 75000 TkWh hits the earth every day. A mere 0.1 percent of this amount is adequate to meet world energy needs. A mere 0.1% of this staggering figure is sufficient to meet world energy needs. Utilization of sun energy has grown at the @ 16% during 1990-98 and solar market is expected to reach 10600 MW if there is a constant annual growth of 25% every year. Japan is the prime country in utilizing solar power. Solar energy is currently being used to generate electricity using three technologies: 1) direct heating, 2) solar photovoltaics and 3) solar thermal.

7) Jogi Krupalsingh

“Energy Resource Planning and Management”, in this book author discussed on global market development of photovoltaics. He remarked as, the four largest PV manufacturers share half of the market between

them. Siemens solar is the undisputed market leader, followed by solarex, BP Solar and Sharp. In recent years the PV market has shown a tendency towards concentration.

Further he states global production of solar cells and modules has been growing steadily for years. the four largest companies are producing to capacity. The Asian-Pacific market is taking almost three times as many modules as the European market.

8) Jogi Kripalsingh

“Energy: Potential Alternative Resources” the author opined in this book market incentive of financial and psychological nature should be created to ease the transition to cost-efficient large scale production. The importance of solar energy for vast areas of the world as an economically feasible, resource-saving and ecologically sensitive, complement or even alternative to conventional energy sources should be emphasized.

9) Asthana D.K., Asthana Meera

In the book “Environmental Studies” authors explained about utilization of solar thermal energy. They opined that an enormous amount of energy is available in the form of sunshine in our country which provides light as well as heat. Solar heat can be trapped by using reflecting devices which concentrate solar energy to a particular area. Department of non-conventional energy sources has been trying to popularize the use of solar cookers and solar water heating devices by providing large subsidies to the consumers. Solar water heater, solar drier and desalinization plants have already become popular in India at a number of places.

10) Meenakshi P.

In the book “Elements of Environmental Science and Engineering” author discussed about solar energy as the total amount of solar energy reaching the earth’s surface is tremendous. For example, on a global scale, two weeks of solar energy is roughly equivalent to the energy stored in all known reserves of coal, oil and natural gas on the earth. Solar energy may be directly used either by active solar systems or passive solar systems.

Another potentially important aspect of direct solar energy involves solar cells or photovoltaics that convert sunlight directly into electricity. Two other types of solar energy are the solar power tower and solar ponds. Another example of direct utilization of solar energy involves using part of the natural oceanic environment as a gigantic solar collector. The construction of large scale ocean thermal plants will depend upon whether they can be built close to potential markets and whether the plants are economically feasible.

India has been one of the major producers of photovoltaic (PV) systems. PV systems currently used include street lighting system (SLS), domestic lighting systems (DLS), community lighting systems and TVs (CDs and TV), water pumping system and small power plants. These systems use the sun to heat either water or a heat-transfer fluid, such as a water-glycol antifreeze mixture, in collectors generally mounted on a roof. The heated water is then stored in a tank similar to a conventional gas or electric water tank. Some system use an electric pump to circulate the fluid through the collectors.

11) Anandan P., Kumaravelan R.

“Environmental Science and Engineering” author discussed on solar energy as solar energy is equivalent to 75000 TkW/hr reaching earth surface every day. 0.10% of the above will meet the daily energy requirement of the world. The techniques for trapping the energy from the sun is not familiar due to its lower efficiency, higher cost and some of the practical difficulties.

Techniques like solar photo voltaic cells can convert the sunlight directly into electricity. These are also called as PV cells. Presently it is used to power satellites, watches, calculating devices etc.

Following are some applications of solar energy directly useful to the human beings.

1) Solar water heater
2) Solar cooker
3) Solar drier
4) Solar refrigerator

12) Malik Amitav, Mate Nitan and Bhave Devayani[12]

In the book “Renewable Energy Technologies: Special Focus on Distributed Power Generation” discussed about solar energy as an alternative. For the past several decades since the early 70s, it has been thought that Solar Energy has a bright ‘future’. Unfortunately, the word ‘future’ has stuck with the field. Solar energy is struggling to reach the critical mass when sustained market development can be achieved. This is mainly due to the heavy initial costs involved in SPV systems. Although the cost has reduced over the years, it is still considerably more expensive as compared to conventional energy. The typical cost of 1 MW capacity of a thermal power plant will be in the rage of 40 to 50 million

Indian Rupees, whereas the same for an SPV power plant will be about two and a half times higher. Moreover, solar energy has the limitation of being available only during the day time, although the requirement is considerably high after sunset.

Nonetheless, in the world over, SPV market has generally grown depending on the government policies, incentives and subsidies.

13) Nersesian Roy L.

"Energy for the 21st Century A Comprehensive Guide to Conventional and Alternative Sources" in this book author discussed economics of solar power. He stated such as solar power works better if electricity rates are based on time-of-day metering when rates track actual demand. This would improve the economics of solar power immensely since the day rate for electricity is much higher than the night rate, reflecting marginal rates charged by base-load electricity providers. If electricity rates during daylight hours were sixteen cents per kilowatt hour, then the investment of $8000 (after the rebate) will generate savings of $16000 in avoided electricity purchases over a twenty-five-year period, providing a 2.85 percent return on the investment. If there were no rebate, the savings would only compensate for the investment, assuming the money has no time value. If it is profitable to install solar power, then one can consider oversizing the array and selling the excess power back to the utility. Regardless of the economic analysis, one may still choose solar power just for the satisfaction of having a home that does not require burning a fossil fuel ore relying on nuclear power.

14) Khan Alimuddin

"Basics of Energy" discussed on world energy resources is an explanatory energy survey of the countries and major regions of the

world, their geographic and economic settings and significant inter-relationships. This book attempts to combine several interacting energy themes that encompass a historical development, energy issue and forecasts, economic geography, environmental programs and world energy use.

The main thrust of this book World Energy Resources is based on principles of energy science, applied geology, geophysics and production of resources in this country and throughout the world. This work is an analysis of world oil, gas, coal, and alternative energy resources have been attempted without a broad geological exposure and international geographic awareness. Much information is scattered among federal and state agencies, schools, and other institutions, and this book has attempted to combine some of the vast information base. This attempt can only skim the information surface at best, but its regional and topical coverage is broad in scope.

15) Chauhan Pradip S.

“Energy and Climate Change Issue of Sustainable Development” he stated on renewable energy consists of energy produced and / or derived from sources that can be renewed indefinitely, such as hydro, solar and wind power, or sustainably produced, such s biomass. Notwithstanding the forecast dominance of fossil fuels, the use of renewable source of energy is expected to expand. Based on United States Energy Information Administration (EIA) projections, marketed renewables will grow over the next decades at an annual rate of around 1.9 percent. The greatest absolute increases are expected in North America, Asian developing countries and Central and South America. Annual growth rates in consumption of renewables are expected to be

highest in the Near East, Asian developing countries and Central and South America. In Asian developing countries, the trend is driven more by increased energy consumption than a particular focus on renewables as in Central and South America.

In most of the world's regions, the proportion of energy from marketed renewable sources is expected to increase in the coming years. by far the greatest overall proportion of renewable energy consumption is in Central and South America, where economically competitive nonfossil fuel sources of energy are already well established.

These figures do not take into account the recent long-term energy strategy of the European Union (EU), which proposes that by 2020, EU consumption of renewable will increase to 20 percent of total energy use; the proportion of biofuels used in transport will increase to 10 percent; and EU greenhouse gas emissions will be reduced to 20 percent below 1990 levels. (European Union, 2007).

Articles:

16) Sharma B.D., Wade, H. and colleagues

"Experience with Solar Home System in Developing Countries: A Review" in this article authors opine as solar energy is widely perceived as a promising technology for electricity generation in remote locations in developing countries. It is estimated that 1.3 million solar home systems had been installed by early 2000. As estimated one-third of installed systems were baked by foreign donor support in government programmes and two thirds supplied by commercial dealers. The estimated growth in the development of solar lanters is less than for SHS. One out of every 100 households that gain access to electricity in developing countries uses solar power. In spite of these successes, doubts have arisen about the

effectiveness and suitability of small PV systems for rural development. Many organizational, functional and technical problems appear to present difficulties. A literature survey has been conducted to make an inventory of experience with solar PV applications for households in developing countries. The main finding is that an adequate service infrastructure is required to make projects viable. Household choice in system sizes is often too restricted in donor-funded projects. Smaller systems sold for cash can be a good alternative to credit systems by offering to increased affordability. Gaps in existing knowledge have been identified, which could be overcome by field monitoring programmes.

17) Dabrase Pramod S. and Ramchandra T.V.

"Integrated Renewable Energy System-Perspective and Issues". Authors of this article studied Kolar District in Karnataka about renewable energy systems- perspectives and issues. They came to conclude as Kolar depends mainly on non-commercial forms of energy. Non commercial energy constitutes 84%, met mainly by sources like firewood, agriculture residues and cow dung, while commercial energy share is 16%, met mainly by electricity, oil etc. Based on this investigation of biomass resource availability and demand, Kolar can be categorized deficit region. The present inefficient fuel consumption could be brought down by the usage of fuel-efficient stoves.

Availability of animal residues for biogas generation gives a viable alternative for cooking, lighting fuel and a useful fertilizer. However to support the present livestock population fodder from agricultural residues is insufficient in these Talukas. Various alternatives such as fuel-efficient stoves, biogas, energy plantations are proposed for improved utilization

of bio resources and to enhance bioresource stock in a region with techno economic analyses.

Renewables such as solar has good potential in the area, but the spread is hampered by economic constraint. Small-scale use of wind turbine can be promoted for water lifting and such other purposes. Solar energy is available and can be used for water heating and water lifting need effectively provided it is subsidized to affordable cost. Integrated approach in energy use involves diversity in energy use, keeping environmental and social criterions.

18) Dr.Kumar Ashvini

“Development and Promotion of Low-temperature Solar Thermal Energy Technology in India”. The author of this article discussed on various solar, thermal technologies. The author mainly thinks on solar water heating system. He describe here present scenario such as the overall potential in India for solar water heating systems is estimated to be 140 million m^2 of collector area. About 2 million m^2 of solar collector area has been installed in the country so far. It is easy to note that the rate of growth in last couple of years has accelerated quite substantially.

With a view to give a major boost to the promotion of solar energy systems, the Ministry has been working with the Ministry of Urban Development to get the building byelaws in municipalities across the country amended so that installation of solar water heaters becomes mandatory for various categories of new buildings. The State Electricity Boards/ utilities are also being encouraged to provide rebates in electricity tariff to house owners who install solar water heaters in their homes. The utilities in Rajasthan, West Bengal and Karnataka are already providing such rebates.

19) Chandak Ajay, Dr.Somani Sunil K.

“Design of Solar Dryer with Turboventilator and Fireplace” in this article authors discussed on design of solar dryer and they come to know solar dryer is an innovative design with combined draught, natural, and induced with fan. It works well when fan induces draught. However, when there is no power, the dryer works with natural draught, although the system underperforms because of the drastically reduced airflow. In the rural areas of Maharashtra, power cuts increased to almost 14 hours a day and no power is practically available to run the fan during daytime. So, the author came up with a new design of solar dryer, which uses turboventilator for creating draught. It runs on “external” wind to create necessary draught and maintains good airflow through the solar dryer, giving excellent performance. As it works on wind, no power is required. So, the unit is truly a renewable energy gadget. The unit is also provided with a fireplace and bypass chimney. This allows the use of the dryer at night and during cloudy days. It also helps to accelerate the drying process when the sun is available by using some fuel-like waste biomass. Turboventilator was preferred over solar PV (photovoltaic) operated fan for the reasons of cost and possibility of operation at night or in cloudy period. The result of the new solar dryers are very encouraging.

20) Purohit Gunjan & Purohit Ishan

“Prospects of Solar Drying in Uttarakhand” the authors come to know the solar radiation pattern, climatic study, and the study of agro and medicinal plant production in the hilly regions of Uttrakhand show a large potential for solar drying in the state. The Government of Uttarakhand has announced the state to be a ‘herbal state’ and thus, a number of efforts have been made in this direction. The companies

involved in the filed of medicinal plants or produce import the raw material from the typical areas and process them in-house for production of various end-products. Once the local farmers get the facility of solar drying at their locations, the transportation of these products in bulk will be easier and a large amount of energy used for drying will be saved. Local manufacturing of the systems would also enhance the employment opportunities. And the technology would improve the income level of local farmers who can sell dried products at high cost, instead of the raw materials at a much lower cost.

21) Bandopadhyay Bibek

“Electricity from Solar Energy: the Thermal Route” author express his view as with abundant availability of solar radiation, India is potential country for installation of solar thermal power plants. As a result of programmes undertaken by MNRE, experiments have been conducted in the country on a number of solar thermal power units based on a variety of technologies. Organisational namely SEC, Indian Institute of Technology, Indian Institute of Technology Bombay, BARC, National Thermal power Corporation, and Bharat Heavy Electriclas Ltd have already gained sufficient expertise in the technology. Installation of a large capacity grid interactive solar thermal power plant in the country will bring India on the international map on solar power. With increasing cost of conventional energy and continuing trend of internalizing environmental cost of fossil fuel based electricity production, solar thermal power plants will be one of the competitive options for electricity generation in the near future.

22) Rao Chodagam

“Affordability of Solar PV in India – Issues Related to Feed in Tariff” in this article author compares solar PV against conventional diesel power generation and give some suggestions about how solar PV affordable. And his view express in this article. For fast growing markets like India, energy demand will always exceed available supply. Dependence on volatile external sources of supply is always a high-risk situation. Solar PV can be an effective medium to help close this gap and enable India to be energy self-reliant.

Solar PV is one of the cleanest and abundantly available energy sources, but it comes with a higher price tag. To make PV more affordable, an immediate step could be to fix the feed in tariffs higher than other conventional energy generations and allow PV to get into on-grid application.

23) Pahari Gwal

“Solar Energy Centre” in this article author gave information about solar energy centre. The SEC (Solar Energy Centre) established in 1982, is a dedicated unit of the MNRE (Ministry of New and Renewable Energy), government of India for development of solar energy technologies and to promote its applications through product development. The centre, along with the programmes division of the ministry, has contributed significantly towards the implementation of the national programme on solar energy. SEC has the requisite equipment, laboratories, and other associated facilities for design, development, testing and evaluation. Facilities for conducting training programmes and seminars are available in the form of an auditorium, a seminar room, and a meeting room equipped with audio-visual equipment. The SEC serves

as an effective interface between the government and institutions, industry, and user organisations for the development, promotion and widespread utilization of solar energy in the country.

24) Raghuraman V. and Ghosh Sajal

“Indo-U.S. Cooperation in Energy – Indian Perspective” this paper present some area for enhanced Indo-U.S. cooperation in the energy sector from an Indian perspective. To lay a sound foundation for identifying these areas, the paper first presents an energy scenario for India and then a summary of existing Indo-U.S. cooperation efforts in the public and private sectors.

This paper highlights opportunities for foreign investment (including U.S. investment) in subsectors of the energy sector, ranging from oil and gas to renewable. The paper then identifies areas for possible enhanced Indo-U.S. energy cooperation in a range of areas including geophysical exploration, energy efficiency, clean energy sources and the power sector.

25) Jhirad David

“Market Potential of Renewable Energy Technology” in this paper author deals broadly with new and renewable sources of energy, and discusses some examples of their application in several Third World Countries. The author suggests that there are a variety of systems that currently produce end-use energy at prices competitive with oil-fired systems, especially in locations that are richly endowed with renewable resources, or where costs of fuel transportation are high. Systems which could have national and international impact are not yet economic in comparison with conventional energy systems or energy efficiency measures. The paper also discusses cost goals that must be achieved if

solar photovoltaic and solar thermal systems are to have a major impact on the energy situation in developed and developing countries.

26) Sarma Amal Ch.

“Solar Energy – A Renewable Energy Option” in this paper author discussing on the potentiality of hearnessing solar energy for various applications in enormous. Significant efforts have been made to harness solar energy resources in our country during the last decade. The ministry of Non-conventional Energy Sources (MNES) has played a very important role for development and application of solar energy. A large number of R & D, training and extension programmes have been initiated by the Ministry, Indian Renewable Energy Development Agency (IREDA) was established to give impetus to the development, commercialization and expansion of usebase of NRSE system like solar energy. IREDA is providing soft term loan to manufacture as well as user of solar energy sytem.

With the fuel price rising, it would be prudent to make all out efforts to make maximum possible use of solar energy with the help of efficient and economical solar energy devices.

27) Jagbirsingh and Kumar Sandeep

In the paper “Scope of Solar Energy in India” stated that solar energy can be harressed directly as well as indirectly. The radiation can be converted directly into eectrcity during the day by photovoltaic cells and stored in batteries. A photovoltaic cell of silicon having a diameter of 8cm normally generates electricity at the rate of 0.5W/hr, and an array of several hundred photoelectric cells would be able to meet the needs of a family. The indirect method of tapping solar energy involves concentrating the sun’s rays by use of mirrors or blackened collectors on

water to produce stem that runs and electricity is generated. The heated water can be used for a variety of purposes, including heating homes. In one technique, collectors coated with black heat absorbing substance are placed on roofs or open points and water circulated through them. In another technique, and array of mirrors that can be automatically manipulated to turn in the direction of the sun, concentrate the solar rays on overhead tanks (boilers) where steam is generated. The steam is than fed into the turbine of the generator as is the case in thermal plants.

28) Gupta C.L.

"Solar Energy for Plantation Crops: Scope and Issue" in this paper author opined about currently available solar thermal and PV technologies in India relevant to Plantation Industry's energy demands are outlined. Significant examples of integrated rooftop solar air heating for tea processing, large scale solar water heating for industrial use, solar buildings for cold climate, architecturally integrated solar thermal systems, stand alone rooftop solar PV for a research centre and a biomass based power system are described. A proper integration of these technologies for meeting the energy needs of plantation crops is posed as the challenge of the decade.

29) Bulmenberg Jurgen

"Solar Drying of Agricultural Products- Case Studies" in this paper author take an overview of several international solar drying projects such as in Spain, Indian and Nepal is presented. Different types and sizes of solar and solar-assisted drying devices such as small local cabinet dryers, medium size solar dryers with venture assistance and ventilator, solar drying devices using slopes and chimneys and large solar drying plants for tea processing are discussed. An usually successful solar drying

project in a typical underdeveloped country (Lower Mustang Area in West-Nepal) is described in detail. Partners in the project were a village community represented by the headman and a group of diploma students from Technical University of Munich under guidance of their teacher. An overview of the optimized construction of the solar drying plant, the food technological aspects of the dried products, the costs of the project and the experience of the German-Nepalese cooperation is provided. Further necessary research activities in the field of solar and solar-assisted drying (experimental and theoretical) are highlighted.

30) Venkatesh A.

"Solar Refrigeration and its Applications" in this paper author explain solar cooling can be a viable proposition for refrigeration, especially with regard to preservation of perishables, if not comfort air conditioning. The ever increasing cost of conventional energy due to the rapid depletion of fossil fuel and the combustion related pollution, will definitely favour viable solar devices in years to come.

The fact that a solar operated refrigeration system performs well when the intensity of solar radiation is high makes it attractive for cold storage applications as i) the demand for cooling is most when the solar radiation intensity is high and ii) the intensity of radiation is indeed high in tropics where most developing countries exist. Production of chilled water and food preservation are the most promising areas of application of solar cooling. It has particular relevance to India where considerable quantities of dairy farm and marine food perish for want of suitable and adequate cold storage facilities as the place of origin are more often that not either far away from the grid and major highways or conventional energy sources are not readily available. In such a scenario, the producer

is forced to sell his products at distress rates causing a glut in the market at the time of production and scarcity during off season.

The viable solar technologies available for solar refrigeration can broadly be classified into three, namely, vapour compression refrigeration system, vapour absorption refrigeration system and vapour jet refrigeration system. The system are described and their relative merits and demerits with respect to their performance, operation and maintenance are discussed.

31) Ragunaathan K.E.

“Techno-Economic Aspects of Solar Water Heaters” in this paper author stated solar water heating system is a commonly available technology to heat water to a maximum temperature of 80C to be used in household, hotels, hospitals, industrial canteens, boiler preheating applications etc. Each solar system comes with solar collectors, solar tank, pump and control (if needed) and piping connections between solar tank and collectors. The various possible designs are thermosiphon, closed loop-forced and open loop-forced circulation systems. The water heated during the daytime is stored in an insulated tank. Normally the solar water heating systems have a life span of 12-15 years. The solar collectors consist of copper pipes, brazed with copper absorber sheet which is coated either with black paint or a selective coating. This construction is enclosed in an aluminium casing with insulation at the bottom and sides and covered by toughened glass at the top.

Normally, the cost of solar water heating system for 60^0C application is about Rs.130/- per lit. including installations e.g. 2000 LPD at 60^0C solar water heating system costing about Rs.2.6 lakhs can save nearly Rs.325/- worth electrical energy units every day. The pay back

period of solar water heating system can vary from 2 to 4 years depending on the application. These systems are eligible for 100% depreciation in the first year apart from loan assistance at concessional rate from IREDA for systems costing more than 2.5 lakhs.

32) Srivatsan R.

"Some Elementary Aspects of SPV Applications" This paper explains some of the elementary aspects of SPV (solar photovoltaics) system applications language that is accessible to the potential user who does not have specialized knowledge of SPV technology. It familiarizes the user with the engineering terms, system and sub system function, selection criteria and criticality of each part of the SPV application. A few SPV applications are described in order to give the potential user a feel for what SPV system are like. The systems described increases in size and complexity from the multipurpose lantern to the full scale power station.

Report:

1) "Solar Water Heaters in India: Market Assessment Studies and Surveys for Different Sectors and Demand Segments"

Final report submitted to Ministry of New and Renewable Energy by Greentech Knowledge Solutions. In this report following recommendations are given.

1) MNRE should identify 10-20 districts and focus its attention on implementing SWH programme during the first phase of JNNSM (2010-2013) in these districts.
2) MNRE should set-up a working group to initiate a dialogue with Ministry of Power, Electricity Sector Regulators and Electricity

Distribution Companies to develop a SWH programme for implementation through Electricity Distribution Companies by 2011.

3) MNRE should initiate work with selected (3-5) municipal corporations and state governments having prior experience in implementation SWH mandatory regulations to update the regulations and develop a fool-proof strategy for implementation.
4) MNRE may set-up a task force to study the issues and for developing a comprehensive strategy for multi-storey residential buildings.
5) MNRE should develop targeted and variable incentive packages that takes into account the specific requirements of different regions, sectors and vintage of buildings.
6) MNRE should work out a blue print for the development of appropriate products, supply chains and a policy package focused on developing rural market for SWH.
7) MNRE needs to work on a package of fiscal/ monetary/ subsidy policy to promote industry- consolidation, product/ technology development appropriate to low/ middle income group market visible and extensive distribution network, quality-standards and rating. It will help if the industry, on its part, work out a collective vision and strategy for realizing market-volume projected under the report.
8) MNRE should consider giving this responsibility to an independent organization to develop and maintain a database of SWH manufacturing, sales and installations.

Unpublished Ph.D. Thesis

1) Warad A.U.

"Studies on Electrochemical Photovoltaic Solar Cells Formed with Bi Doped Cds Films" (1984) Submitted to Shivaji University, Kolhapur. In this thesis author describe on energy conservation. All other parts of this thesis related to physics subject.

Unpublished M.Phil. Thesis

1) Patil Sandip

"A Study of Solar Energy System in Southern Maharashtra" (2001) Submitted to Shivaji University, Kolhapur. Researcher first decide objective for the study to know about different government schemes related to the solar energy systems in Southern Maharashtra. After doing the study researcher come to know major percentage of people are well aware of government facilities encouraging people to use solar energy. They came to know about government facility through different exhibitions, seminars, get together done at local level by government nodal agencies. Researcher also come to know people are preferring the solar systems due to heavy subsidy available on the solar system and soft loan scheme to purchase the same.

1.3 STATEMENT OF THE PROBLEM

The entire above discussion researcher felt that non renewable energy is not enough for getting hot water for domestic use and renewable energy widely available for use. Researcher want to know how much solar energy used for getting hot water for domestic use and market analysis (SWOT) of solar water heaters in Satara District.

1.4 OBJECTIVES OF STUDY:

1. To study non - renewable and renewable energy.
2. To study regarding solar water heating systems.
3. To identify the strengths, weaknesses, opportunities and threats (SWOT analysis) of market of solar water heaters in Satara District.
4. To put forth the suggestion if any.

1.5 RESEARCH METHODOLOGY:

In order to study the above mentioned objectives, researcher collected the reliable information pertaining to the solar water heating systems.

For accomplishing the above objectives collected both primary and secondary data. Primary data collected through survey method by administering a separate structured interview schedule to the identified sample respondents of the user and non user of solar equipments in Satara district. Secondary data collected through documentary research method.

1.6 PRIMARY DATA:

Primary data collected directly from the respondents through direct discussions and structured questionnaires method, with the view, to collect the useful information pertaining to the market analysis of domestic solar water hearers.

Researcher personally conducted interviews with the selected respondents from the Satara district. In order to obtain more relevant information; which was not cover in structural questionnaires, researcher done personal discussion with the respondents.

A comprehensive survey carried out by contacting the citizens and data collected by using structural questionnaire. User and non user of domestic solar water heater systems are the prime resource in primary data collection. one structured questionnaire prepared.

1) Questionnaire for domestic user and non users of solar water heating system.

1.7 SAMPLING:

For any research study, a scientific sampling method should be adopted. Only when the sample is representative of the total population, valid inferences can be drawn from the sample. In the present study the geographical scope of the population includes 11 talukas of the Satara District. Observing the spread of the population in the talukas, it can be seen that population is not evenly spread out in the district. In order to get a true representative sample for the study, the following methodology adopted. By considering the spread of the study, it will be decided to use the population of the respective taluka as the base for selecting the sample size.

- **Domestic user –** A household which uses solar water heating system for individual or family consumption.

1.8 QUOTA SAMPLING:

Initially a quota of 500 sample units decided.

1.9 PROPORTIONATE SAMPLING:

To ensure that weightage give to the sample units according to the strength of the population of the taluka, the method of proportionate sampling adopted at the taluka level.

For example in case of Karad Taluka, the population of taluka is 5,43,424. The proportionate sample size to be drawn from Karad taluka calculated by the following formula.

$$\text{Sample size for Karad} = \frac{\text{Total population of the taluka}}{\text{Total population of Satara}} \text{ X (Quota sample)}$$

$$= \frac{5,43,424}{28,08,994} \text{ x } 500 = 97$$

Therefore, 97 respondents select in the sample from Karad taluka of Satara district. This sample method adopted to get the figures of sample size drawn from other talukas of the district. The distribution of the sample units obtained by the above method presents in following table.

Table No. 1.1: Distribution of sample over different Taluka in the district.

Sr. No.	Taluka	*Population of Taluka	Sample size Domestic solar User and Non User
1	Mahabaleshwar	54,546	10
2	Wai	1,89,336	34
3	Khandala	1,19,819	21
4	Phalton	3,13,627	56
5	Maan	1,99,598	36
6	Khatav	2,60,951	46
7	Koregaon	2,53,128	45
8	Satara	4,51,870	80
9	Jawali	1,24600	22
10	Patan	2,98,095	53
11	Karad	5,43,424	97
	Total	28,08,994	500

*Socio Economic Abstract Of Satara District, 2005-2006

1.10 CONVENIENCE SAMPLING:

Within taluka the method of convenience sampling adopted to select the respondents.

1.11 CARE taken to include the respondents from all type, (i.e. self employed, Industrial, Traders, Employees, Govt. servant etc).

Thus, the sampling technique used in the study was quota, proportionate and convenience sampling.

1.12 SECONDARY DATA:

Secondary data collected from Books, journals, newspaper and magazines, annual reports of companies etc. Researcher visits various Govt. offices to collect related information.

The researcher visits various libraries to collect relevant literatures on market analysis of domestic solar water heating systems, such as:

1) Shivaji University Library, Kolhapur

2) SIBER library, Kolhapur

3) Arts and commerce college library, satara.

1.13 SCOPE OF THE STUDY

The geographical scope of the present study covers the Satara district of Maharashtra state. The topical scope of the present study is restricted to market analysis of domestic solar water heaters. An analytical scope covers the aspect of objectives present for the study. The functional scope includes cohort findings for effective marketing strategies.

1.14 LIMITATIONS:

1) Conclusions drawn from the surveys are limited for Satara district only.
2) The researcher has selected random sample so as to cover the representative samples in given time period.
3) The study is limited to market analysis which is part of marketing, special reference to domestic solar water heating systems.

1.15 VALIDITY OF THE STUDY

Present research will throw light on present solar water heaters market, It is very useful for those people who are in the business of solar water heaters. This research may be the proper base, as it is representing the opinion of the people about the solar water heaters. It is may help the organization in deciding the market policies regarding solar water heaters.

1.16 OUTLINE OF THE STUDY

CHAPTER-1 Research Design

In this chapter introduction about the subject, objectives of the study, data collection methods, scope and limitation of study is discussed.

CHAPTER- 2 Theoretical frameworks

In this chapter, the conceptual background with respect to the market and marketing , SWOT analysis highlighted.

CHAPTER-3 Information related to energy and solar water heaters

This chapter covers information about non renewable energy, renewable energy, solar energy and solar water heaters.

CHAPTER-4 Data presentation and analysis

The survey data is being tabulated and a analyzed with the help of tables and graphs.

CHAPTER-5 Findings and suggestions

Based on various information of the suggestions were made in the light of the conclusion from the study.

Chapter 2

THEORETICAL ASPECTS OF THE STUDY

2.1 The Market

2.1.1 Concepts of Market

2.1.2 Features of Market

2.1.3 Factors Affecting the Size of Markets

2.2 Marketing

2.2.1. Concepts of Marketing

2.2.2 Functions of Marketing

2.3 SWOT Analysis

2.4 SWOT Analysis of Market

Chapter 2

THEORETICAL ASPECTS OF THE STUDY

2.1 The Market

Market is a group of buyers and sellers. They are interested in negotiating the terms of purchase/sale of goods/services. The negotiation may be face-to-face at a certain place.

Following are the some definitions of markets.

American Marketing Association – "A market as the aggregate demand of the potential buyers for a product /service."

P. Kotler – "A market is an area for potential exchanges."

Professor Jerons – "Market means any body of persons who are in infinite business relations and carry an extensive transactions in any commodity."

Mr. Pyle – "Market includes both place and region in which buyers and sellers are in free competition with the another."

Professor H.E. Mitchel – "In fact, the market must be thought of not as a geographical meeting place but as any getting together of buyers and sellers in person, by mail, telephone, telegraph or any other means of communication."

2.1.1 Concepts of Market –

1. Place Concept :- A market is a place where buyer and seller come together and do activity of buying and selling. e.g. a spot, cash or physical market, wholesale or retail market.

2. Area concept :- A market develops in any area, small or large, the moment there are three prerequisites for exchange : (a) Two or more persons have unsatisfied wants. (b) They have products to exchange, and (c) They have some means of communication such as Phone, internet, correspondence, etc. With the means of communication buyers and sellers can establish close and continuous contents and exchange of products without formal face-to-face meeting. In such a market, price uniformity can be easily established place-wise through transport and time-wise through warehousing. In this way, we have a national and international market for many products. The meeting place for exchange is not essential and it is for convenience only. For example, a money market is a highly organized market for the entire nation without any central meeting place for borrowers and lenders of money.
3. Demand Concept :- Total customer demand is also used for represent the term market. In this sense, market means people with needs to satisfy, the money to spend and the will to spend money to satisfy their wants. The human beings have varied, ever-changing and endless wants. The process of want satisfaction is continuous and under keen competition, sellers want to create, capture and retain the market (customer demand) for their goods. From a sellers point of view, a market offers an opportunity to seek success through the development and implementation of a marketing programme which will meet customer needs and desires. When sellers product has no demand then he priced out of the market. Every product has a life cycle, what is popular tody may not be popular tomorrow. In the market environment buyer behaviour and compition are the main changing variable.

2.1.2 Features of Market

After studying above concept of ‘market’ we reveal the following features.

1) Meeting place for exchange is recurred for convenience only.
2) Buyers (demand) and sellers (supply) are the main two sides of the market.
3) For creating market there is need to meet minds and not required to meet face-to-face, wherein we have one single price for an article of exchange the price determined by the free play of demand and supply.
4) It is presumed that there is free competition in the market sellers and buyers.
5) Usually money acts as the mean of exchange and the act of exchange involves transfer of ownership and possession from a seller to a buyer in the market.

2.1.3 Factors Affecting the Size of Markets :-

We have many variable that affect the size of market.

1) Demand:- The market for products whose demand is very high, will be spread over large geographical dimension provided they are durable and can be easily transferred from one place to another e.g. Cement.
2) Infrastructure :- The market size depends upon the infrastructural facilities of that place. Transportation cannot be carried out with improper infrastructure which hampers the growth of the market.
3) Credit facilities :- Where raising funds and credit for business is easily available there is great scope for the expanding market. A

sound system of financial institutions gives opportunities to the upcoming and existing the business units.

4) Governments :- Where the government policies and rules for trade do not favour the business, always carry a risk to taking the business expand in such a state of affairs. Moreover the political conditions of the country should also be as stable as possible to four the markets.
5) Durability :- Non-durable or perishable product cannot have a wider market. The market of a durable product will definitely be wider because being long-lasting it can be dealt with for any length of time.

2.2 Marketing :

The marketing term is widely misunderstood. Even persons involved in marketing misunderstood the term. Generally, the purchase and sale of commodities is taken to mean marketing. Thus, a producer and businessman consider marketing a selling activity, whereas a purchaser feels that purchasing goods is marketing. But marketing is not only purchase and sale of commodities. It is something more.

Goods and services do not move automatically from the producer to the end user. There is the mechanism to bring products at users door-step against exchange value. This value may be satisfaction to the consumers and surplus to the producers and manufacturers. Marketing is the belt that connects the two major wheels of any economy namely, producers and consumers. In industry, commerce and trade there is a common function – the exchange function. This important and powerful function is termed as marketing. Thus, marketing here means exchange of goods for money or money's worth.

Marketing, in its earlier definition and in legal aspect is said to be the effort by which the transfer of ownership in goods between the seller and buyer is effected-emphasises ownership transfer. It limits the scope of marketing to mere transfer of ownership. “Marketing includes all activities which are concerned with effecting changes in the ownership and possession of goods and services.”

Marketing in economics point of view, is defined as the exchange function by maintaining supply and demand in equilibrium. In this object of marketing is create welfare and improve standard of living to the society.

“The phase of business activity through which human wants are satisfied by the exchange of goods and services for some valuable consideration.”

2.2.1. Concepts of Marketing :

Marketing concept is referred to relation of organizations philosophy. Every organization have his own philosophy to work. The organization works on some established principles. Marketing goes under four concepts since revolution of marketing. These are as follows-

1] Concept of product :-

In this concept management believes that if our product is good qualify then customer will give response automatically. They also know if they take little efforts for selling product then customer will give definitely favourable response. This type of philosophy of marketing upto 1930. in this concept management take little efforts for promoting their products they think supply only best quality product, customer will come

without any hegitation. The price of product doesn't matter in this concept.

2] Concept of Selling:-

In this concept of marketing it points out that we cannot have enough customer response without promotional efforts. If we supply best quality product then also we cannot get assured sale without the help of sales promotion and aggressive salesmanship. The selling concept gives stress on high pressure salesmanship to secure marketing success.

This concept assumes that consumers will not buy enough of the company's products as long as they are not approached through intensive sales promotion, advertising and salesmanship efforts. Such a marketing concept points out that goods are not bought but they have to be sold with the help of salesmanship, advertising and publicity.

3] Concept of Marketing :-

This concept comes in force after 1950. This concept also recognized as modern marketing concept. Customer oriented marketing approach points out that the primary task of a business enterprise is to study needs, desires and values of the potential customers, and on the basis of latest and accurate knowledge of market demand, the enterprise must produce and offer the products which will give the desired satisfaction and services to the customer better than its competitors. The meaning of marketing concept is the heart of the entire business system. There is no value for product & their quality. It emphasizes customer oriented marketing process. All business operations move around customer satisfaction & service plans, policies and programs of marketing are formulated to serve efficiently customer demand. Marketing research and marketing information service is expected to provide adequate,

accurate and latest information related target markets and current consumer demand as well as dealers demand to the marketing managers and on the basis of such realistic information, they will take sound decisions on any marketing problem. The entire marketing policies will be formulated on the basis of marketing information and research.

4] Concept of Social Marketing:-

This is very broad concept of marketing. Environmental trends like public welfare, concern for better living environment or quality of life, etc. indicate that organizations would have to adopt socially responsible marketing policies and plans in order to assure social welfare in addition to consumer welfare.

This concept is based on the following premises:

a) The goal of an organization is to create satisfied and healthy customer.
b) Without interest of consumer the organization offer product.
c) The organization will offer long run consumer and public welfare.
d) Marketing plans and programmes shall duly consider consumer wants, interest, social welfare and corporate needs, e.g. long run profitable sales to assure survival and growth.

2.2.2 Functions of Marketing :

The delivery of goods and services from manufacturers to their end users includes many functions. These functions are known as marketing functions. Marketing function is, “an act or operation or service by which original product and the final consumer are linked together.” These functions we can group into three major points.

1] Merchandising functions :

In this marketing functions include all those functions of marketing which are performed in relation to create a demand of a product and to make it available in a specific market having some specific needs following are the functions include in this group.

i) Product Planning and Development :

Now a days every activity of a producer clusters around the needs and wants of consumers. Producer produces only those goods and services which are required by his customer. By this customer satisfaction may be achieved. Producer make the design, size, weight, price and packing of his product according to the changing needs and tastes of his customers. That's why first functioning of marketing is to plan product and to develop it so that it may satisfy the expectations of customers. The function of product planning and development was performed by production department in early stage of trade and commerce. Now, this work has also been delivered to the marketing department with a view to meet the consumer needs more effectively and easily. Therefore, now-a-days, all the important decisions related to product planning, product modification, product development, gradation, standardization, diversification, brand, packing etc. are taken by the marketing department.

ii) Buying :

Buying is the first step in the process of marketing. A producer has to buy raw material for production; a wholesaler has to buy goods to sell them to the retailer; a retailer has to buy goods to be sold to the consumer. Transfer of ownership of goods from seller to buyer it involves in buying. Buying is an intelligent work, buyer need specialized knowledge.

Speculate buying means buying to keep large stocks so as to derive the maximum advantage out of an expected price rise In future. Buying for inspection means the buyers before making a final decision, like to examine the goods.

iii) Assembling :

Assembling means creation and maintenance of the stock of goods, purchased from different sellers. The right type of assembling gives a streamlined approach to a hassle free process of marketing. This is also known as a concentration function in which all the goods are collected at a place near that of production. Assembling process involve related elements such as kind, quality, price, date of delivery and other terms and conditions. All these required specialized knowledge on the part of the buyers.

iv) Selling :

Selling is important from the point of view of the seller as well as the consumer as the little to the goods is transferred from seller to buyer only through selling. The profit making object of a business concern is achieved only through the sale of goods. After Industrial Revolution and increasing use of machinery, mass production has become possible which in its turn requires mass selling of goods. selling involves following steps:

Deciding about the product to be sold requires research and scanning of various matters related to selling. Supplied product does not get stable demand forever. Often consumers tastes and habits change so that modifications in the product become inevitable. Only developing a new product does not help. Innovation is an ongoing process.

Research in selling request a lot of home work to be done by the concerned department. Organizations categories sales on the basis of area, region, territory, zone etc. It is very important to be familiar with the type sale of a company so that the future sales can be estimated. The decision about the selection of proper channels of distribution provides a basis for the fair handling of goods unless they are directly collected by the consumer. A channel of distribution acts as a middlemen between the seller and the buyer. The channels of distribution can be in the form of wholesalers or relatives, dealers, distributors, franchisees, etc. who are concerned with profitable business in the context of the organization. It is a form of indirect selling where there is no direct contact between the buyer and seller. This is different from direct selling which is done for those goods that need visual demonstration or explanation about some specific aspects of the subject.

Demand creation means that people should be convinced to give a try to the product even if they may not be requiring it. Many times trial can create a satisfied, permanent customer. That means it is not merely the fulfillment of demand that is essential but also its creation among consumers. The existing demand is all right but the test of the company lies in its capacity to attract more customers.

Sales terms deciding upon prices to be fixed, additional concession to be given, etc.

After sales service of a firm that can add to its popularity. The consumer trusts the company from where he has bought and the maintenance of good relations with the consumer by the company through after sales services does benefit both the parties in the longrun.

2] Physical Distribution functions:

This functions of marketing are the activities performed for the purpose of distributing the goods and services to their consumer. These functions include all the functions related to the transportation of goods and services from the place of manufacturer to the place of end user. It includes following functions.

i) Transportation :

Marketing system requires low cost and effective transportation system. Transportation system increases the value of goods by the creation of place utility. The opening of new markets has been possible by the quick development of transportation and good communication. Expansion of markets possible only effective transportation. Further transportation make possible regular supply at lower price and improved services to the consumers.

ii) Storage and Warehousing :

Now a days storage is the very important activity of marketing. It is done for the preservation of goods, to protect them from getting spoiled. A proper storage leads to a reduction in the wastage of the product. It offers additional scope for marketing the product. Many products are not demanded throughout the year, but their production cannot be undertaken every now and then. For this reason, goods having a seasonal demand are stored for business when the time comes. Proper storage activity can prove to be a sound decision to meet the demand in times of shortage in the market.

Excess stock has its own drawbacks though a stage of shortage can prove worse. The firm may be forced to bring down or hike the prices. It

is advisable to make an attempt to foresee the future trends in the market. In that case storage will not be a problem and the firm will be able to adjust to the dynamic modes of the market.

A warehouse is a place or a large room for storing goods. generally every firm has a warehouse because the function of storage is inevitable part of production. Manufacturers can be maintained warehouse at central places form where the distribution can be made according to the needs of the consumers. Storage trends to adjust the supply to demand of the product and also holds the price line. Thus storage can be regarded as a function of equalization. It creates time and place utilities.

3] Auxiliary functions :

These functions make the marketing process simple and convenient. It includes the following functions.

i) Marketing Finance :

It means the arrangement of adequate finance for the distributing the goods and services to their end user. It is very important function of marketing because it is only imaginary to carry on marketing activities successfully without adequate finance. Every business need short term, medium term and long term finance.

ii) Standardization :

Marketing can give relief to the customers by standardizing the goods. Now a days standardization has now been accepted as an ethical basis of marketing. A standard is a measure that is generally recognized as a model for comparison. Comparison makes in quality, size, weight, contents, durability, etc. It facilitates purchases and sale of goods.

iii) Marketing Information :

Marketing information play a very important role in the success of an organization. A producer has to collect different types of market programme and policy according to these information. In market information various type of work done such as collection of data regarding trend of market, government policy, price policy of different business enterprises, tastes of consumers, change in fashion, scientific development, channels of distribution, media of advertisement etc. No business effort can be successful in the absence of these information. These information are collected by different business enterprises, specialized agencies, government and research scholars at different times. A businessman must collect all these information to get through these problems so that he may make necessary changes in his marketing policy and programme. Marketing information and its analysis led to marketing research which has now become an independent branch of marketing.

iv) Risk bearing :

Marketing have many types of risk. Some are the risks which can be insured, such as flood, fire, robbery, etc. On the other and, some are the risks which cannot be insured, such as fall in the prices, changes in the tastes of consumers etc. These risks can never be eliminated, how ever, these can be minimized through effective system of sales forecasting market research, advertisement, sales promotion, product diversification etc.

v) Pricing :

Marketing has much to do with pricing. There is plenty of homework to be done in fixing the product prices which should be stable to avoid confusion in the market. Changing prices disturb consumers and

perturb the peaceful market conditions. Price should be reasonably stable because they have much to do with the profit element. Pricing policy should be such that the cost involved in production is covered and a considerable amount of extra income is earned. Prices are also fixed. Keeping in mind the competitors prices, government policies, etc.

An analytical study of all the functions of marketing discussed above makes it clear that marketing is a very wide term including all the activities from the discovery of needs and wants of consumers to their satisfaction.

2.3 SWOT Analysis

Mainly business organasations make SWOT analysis to its external and internal environment . Due to this business organasations comes to know their strengths, weaknesses, opportunities and threats. In this regards following terms explained as-

1) **Strengths:-** A strengths means capacity which an organisation can use to gain stratgic advantage. e.g. the research and development skill in the organisation, team- sprit, the efficient communication system, flat structure of the organisation, skilled and knowledgeable employees etc.
2) **Weakness:-** A weakness means limitation or constraint which creats strategic disadvantage e.g. overdependence on a single product, hierarchy and multiple decision level, one way long communication etc.
3) **Opportunity:-** An opportunity is described as a favorable condition in the organisation environmental which enables the organisation to consolidate, rising income level a favorable government policy, reduction in tax rates are normally viewed as opportunities.

4) **Threat:-** A threat is defined as an unfavorable condition in the environment of the organisation which creates a risk for the organisation or causes damage to the organisation e.g. arrival of a new competitor, increase in tax-rates, availability of substitute product, an adverse government policy, decreased income level, depressive trade in the economy etc.

2.4 SWOT Analysis of Market:-

Any organization want more sell in market. That time organization makes SWOT analysis. This analysis enables the organization to know about its own strengths and weaknesses. This is to be matched with opportunities and threats existing in the environment. It enables the organization to formulate effective strategy. Thus effective strategy is describe d as the one that capitalizes on the opportunities through the use of strengths and neutralizes the threats by minimizing the impact of weaknesses.

The process of SWOT analysis consists of four steps which are as follows.

1) **Identifying strength and weaknesses:**

Strength is something a company is good at doing. It is the characteristic that gives the organization an important capability. The strength out of an organization may be in the form of an organization skill or capability, a valuable organizational resource, or an important organizational achievement etc.

A weakness on the other hand is something that an organization does not possess or does poorly in comparison with its competitors. A weakness is a condition that puts the organization at a disadvantage.

The company has to identify its strengths and weaknesses and enlist them. For this purpose it has to search out as to which factors are more crucial and important.

a) In determining performance.
b) In competing with other organizations, efficiently.
c) In formulating powerful strategy.

2) Developing core competencies:

A core competence is described as any advantage a company has over its competitors because it can do something better than the competitors can. In other words, it is something which a company does especially well in comparison with its competitors. It provides the organization the capability to capitalize the opportunities which are existing in the external environment. In order to develop core competencies, the organization has to consolidate its different skills and technological human and knowledge resources relating to production, marketing, finance etc. The organizational resources combined with the typical organizational behavior, together lead to the development of core competencies. Some important core competencies which provide an organization a competitive advantage is as follows:

a) Excellent quality management
b) Effective cost control and cost reduction
c) Consistent research and innovations
d) Technology development and utilization
e) Ability to provide prompt and efficient service
f) Sound goodwill and high creditworthiness.

3) Identifying Opportunities and Threats:

The opportunities and threats create favorable and unfavorable conditions for the enterprise. The factors leading to

such conditions are to be analyzed in the context of the strengths and weaknesses of the organization. Because what is perceived as opportunity by one organization; may be perceived as a threat by another organization. Further there may be an opportunity or threat for the whole industry or for a specific firm. Therefore an appropriate analysis of environment is necessary.

4) **Strategic cost analysis:**

In SWOT analysis, cost comparison and evaluation is an important step. Cost is a critical factor which decides the strength: or weakness of the firm. Lowest cost produces a competitive advantage and gives the firm an edge over competition. The different elements of cost are to be studied and monitored efficiently. The major components of cost are as follow.

a) Cost/ price of raw materials and component parts.
b) Wages and salaries of employees
c) Operating expenses

These elements of cost are to be studied carefully and the control points should be located. Steps are to be taken to avoid all kinds of wastages, spoilages and unproductive expenses.

SWOT analysis, in fact makes an assessment and appraisal of the internal environment of the organization and tries to match its capabilities with the external environment. The important potential SWOT elements are as follow;

Potential Strengths

1) Cost advantages
2) Proven management
3) Core competencies in key areas
4) Adequate financial resources

5) Organizational loyalty among buyers
6) Market Leadership
7) Well conceived functional strategies
8) Access to economies of scale
9) Proprietary technology
10) Effective advertising
11) Product development and innovation skill
12) Manufacturing efficiency

Potential Weaknesses

1) Lack of strategic vision and direction
2) Obsolete facilities, methods and techniques
3) Absence of suitable managerial talent
4) Negligence to research and development
5) Narrow product line
6) Weak market image. Bad reputation.
7) Absence of quality orientation and quality perspective
8) Lack of cost control awareness and machinery
9) Inadequate resources to finance the required changes
10) Absence of marketing and distribution efficiencies
11) Absence of backward and / or forward integration
12) Weak communication and market information system

Potential Opportunities

1) Fast growing market
2) Fall of trade barriers in foreign market
3) Rising income level and emergence of new customer class
4) Liberalization and globalization
5) Possibilities of alliances and vertical and horizontal integration

6) Favorable changes in government policies, tax and other related laws
7) Scope for diversification
8) Evolution of consumption-culture
9) Development of new markets
10) Emergence of industrial climate and incentive to entrepreneurship

Potential Threats

1) availability of substitute products
2) Slow market growth and stagnant market
3) Changes in customers needs and priorities
4) Conservative government policies and trade restrictions
5) Entry of foreign competitors
6) Rising consumerism and increasing bargaining power of buyers
7) Recessionary pressure of business cycle
8) Adverse changes in the volume and composition of population
9) Increasing cost of capital and pessimistic attitude of investors
10) Changing life style and cultural transition.

Chapter 3

INFORMATION RELATED TO ENERGY AND SOLAR WATER HEATERS

CHAPTER- 3

INFORMATION RELATED TO ENERGY AND SOLAR WATER HEATERS

3.1 Energy

Can you imagine life without lights, fans, cars, computers and television or of fetching water from the well and river? This is what life would have been like had man not discovered the uses of energy – both renewable and nonrenewable sources.

Energy lights our cities, powers our vehicles, and runs machinery in factories. It warms and cools our homes, cooks our food, plays our music, and gives us pictures on television. Energy is defined as the ability or the capacity to do work.

We use energy to do work and make all movements. When we eat, our bodies transform the food into energy to do work. When we run or walk or do some work, we ‘burn’ energy in our bodies. Cars, planes, trolleys, boats, and machinery also transform energy into work. Work means moving or lifting something, warming or lighting something. There are many sources of energy that help to run the various machines invented by man.

The discovery of fire by man led to the possibility of burning wood for cooking and heating thereby using energy. For several thousand years human energy demands were met only by renewable energy sources—sun, biomass (wood, leaves, twigs), hydel (water) and wind power.

As early as 4000–3500 BC, the first sailing ships and windmills were developed harnessing wind energy. With the use of hydropower through water mills or irrigation systems, things began to move faster.

Fuel wood and dung cakes are even today a major source of energy in rural India. Solar energy is used for drying and heating.

With the advent of the Industrial Revolution, the use of energy in the form of fossil fuels began growing as more and more industries were set up. This occurred in stages, from the exploitation of coal deposits to the exploitation of oil and natural gas fields. It has been only half a century since nuclear power began being used as an energy source. In the past century, it became evident that the consumption of non-renewable sources of energy had caused more environmental damage than any other human activity. Electricity generated from fossil fuels such as coal and crude oil has led to high concentrations of harmful gases in the atmosphere. This has in turn led to problems such as ozone depletion and global warming. Vehicular pollution is also a grave problem.

3.1.1 Need of Energy:

Energy is one of the vital infrastructural facility which is used extensively by almost all the sectors of the economy including industry, agriculture, transport, household and service sectors.

1) Household:

In household sector, the energy is used directly to meet our daily needs. The main use of energy for this sector is for cooking. In rural areas the energy for cooking comes mainly through firewood and dung. The urban area, however, are meeting their cooking needs through gas, electricity and kerosene oil. Besides cooking the household sector uses energy for lighting.

2) Agriculture:

There was a time when all agricultural activities were performed manually. Animal power is still used for ploughing the fields. However, it is being gradually replaced by tractors. Tractors work by using the energy derived from diesel. The uncertainty with regard to mansoons have made it desirable to use reliable sources of irrigation like tube-wells, water pumps etc. These devices use energy inherent in power or diesel. Use of such mechanical devices helps in increasing productivity i.e. higher output per hectare of land. The agricultural sector could not have used these devices without help of energy.

3) Industry:

Industry uses various types of machines for production of goods. These machines not only increase the production but also save a lot of time. Energy is used extensively in the form of power for running these machines in the industry. Energy is also used in the form of fuel for various heating operations. You must have seen how a blacksmith works. He first heats up the iron before he finally shapes it. Industry uses various types of furnaces which heat up the materials with the help of coal, oil and power. Heating of materials is necessary if further operations like bending, rolling etc. are to be performed. Likewise energy is also required for lighting.

4) Transport and communication:

Transport sector is one of the major, consumers of energy. Road transport uses petrol and diesel. Though rail transport started with the invention of steam engine, in modern times rails run mainly by using the energy drawn from power and disease. Means of communication like

radio, television etc. are also dependent upon energy resources like power.

3.1.2 Characteristics of Energy:

Energy is totally related to power, such as industry power, consumer power, natural power etc. Economic and military power of the country depends on many factors but significant among them is access to abundant cheap energy supplies to support industry and trade in that particular country.

Many of the countries in the world are influenced by access to the raw materials for energy production. It is interesting to know the significant role of the Middle East in the world politics as it is rich with crude oil.

Many multinational industries have strong vested interests in energy supplies. Some of them are using new technologies to exploit energy supplies. Others are blocking new energy technologies because they might threaten their dominant position in current energy markets. But there is no ideal energy source. Energy sources have a number of characteristics which influence their usefulness to humans. In general, the most concentrated forms of energy are the fossil fuel, where millennia of solar power have become concentrated into gas, coal or oil. But these, by their nature are the least long lasting and the most environmental causing damage. It causes great air pollution and ecological imbalance.

3.1.3 Types of Energy:

There are many types of energy. These are classified as follows.

1) Mechanical energy: is the energy of motion that does the work like the wind turns a windmill.

2) Heat energy: where motion or rise in temperature is caused by heat like a fire at your fireplace.
3) Chemical energy: It is the chemical reaction causing changes, food and fuel both stores chemical energy.
4) Electrical energy: It is when motion, light or heat is produced by an electrical current like the electric coils on your stove.
5) Gravitational energy: where motion, like water going over a dam is caused by gravity's pull.

3.2 Renewable energy:

The key characteristics of renewable energies are that the energy sources are continuously available. In some cases, like hydropower and biomass, continuous availability requires good management of raw material e.g. tree plantation or river management. Other renewable resources are solar and wind power which is available for the foreseeable future without any human intention.

Advantages:

1) Widely available
2) Low running cost
3) Decentralized power production
4) Minimum pollution
5) Available for the foreseeable future

Disadvantages:

1) Unreliable supply
2) Produced usually in low quantities
3) Very difficult to store
4) High cost compared to other types

3.3 Non-renewable energy:

This type of energy includes all the fossil fuel such as coal, oil, gas and their derivatives such as petrol and diesel. The non-renewable sources are finite in stock because their rate of formation is so slow that there current availability is the stock level for tomorrows world.

Advantages:

1) Available in highly concentrated form
2) Stored easily
3) Reliable supply
4) Low cost per unit due to technology matured

Disadvantages:

1) Highly polluting
2) It is available in few places
3) Running cost is high
4) Limited supply and will get exhausted one day

3.4 Sustainable energy:

Sustainable energy is a term sometimes applied to clear power. The supplies are not exactly renewable but they will last for a very long time because a great deal of electricity is produced from a small amount of radioactive material.

Advantages:

1) Highly reliable
2) Process large amount of energy with very little carbon dioxide emissions
3) Uses small amount of raw material per unit energy production

Disadvantage:

1) Risk of radioactivity.
2) High waste disposal cost.
3) High capital investment and maintenance cost.

3.5 Sun:

Sun is the source of our all sorts of energy and remains as principal deity since human thinking began. In Hindu scriptures we began with ‘Ekam, Adityam’, which means only one is Aditya. That means Aditya or sun was only god when the civilization begun. Therefore, sun remains as the principal deity right from the beginning and even today. A Hindu begins his ritual with surya namaskar.

Before we invented fire, sun was the only source of energy using the sun rays for drying or for other purposes.

Sun is the core of solar system around him all the planets move. In other words, unless the contradicted the planets were born out of sun and therefore for all practical purposes are son of sun. therefore, sun remains as our father figure and as we give respect to our ancestors, we give our respect to our father sun.

3.5.1 Solar energy options:

Energy is very critical to all development aimed at human welfare covering household, agriculture, transport and industrial sectors. There is also a direct correlation between the level of economic development and energy consumption. Countries all over the world have now begun to think about a policy on energy and look into the possibility of having energy systems with no or very limited environmental impacts. They now draw plants to use non-renewable sources on a sustainable basis as also

replace them with renewable sources. It may be emphasized that most renewable sources of energy are environmentally rather sound and could especially help to meet decentralized rural energy requirements. This itself could stall environmental degradation by fuel substitution, greater efficiency in energy production and use improvement and identification of alternative sources.

The commercial energy consumption in the developed countries has increased during the last 3-4 decades. More than 80% of total world which account for only 30% of the population on the other hand 20% of the energy is consumed by 70% of the world population in developing and socialist countries. Furthermore there had been a major shift from coal to oil on account of the increased availability as also many technological advances in the area of oil. The very high consumption of energy in advanced countries is due to the ready access to energy for the daily life of the peoples, heating, cooking, lighting, domestic work etc. In the developing countries the energy (particularly commercial) consumption is concentrated in the urban areas for industrial, commercial and even domestic use. The non-commercial energy is typically concentrated in rural area through the use of firewood, agricultural residues, animal manure and human and animal power.

The economic history provides a powerful study of arguments for solar energy. Two major energy transitions have swept the world in the last 125 years. First, coal replaced the wood as the dominant source of commercial energy. Coal itself was displaced by oil and gas. Both these changeovers occurred with breath taking speed. The figure above shows the way we change over quickly to easy access for the energy.

Solar energy now makes economic sense at the margin which means that the energy from a unsubsidized new nuclear power plant (if there were such a thing) would cost more than that from an unsubsidized new solar energy. If the society's scare capital is to be invested efficiently, the microeconomic interest of individual consumers must be brought more closely in line with the macroeconomic interest of the nation. Only through federal policy can such an alignment come about. The energy system of our country is complicated. A historical force of in its own right its many threads are woven into the fabric of our lives. Moreover, an enormous amount of capital has been invested in equipment designed to use or produce fuels that are becoming increasingly expensive. Therefore, shifting to an economy fueled by renewable resources require taking action of many kinds of many fronts. Nothing less than a major technological revolution will be necessary outlying the several steps towards this goal all Indians support makes more sense than attempting to chart the entire journey. Since some new opportunities will arise technological breakthrough or holdups will change priorities and human wisdom will find new paths, the key is to design policies that maximize our opportunities for future flexibility.

The programme we envision is both more modest and more manageable than the moral equivalent of war. It is a practical plan for correcting the distortions in the energy market place by reconstructing the subsidies regulations and other public policies that bias the market in favour of the development and production of conventional fuels. Huge uncertainties impede public and official understanding of the impact of policies to promote solar development.

Most of the principal tools of policy analysis reflect the assumption that life will not change dramatically in the foreseeable future with a patency false assumption as applied to energy policy.

Some uncertainly systems from the longstanding neglect of solar technologies by policy markets. In like of data on likely impacts of such policies, and yet must now rely almost solely on judgment. Whether the result are dressed in computer language or dashed off on the backs of envelopes.

3.5.2. Advantages of solar energy:

1) Solar energy is free though there is a cost in the building of collectors and other equipments required to convert solar energy into electricity or hot water.
2) Solar energy does not cause pollution. However, solar collectors and other associated equipments/ machines are manufactured in factories that in turn cause some pollution.
3) Solar energy can be used in remote areas where it is too expensive to extend the electricity power grid.
4) Many everyday items such as calculators and other low power consuming devices can be powered by solar energy effectively.
5) It is estimated that the world's oil reserves will last for 30 to 40 years. On the other hand solar energy is infinite. (forever)

3.5.3 Disadvantages of solar energy:

1) Solar energy can only be harnessed when it is daytime and sunny.
2) Solar collectors, panels and cells are relatively expensive to manufacture although prices are falling rapidly.
3) Solar power stations can be built but they do not match the power output of similar sized conventional power stations. They are also

very expensive.

4) Unreliable climate means that solar energy is also unreliable as a source of energy. Cloudy skies reduce its effectiveness.
5) Large areas of land are required to capture the sun energy. Collectors are usually arranged together especially when electricity is to be produced and used in the location.
6) Solar power is used to charge batteries so that solar powered devices can be used at night. However the batteries are large and heavy and need storage space. They also need replacing form time to time

3.6 Solar energy: A SWOT analysis:

We analyze strength, weakness, opportunity and threat for any concept of process we propose. In this case also SWOT analysis is necessary so that the analysis shall be considered right at planning stage for ultimate success. SWOT analysis of solar energy is given below.

Strength:

1) Source of energy is never ending.
2) Totally pollution free.
3) Can be utilized for all purpose.
4) Can be utilized in any form of energy.
5) Scope for decentralization.
6) Easy to operate.
7) Minimum working expenditure.
8) Saves fossil fuel deposit.
9) Economically self sufficient.
10) Less hazardous.

Weakness:

1) Problem of storage.
2) Not available in cloudy or eclipse days.
3) Quantum varies according to season or weather.
4) Initial investment is high.
5) Needs subsidy.
6) Spares not available.
7) Creates problem for urban planning since higher buildings interrupt lower solar system.
8) Not yet taken on priority list.

Opportunity:

1) Scope for utilizing magnetic energy from solar wind.
2) By bringing down the price, it can be boon even for low income group.
3) Chance of hazards is less.
4) Scope for decentralization.
5) Chance of adverting exploitation of energy consumers.
6) Totally pollution free.
7) Vast opportunity for expansion in many use.

Threat:

1) Threat from oil lobby.
2) Threat from coal lobby
3) Opposition from different forces due to subsidy.
4) Lack of knowledge of common consumers.
5) Fluctuation due to season or weather may discourage consumers.

3.7 Solar water heater :

Solar water heaters currently available the economic and environmental benefits of owing a system. This could be helpful in selecting a system for your home or industry.

Solar water heaters are cost competitive in many applications when you account for the total energy costs over the life of the system. Although the initial cost of solar water heater is higher than that of conventional water heaters, the fuel (sunshine) is free plus, they are environmentally friendly. To take advantage of these heaters, you must have an unshaded south facing location (a roof, for example) on your property.

These systems use the sun to heat either water or a heat transfer fluid, such as a water glycol antifreeze mixture, in collectors generally mounted on a roof. The heated water is then stored in a tank similar to a conventional gas or electric pump to circulate the fluid through the collectors.

Solar water heaters can operate in any climate. Performance varies depending in part on how much solar energy is available at the site, but also on how could the water coming into the system is. The older the water heater more efficiently the system operates. In almost all climates, you will need a conventional backup system. In fact, many building codes require you to have a conventional water heater as the backup.

3.7.1 Solar water heaters benefits:

There are many benefits to owing a solar water heater, and number one is economics. Solar water heater economics compare quite favorably with those of electric water heaters, while the economics aren’t quite so

attractive when compared with those of gas water heaters. Heating water with the sun also means long term benefits, such as being cushioned form future fuel storages and price increases and environmental benefits.

1) **Economic benefits:**

Solar water heaters offer the largest potential saving compared to electric heating, with solar water heater owners saving as much as 50% to 85% annually on their utility bills over the cost of electric water heating.

However at the current low prices of natural gas, solar water heaters can't compete with natural gas water heater in most parts of the country except in new home construction. Although you will still save energy costs with a solar water heaters because you won't be buying natural gas it won't be economical.

Paybacks vary widely, but you can expect a simple payback of 3 to 8 years on a well designed and properly installed solar water heater. (Simple payback is the length of time required to recover your investment through reduced or avoided energy costs). You can except shorter paybacks in areas with higher energy costs. After the payback period, you acquire the savings over the life of the system, which ranges from 15 to 40 years, depending on the system and how will it is maintained.

2) **Tax incentives and rebates:**

In India some states offers subsidies on domestic as well as commercial solar water heating systems installations. Government of India offers 100% depreciation claim in the first year itself on installation of commercial solar water heating system.

3) **Long term benefits:**

Solar water heaters offer long term benefits that go beyond simple economics. In addition to having free hot water after the system has paid

for itself in reduced utility bills, you and your family will be cushioned from future fuel shortages and price increases. You will also be doing your part to reduce this country's dependence on foreign oil. The national remodelers association reports that addition a solar water heater to an existing home raises the resale value of the home by the entire cost of the system. You may be able to recop your entire investment when you sell your home.

4) Environmental benefits:

Solar water heaters do not pollute. By investing in one, you will be avoiding carbon dioxide, nitrogen oxides, sulfur dioxide, and the other pollution and wastes created when your utility generates power or you burn fuel to heat your household water. When a solar water heater replaces an electric water heater, the electricity displaced over 20 years represents more than 50 tons of avoided carbon dioxide emission alone. Carbon dioxide traps heat in the upper atmosphere, thus contributing to the "greenhouse effect".

3.8 Application of solar water heating systems:

Heating water is one of the best known applications of solar energy.

Domestic solar water heating is quite popular and is preferred over electric water heating by many a home owner.

However business applications conventional heating systems based on electricity / coal / furnace oil/ wood still rule the roost. In spite of massive subsidies in the past not many industries opted for solar water heating systems. Only recently with the tremendous increases in cost of electricity and conventional fuels are industrialists turning to solar energy as a means to meet their hot water needs.

Industries that can benefit from application of solar energy to heat water are –

Hotels:

Bathing, kitchen, washing, laundry applications.

Dairies:

Ghee (clarified butter) production, cleaning and sterilizing, pasteurization.

Textiles:

Processing bleaching, boiling, printing, dyeing, curing, ageing and finishing applications.

Edible oil and refining:

Boiler feed applications.

Breweries:

Bottle washing, wort preparation, boiler feed applications

Distilleries:

Bottle washing, boiler feed applications.

Bulk drugs manufacturing units:

Fermentation of mixes, boiler feed applications.

Electroplating / galvanizing units:

Heating of plating baths, cleaning, degreasing applications.

Chapter 4

DATA PRESENTATION AND ANALYSIS

Chapter 4

DATA PRESENTATION AND ANALYSIS

This chapter deals with the analysis of domestic usage of solar water heaters.

To analyze the domestic usage of solar water heaters, survey has been conducted in 11 Talukas in Satara district of Maharashtra and covered 500 respondents. Of which 50% are users and 50% are non-users.

The main objective of this study is analysis of solar water heaters in various talukas of Satara district, to know the strengths, weaknesses, opportunities and threats (SWOT Analysis) in solar water heaters market.

To analyze the data, tabulation, pie charts, bar diagrams etc. are used. The analysis is as follows.

Table-4.1: Taluka wise user/non-user classification

Sl. No	Taluka	Non-User		User	
		Number	%	Number	%
1	Mahabaleswar	5	2.00	5	2.00
2	Wai	17	6.80	17	6.80
3	khandala	10	4.00	11	4.40
4	Phaltan	28	11.20	28	11.20
5	Maan	18	7.20	18	7.20
6	Khantav	23	9.20	23	9.20
7	Koregaon	22	8.80	23	9.20
8	Satara	40	16.00	40	16.00
9	Jawali	11	4.40	11	4.40
10	Patan	27	10.80	26	10.40
11	Karad	49	19.60	48	19.20
Total		250	100	250	100

From table 4.1 it is clear that majority (38.8 %) of the respondents are from Karad. However, 19.6% of no-users from Karad followed by Satara (16%), Phaltan (11.2%), Patan (10.8%), where as 19.2 % of the users from Karad followed by Satara (16%) Phaltan (11.2%) and Patan (10.4%). This is because selection of respondents was done on proportion basis as explained in the sampling.

Table-4.2: Occupation-wise user/non-user classification

Sl. no	Occupation	Non-User		User	
		Number	%	Number	%
1	Trading	48	19.20	88	35.20
2	Industry	11	4.40	15	6.00
3	Self-Employed	45	18.00	64	25.60
4	Govt. Service	23	9.20	10	4.00
5	Pvt. Service	41	16.40	19	7.60
6	Retired	8	3.20	23	9.20
7	Semi Govt. Service	63	25.20	18	7.20
8	Agri.	10	4.00	10	4.00
9	Any other	1	0.40	3	1.20
Total		250	100	250	100

The objective of this question is to know the percentage of respondents from various occupations. From the table it is observed that majority of the respondents having occupation as Trading (54.40%). Among users also majority (35.20%) from Trading, followed by self-employed (25.60%), and Retired (9.20%). The percentage of respondents in user category having occupation Govt.Service, Industery and agriculture people is very less. It is also clearly shows that in non-user category major respondents belongs to Sem.Govt. service (25.20%)

followed by Trading (19.20%) and Employed (18%). The percentage of respondents in non user category having occupation Industry (4.40%) Agri (4.00%) and Retired (3.20%) people is very less. This selection was done on random basis.

Table-4.3: Gender of user/non-user of solar water heaters

Gender	Non-user		User	
	number	%	Number	%
Male	245	98.00	246	98.40
Female	5	2.00	4	1.60
Total	250	100	250	100

Solar water heater is expensive equipment and it is technical too. The decision to buy or not to buy is still taken by men in Indian conditions.

From the above table it is observed that male user respondents are more as indicated by 98.4%, where as percentage of female user respondents is very less i.e. 1.6%.

Table-4.4: Age group wise distribution

Age Group	Non-user		User	
	Number	%	Number	%
21-30	32	12.80	10	4.00
31-40	76	30.40	65	26.00
41-50	100	40.00	101	40.40
51-60	31	12.40	51	20.40
61-72	11	4.40	23	9.20
Total	250	100	250	100

In order to know the age group of respondents this question was asked.

From the above tabulation majority both users (40.4%) and non-users (40%) belong to 41-50 age group, followed by 31-40 age group and 51-60 age group.

It is shows that generly person do investment in economical strong condition.

In age group of 41-50 person having good financial condition as well as good mental capacity to invest huge amount.

Table-4.5: income group of user/non-users of solar water heaters

Income Group (in Rs)	Non-user		User	
	Number	%	Number	%
<=10000	92	36.80	63	25.20
10001-20000	90	36.00	102	40.80
20001-30000	51	20.40	52	20.80
30001-40000	9	3.60	23	9.20
40001-50000	8	3.20	8	3.20
>=50000	0	0.00	2	0.80
Total	250	100	250	100

Though the people have a desire to buy the solar water heater, they don't have the capacity to buy it, because it is expensive.

The purpose of this question is to identify the income group from which there are more respondents. From the table it is observed that majority (40.8) of the users from Rs.10001-Rs. 20000 income group. It is shows that who have sufficient income that person invest in capital goods

such as solar water heater. Here researcher want to high light when researcher asks about respondents income that time they don`t want to say actual income. They mostly give wrong answers. It is natural because no one wants to open personal income.

Table-4.6: Education level of users and non-users of solar water heaters

Education	Non-user	%	User	%
Under graduate	55	22.00	42	16.80
Graduate	113	45.20	126	50.40
PG	60	24.00	50	20.00
Diploma	18	7.20	20	8.00
Other	4	1.60	12	4.80
Total	250	100.0	250	100.0

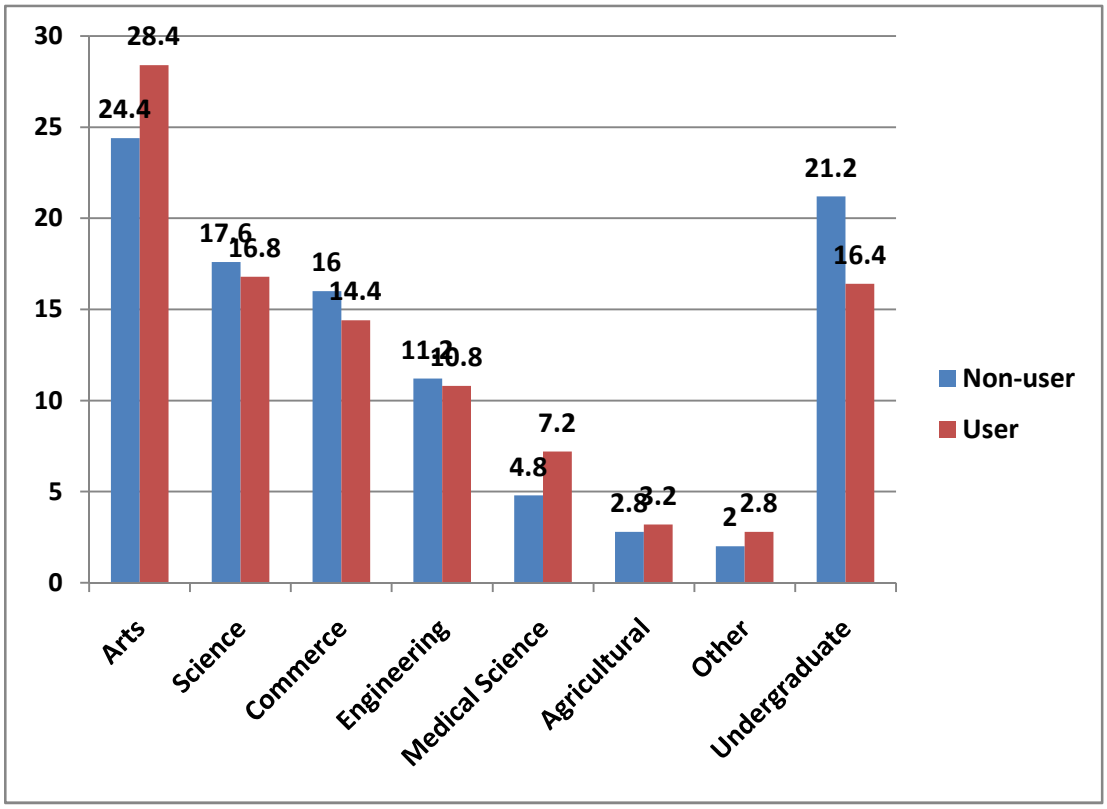
Solar water heater is related to attitude of people towards saving of energy, conservation of energy etc. Education broadens the horizon of thinking and hence favorable attitude may be developed. Hence this question was asked.

Above table shows that most of the users (50.4%) are graduates and most of the non users are also graduates. They are followed by post graduates. 20% post graduates have solar water heater and 24% post graduates are non-users. It is observed education not affect the purchase of solar water heater.

Table-4.7: Discipline-wise user, non-user classification

Discipline	Non-user	%	User	%
Arts	61	24.40	71	28.40
Science	44	17.60	42	16.80
Commerce	40	16.00	36	14.40
Engineering	28	11.20	27	10.80
Medical Science	12	4.80	18	7.20
Agricultural	7	2.80	8	3.20
Other	5	2.00	7	2.80
Undergraduate	53	21.20	41	16.40
Total	250	100	250	100

Graph 4.1: Discipline-wise user, non-user classification



This question is asked to identify the stream of education of the respondents. It is believed that science and engineering people will have great awareness so they will become users.

From the table and graph, it is observed that majority of non-users (24.4%) and users (28.4%) are from Arts discipline followed by science discipline and undergraduates. It is observed that educational background of the users or the non-users doesn't influence the purchase of solar water heaters.It shows that users from all the disciplines. So it is possible to motivate non-users of different educational background to purchase solar water heaters.

Table-4.8: Job Transfer and user type

Job Transfer	Non-user		User	
	Number	%	Number	%
No	191	76.40	248	99.20
Yes	59	23.60	02	00.80
Total	250	100	250	100

Most of the jobs are transferable. Solar water heater are difficult to move. The people may not purchase solar water heaters for this reason. This question is raised to understand the influence of transferable job on purchase of solar water heaters.

From the table it is observed that majority of users (99.20%) are having non transferable job and only 00.80% respondent having transferable job. Form this it is concluded that persons having non-transferable job become user of solar water heaters due to its immovability.

If the people have transferable job then they usually not think of making fixed furniture or immovable things like solar water heaters. It is clearly shows in non-user category respondents have not transferable job (76.40%). It is opportunity to sale them solar water heaters.

Table-4.9: House type of users and non-users of solar water heaters

Own House	Non-user		User	
	Number	%	Number	%
No	59	23.60	02	00.80
Yes	191	76.40	248	99.20
Total	250	100	250	100

This table shows that people who are users and have solar water heaters are 99.2% have own house but at the same time significant percentage 76.40% who have own house but are not users. It is observed that this situation is good for promoters to sale solar water heaters.

Table-4.10: Family size and User type

Family size	Non-user	%	User	%
2 to 5	209	83.60	190	76.00
6 to 10	41	16.40	57	22.80
11 to13	0	0.00	3	1.20
Total	250	100	250	100

It is believed that if the family size is big, then the energy consumption will be more. Hence more expenditure is on non-renewable energy to get hot water.

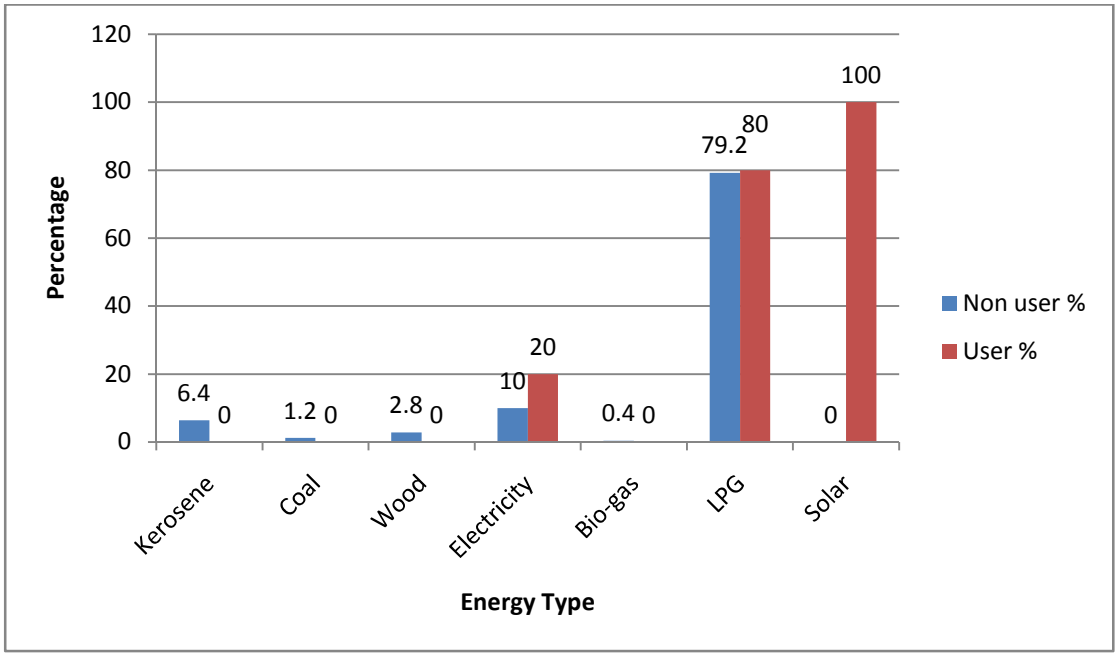
Since there is shortage of non-renewable energy there is possibility that the family having big size can become users of solar water heaters. Above table shows that majority respondents user and non user category belongs to 2 to 5 family members. It means small family also the consumer of solar water heaters. There fore big and small family are the

market of solar water heater. So there is huge market for solar water heater.

Table-4.11: Use of various energy sources

Energy type	Non-user	%	User	%
Kerosene	16	06.40	0	00.00
Coal	13	01.20	0	00.00
Wood	7	02.80	0	00.00
Electricity	25	10.00	50	20.00
Bio-gas	1	0.40	0	00.00
LPG	198	79.20	200	80.00
Solar	0	0.00	250	100.00

Graph 4.2 : Use of various energy sources



In order to meet daily energy requirements for getting hot water people use different types of sources available with them. They use more than one source of energy. These sources are kerosene, coal, wood,

electricity, biogas, LPG and solar energy. Here respondents answer of this question with thinking the use energy for all purpose.

From the above table it is clear that user use solar water heater for getting hot water. But in cloudy & rainy days majority of solar users use LPG as alternative energy source followed by electric power. On the other hand majority of non users of solar energy are using LPG as energy source followed by electricity for getting hot water.

Table-4.12: Satisfaction about present non renewable energy supply

Opinion	Non-user	%	user	%
Very happy	1	0.40	2	0.80
Happy	46	18.40	45	18.00
Not decided	16	6.40	23	9.20
Unhappy	165	66.00	164	65.60
Very unhappy	22	8.80	16	6.40
Total	250	100	250	100

Graph 4.3: Satisfaction about present non renewable energy supply

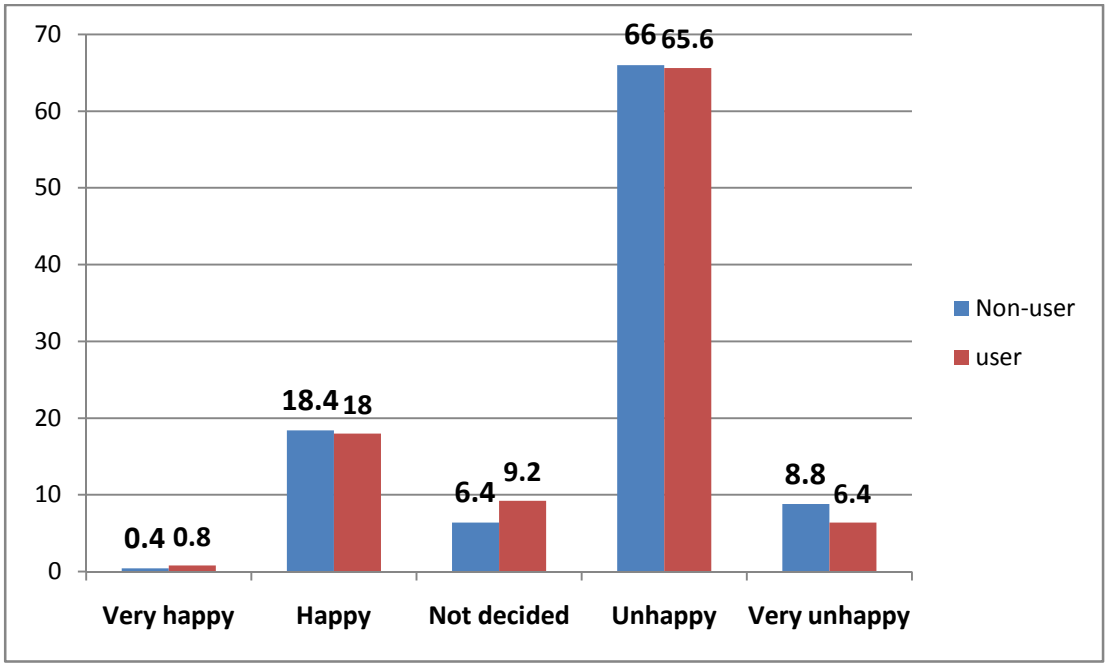
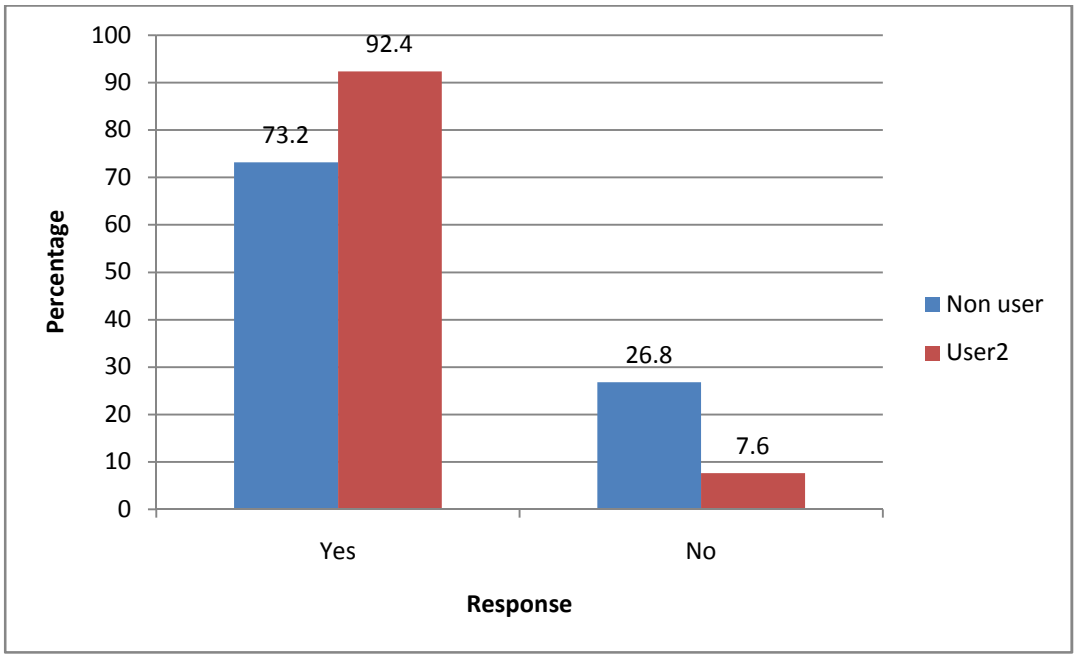


Table and graph shows majority non users are dependent on non renewable energy for getting hot water. There is no regular supply of non renewable energy and hence the respondents are unhappy. In users category majority respondents depend for getting hot water in cloudy and rainy days. Table shows clearly this category also unhappy about present non renewable energy supply. It is observed that higher unhappiness should lead to use of alternative sources such as solar water heater. This is good situation for promoters of solar water heaters.

Table-4.13: Is non-renewable energy is costly

Response	Non-user	%	User	%
Yes	183	73.20	231	92.40
No	67	26.80	19	7.60
Total	250	100	250	100

Graph 4.4: Is non-renewable energy is costly



Above table shows all the respondents opined that non renewable energy is costly and they think it will short in future.

It is observe that this condition is very useful for marketing of solar water heaters. 73.20% unsatisfied non user can be converted in user of solar water heater.

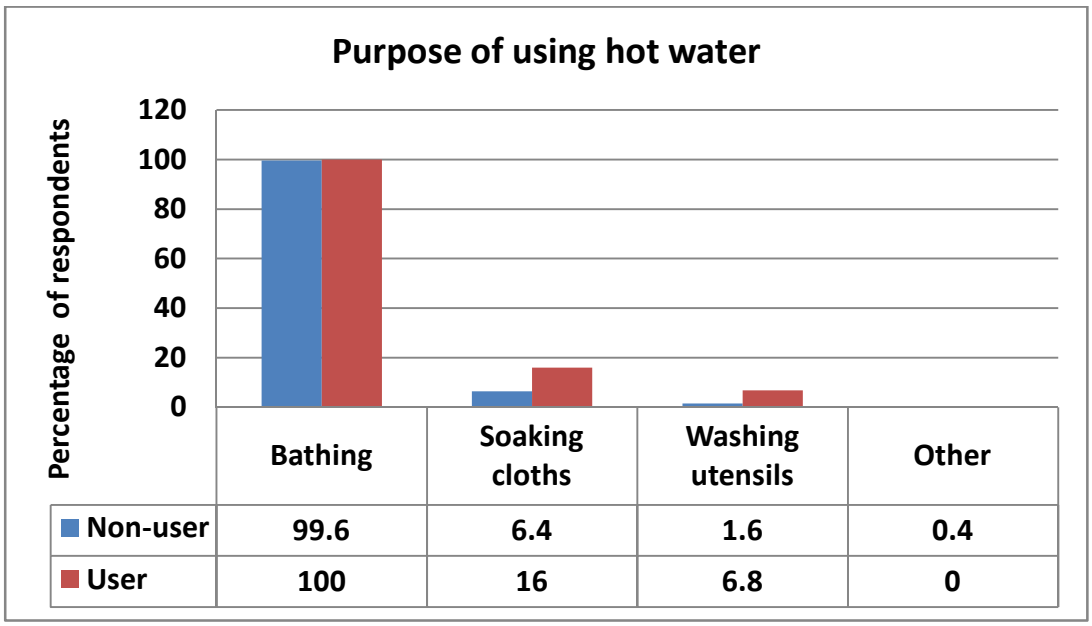
Table-4.14 : Looking for alternative energy

Response	Non-user	%	User	%
Yes	183	73.20	231	92.40
No	67	26.80	19	7.60
Total	250	100	250	100

Since there are problems related to non renewable energy supply. Majority of both the users (92.4%) and non-users (73.2%) are looking for alternative energy source for getting hot water.Thats why (92.40%) users use solar water heaters.

Solar energy is the best alternative energy for getting hot water. If people ready to accept alternative source that time solar water heaters are very useful. It is huge market and opportunity to develop solar market.

Graph 4.5: Purpose of using hot water.



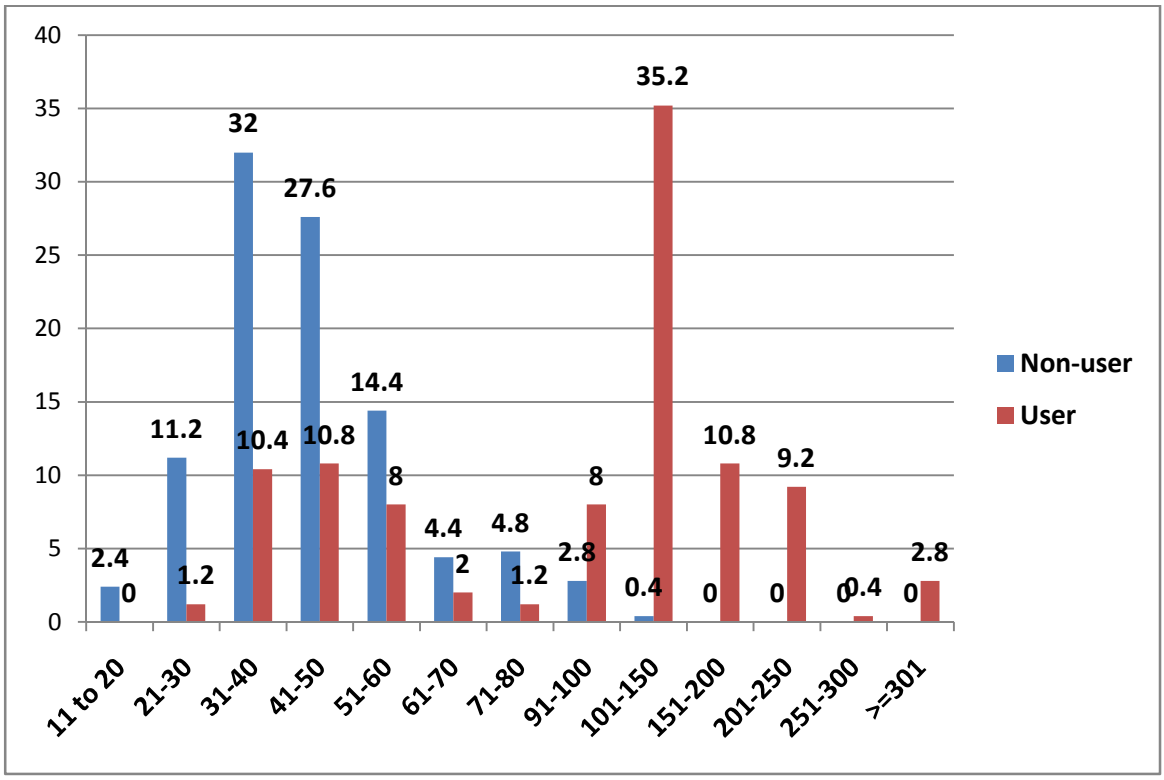
Hot water can be used for different purposes. The requirement of hot water quantity depends upon the purpose of usage. Main use of hot water is for bathing. In order to make clean clothes, hot water is also used. It is also used for soaking clothes.

Above graph shows that majority users and nonusers use hot water for bathing. It is observed that solar water heater have very good market.

Table-4.15 : Use of hot water quantity

Quantity of hot water	Non-user	%	User	%
11-20	6	2.40	0	0.00
21-30	28	11.20	3	1.20
31-40	80	32.00	26	10.40
41-50	69	27.60	27	10.80
51-60	36	14.40	20	8.00
61-70	11	4.40	5	2.00
71-80	12	4.80	3	1.20
91-100	7	2.80	20	8.00
101-150	1	0.40	88	35.20
151-200	0	0.00	27	10.80
201-250	0	0.00	23	9.20
251-300	0	0.00	1	0.40
>=301	0	0.00	7	2.80
Total	250	100	250	100

Graph 4.6:Use of hot water quantity

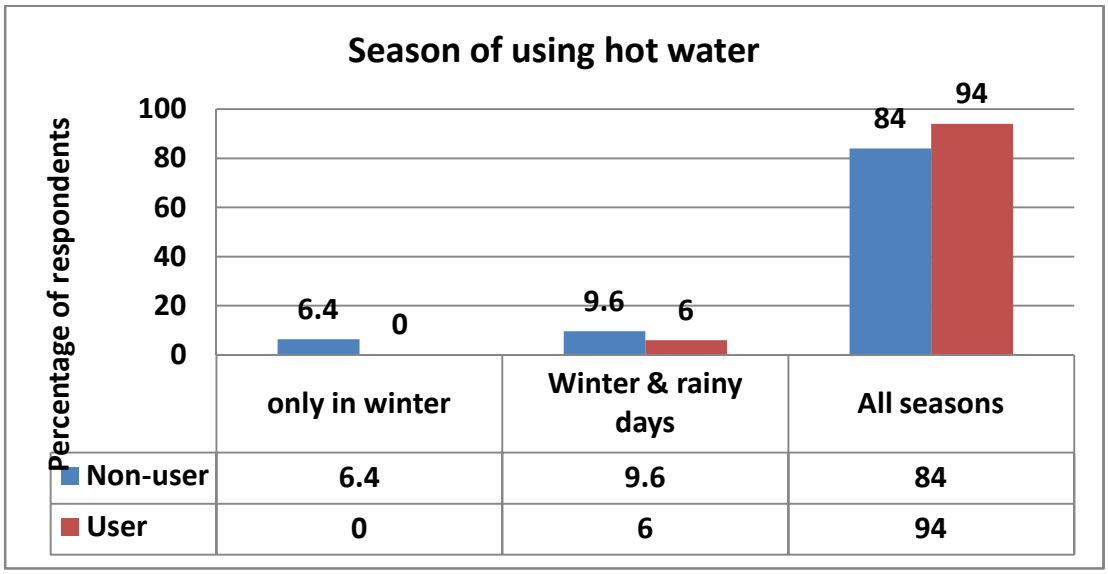


If water is heated using electric or gas geyser , then limited quantity of water is used as the people are conscious about expenditure on gas or electric geyser. If hot water is available at lower cost using solar water heater then this quantity consumption is likely to increase.

From the table and graph it is observed that majority of non-users (32%) are using 31-40 liters of hot water where as 35.2 % of the users of solar water heater use 101-150- liters of hot water for different purposes.

This clearly shows that users of solar water heater enjoy the hot water as compared to non users. This difference in quantity consumption is also very high. If marketers shows this difference to non users they can think to use solar water heater and it will very huge market.

Graph 4.7 : Season of using hot water



	only in winter	Winter & rainy days	All seasons
Non-user	6.4	9.6	84
User	0	6	94

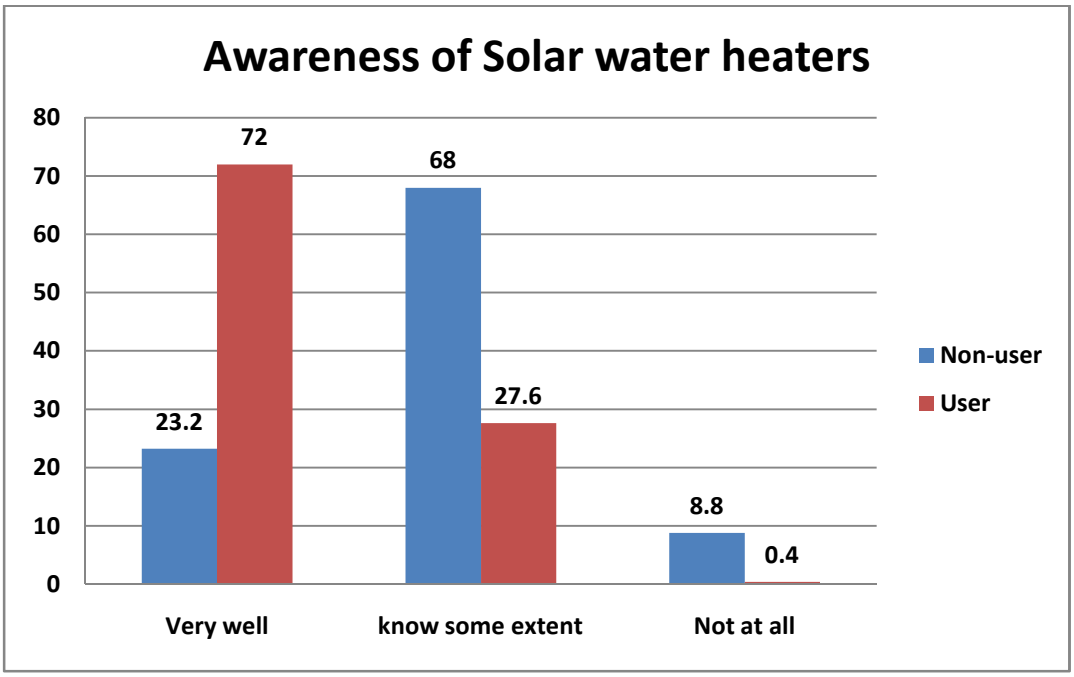
The geographical condition in Satara district is typical so it is believed that almost in all the seasons they will use hot water.

Form the graph, it is observed that Majority of users (94%) as well as non-users (84%) use hot water in all the seasons. Only 9.6% non-users and 6% users are using hot water only in winter and rainy days. This shows that majority of the respondents require energy for heating water throughout the year. It is very good for solar water heaters market.

Table-4.16 : Awareness level about Solar water heaters

Response	Non-user	%	User	%
Very well	58	23.20	180	72.00
know some extent	170	68.00	69	27.60
Not at all	22	8.80	1	0.40
Total	250	100	250	100

Graph 4.8: Awareness Of Solar Water Heaters



The objective of this question is to identify the degree of awareness about solar water heaters as a whole.

The above table and graph show the awareness level about solar water heaters. It is observed that 72% of users of solar water heaters are very well aware of solar water heaters where as only 23.20% of non-users know very well about solar water heaters and 68% of non-users know up to some extent.

This states that clear awareness really affected the use of solar water heaters. Knowing little about the product is not sufficient but they should clearly understand the benefits of the product. This condition is hurdle as well as opportunity in solar market.

Table-4.17: Usefulness of solar water heaters

Opinion	Non-user	%	User	%
Very high	181	72.40	242	96.80
High	29	11.60	8	3.20
Average	9	3.60	0	0.00
Low	2	0.80	0	0.00
Very low	0	0.00	0	0.00
Can't say	29	11.60	0	0.00
Total	250	100	250	100

This question is to know the grading of usefulness of solar water heaters given by respondents.

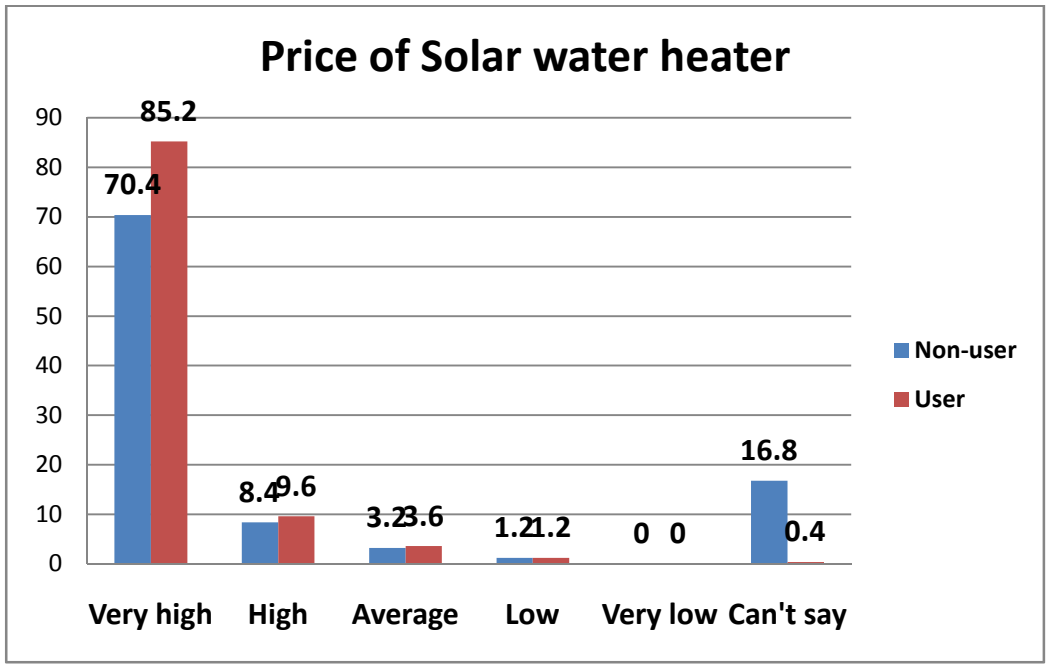
The table clearly shows that among both category respondents the awareness level about usefulness of solar water heaters is quite high. It is observed that majority of users (96.8%) and non-users (72.4%) had an opinion that solar water heaters usefulness is very high. This is positive sign of energy conservation and solar water heaters market.

Since majority agreed that solar water heaters are highly useful, there is scope to promote solar water heater.

Table-4.18 : Price of solar water heaters

	Non-user	%	User	%
Very high	176	70.40	213	85.20
High	21	8.40	24	9.60
Average	8	3.20	9	3.60
Low	3	1.20	3	1.20
Very low	0	0.00	0	0.00
cant say	42	16.8	1	0.4
Total	250	100	250	100

Graph 4.9 : Price of solar water heater



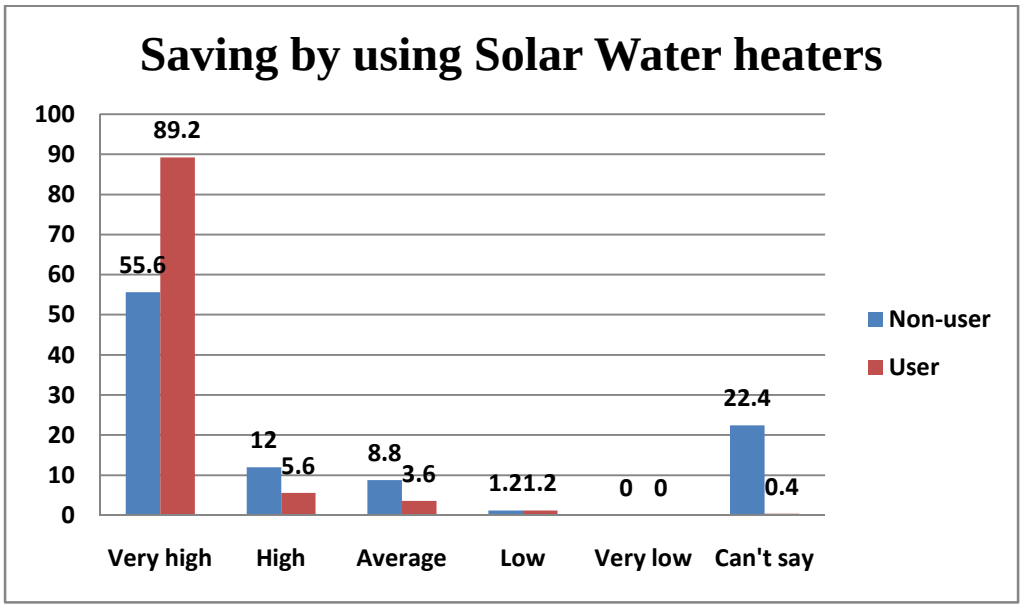
People may have desire to buy the product when they are really aware about the product. But there will be no use of this awareness of the product, if the price of the product is high. Solar water heaters are capital expenditure products and require good amount of money.

The above table and graph explains that majority non-users (70.4%) and users (85.2%) felt that the price of solar water heater is very high. This may be the reason that non-user may not have gone to buy the solar water heaters..

Table-4.19: Saving by solar water heaters

Opinion	Non-user	%	User	%
Very high	139	55.60	223	89.20
High	30	12.00	14	5.60
Average	22	8.80	9	3.60
Low	3	1.20	3	1.20
Very low	0	0.00	0	0.00
Can't say	56	22.40	1	0.40
Total	250	100	250	100

Graph 4.10: Saving by using Solar Water Heaters



People don't buy the product but buy the benefit of the product. Saving on expenditure is outcome of solar water heaters.

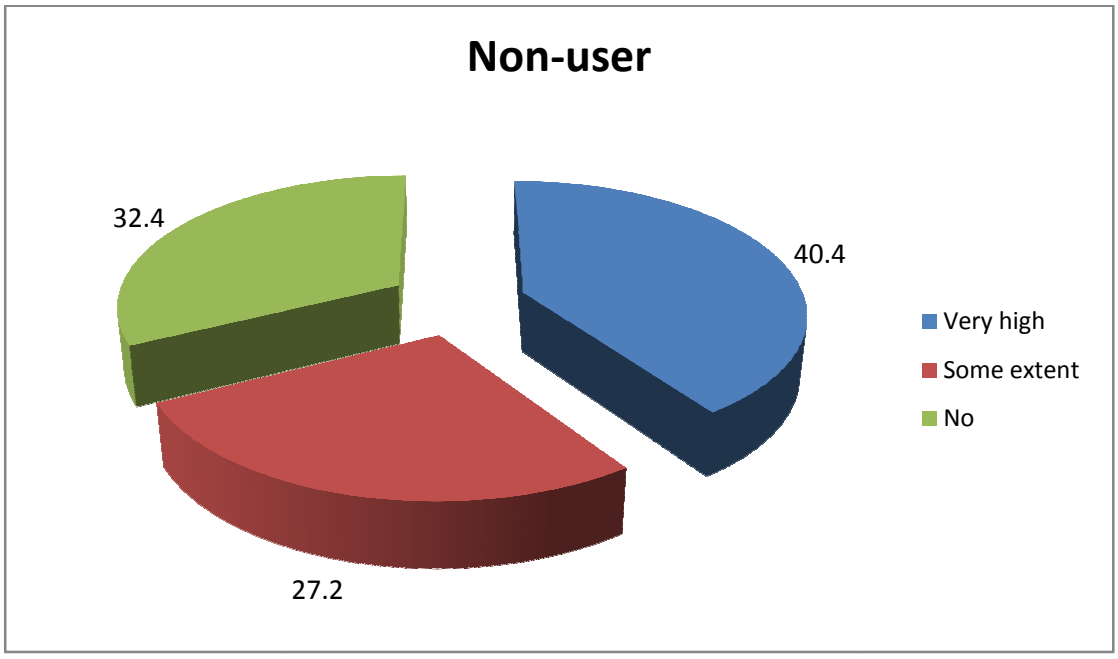
The table and graph explains the opinion about saving level by using solar water heaters. 89.2% of users opined that very high saving level and 55.6% of non-users also opined the same. Since lack of awareness 22.4% of non-users having opinion as can't say about saving.

It states that users are clear about the savings due to solar water heater as compared to non-user category. This condition motivates solar market.

Table-4.20: Interest in purchasing of solar water heaters

Response	Non-user	%
Very high	101	40.40
Some extent	68	27.20
No	81	32.40
Total	250	100

Graph 4.11: Interest in purchasing of solar water heaters



From the above table it is observed that there is significant difference in the proportion of users and non-users interest in purchasing of solar water heaters. 40.40% of non-users having very high interest in purchasing solar water heaters. Because of lack of awareness and high prices, 32.40 % of non-users having very less interest in purchase of solar solar water heaters.

In case of non-user category 40.40% respondents do have purchasing power and purchasing of solar water heater is top priority for them. It is good opportunity to solar market.

Table-4.21: Time to purchase solar water heaters

Response	Non-user	%
After some days	63	25.20
By one year	40	16.00
By five years	55	22.00
Not yet decided	92	36.80
Total	250	100

In order to understand desire level of the non-user the question is raised. From the above table, it is clear that about 25.20% non user ready to purchase after some days. 16 % of non-users are ready to purchase solar water heater within one year, and 22% are ready to purchase within five years. Still 36.8% of them have not yet decided to purchase. This shows that in coming years if proper business strategies followed, people will buy solar water heaters.

Table-4.22: Reasons for not interest in solar equipments

Reason	Non-user	%
High price	32	12.80
Not own house	16	6.40
Not fully convinced	25	10.00
Other reasons	16	6.40

There are many reasons for not interest in purchasing solar water heaters. The major factor is high price due to these 12.80% respondents not interest to purchase solar water heater. 10 % of non-users are not yet fully convinced to purchase. 6.4% of non-uses are not interested because they are not having own house. These are all above reasons are threats of solar water heaters market.

Table No. 4.23 to 4.41 are related to users of solar water heaters only.

Table-4.23: Area from which solar equipments have been purchased

Taluka	No. of respondents	%
Mahabaleswar	0	0.00
Wai	15	6.00
Khandala	1	0.40
Phaltan	26	10.40
Maan	1	0.40
Khantav	5	2.00
Koregaon	2	0.80
Satara	115	46.00
Jawali	4	1.60
Karad	70	28.00
Pune	11	4.40
Total	250	100

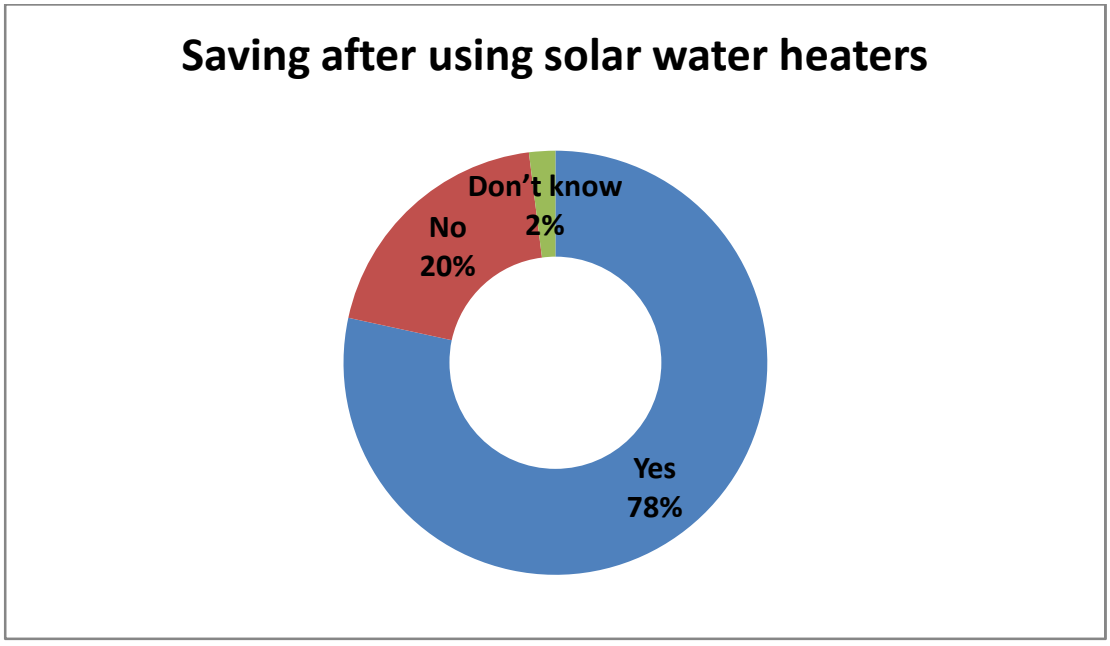
Availability of solar water heaters is also important. If the product is not easily available then it becomes hurdle in buying the product.

It is observed from the table that majority of users(46%) purchased solar water heaters from Satara, 28% users from Karad and 10.4% users from Phaltan. Hence, availability in these three cities of the district especially at district place Satara. For improving Sale of solar water heater manufacturers must make available solar water heater at all taluka placeses.

Table-4.24: Response about saving

Response	Respondents	%
Yes	196	78.40
No	49	19.60
Don’t know	5	2.00
Total	250	100

Graph 4.12 : Saving after using solar water heaters



Saving is playing important role in mankind’s life. When a person purchases a product he definitely thinks of saving. In economics, saving means getting future money earned today. Financial saving always attracts people. Solar water heaters run on solar energy which gets free from nature. Power charges are increasing day by day. Hence the solar water heaters are very useful. Solar water heaters stabilise monthly expenses. In this context we try to know saving due to solar water heaters.

The above table shows that 78.4% of users opined that they are saving by using solar water heaters. Still 19.60 % of them do not feel that they are saving.

Majority of the respondents are happy because of saving. Those who are not able to see saving they should be contacted so that they can understand saving on their own.

This question attempts to understand saving in terms of money. Even though it is difficult for the respondents to calculate the saving, approximate figures are provided.

Table-4.25:Solar water heaters are economical compare to non renewable energy

Response	No.of respondents	%
Very	247	98.80
Some extent	2	0.80
No	1	0.40
Total	250	100

Non renewable energy equipments are used to maximum extent because they are available at low cost as compared to renewable energy equipments i,e. solar water heater. It is also available all over market. But initial cost of solar water heater is high, so people don't prefer to invest. If anybody invests in solar water heater one time then there is no operating cost or recurring cost. Solar water heaterhave almost zero recurring cost or run very economically due to free energy of sun.Solar water heaters are economical in the sense that maximum benefit at minimum recurring expenditure.

It is observed from the table that majority 98.8%, of users agreed that solar water heaters are very economical compared to non renewable energy sources. Recurring expenditure pinches their pockets.It is very good sign for improving solar water heaters market.

Table-4.26: Source of information about solar water heater

Source	Response frequency	%
News Paper	111	44.40
T.V. advertisement	01	00.40
Friends, relatives' information	30	12.00
Exhibition	09	03.60
Solar dealer	99	39.60
Total	250	100

There is need of creating higher awareness when the company wants to sell its products. Higher awareness level will lead to higher sales in future. So, one should know what the effective media are and within reach of the people. It is observed from the above table that the major media in creation of awareness of solar water heater is news paper (44.4) and solar dealer (39.6%) followed by friends/relatives information, exhibition. But televisions role is very minor.

This shows that newspaper is an effective media. Similarly dealers are also efficient and effective in selling the solar water heater. Personal selling plays important role.

Table-4.27: The factors influenced to purchase solar water heater

Factor	No. of respondents	%
Advertisement	05	02.00
Influenced by user	87	34.80
Advantages of solar influenced me	118	47.20
Motivated by dealer	39	15.60
Any other	1	00.40
Total	250	100

Advertising, publicity, personal sale and sales promotion these are the marketing mix. It plays very effective role in marketing. Advertise is impersonal, publicity made by celebrity without cost, personal sale made after personal meet and in sales promotion producer launches various schemes. The result of all above is increasing sale. Solar water heater users also purchase by one of this mode. The purpose of this question is to identify factors which influenced significantly the users to purchase solar water heaters.

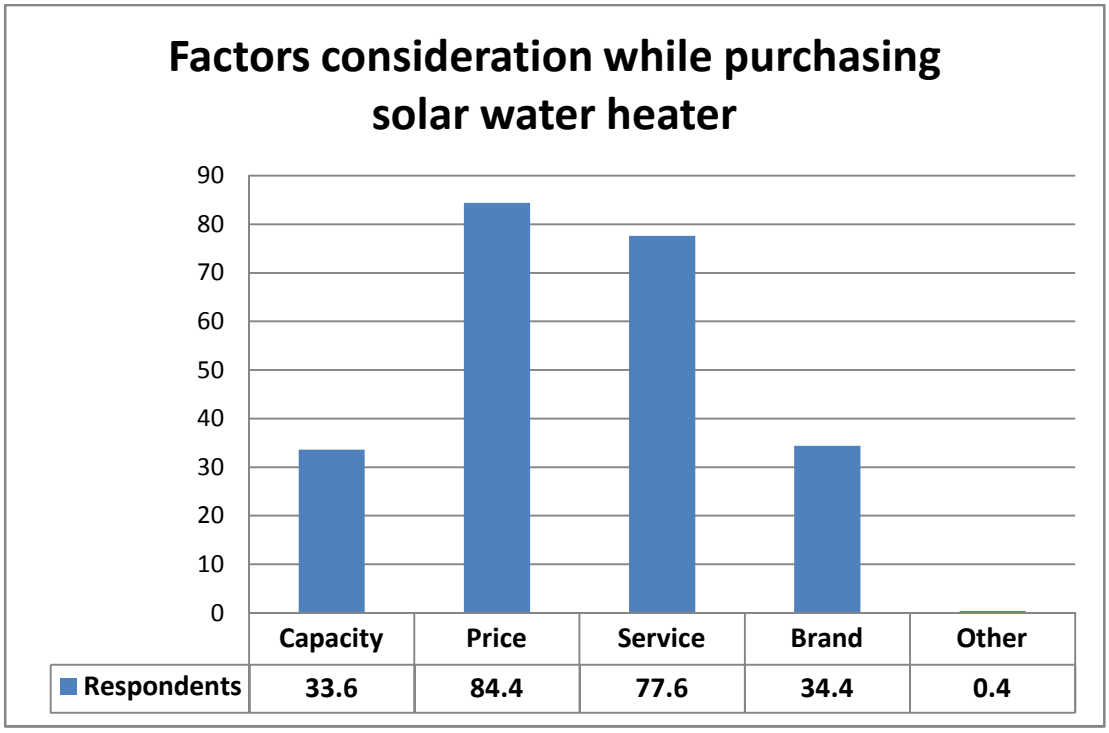
From the table, it is observed that majority of the users influenced by the advantages of solar water heaters(47.20%). However, they were also influenced by the users(34.80%) and motivated by the solar dealer(15.60%).

Hence, benefits of the product must be communicated properly with the help of reference which will result in to purchase of solar water heaters.

Table-4.28: Factor consideration while purchasing solar water heaters

Factor	Respondents	%
Capacity	84	33.60
Price	211	84.40
Service	194	77.60
Brand	86	34.40
Other	1	0.40

Graph 4.13: Factor consideration while purchasing solar water heaters



When customer purchases any product that time he considers some basic things. These things play an important role in any purchasing. Some of them are price, comfort, user friendly, easy to move, quality, after sales service, brand capacity etc. After this some of the things are considered by the customer to finalise purchase decision. This question explains the factors considered while making solar water heater purchase decision. It is observed respondents consider more than one factor.

As seen in the previous tables too that price is a major hurdle in purchase of solar water heaters. The major factors under consideration while purchasing is price of the product (84.4%) and after sales service (77.6%). The other factors are brand and capacity of the products. As it is durable and expensive, respondent really think of maintenance of product.

Table-4.29: Usage days of solar water heaters per year

Days	Number	%
1 to 90	0	0.00
91-180	0	0.00
181-270	11	4.40
271-365	239	95.60
Total	250	100

Solar water heaters run on solar energy. There is need to know how many days solar water heaters are used in year. Solar radiations and density of sun change during seasons. This question is raised to know how many days in a year the users are using solar water heaters.

From the above table it is observed that the 95.60% users of solar water heater are using for a maximum 271-365 days, only 4.40% of them use it for 181-270 days.

This indicates that the solar water heaters provide service near about 365 days. It is beneficial promoters of solar water heaters.

Table-4.30:Life time of solar water heaters

Years	Number	%
0 to 5	0	0.00
6 to 10	1	0.40
11 to 20	54	21.60
21 to 30	179	71.60
31-above	16	06.40
Total	250	100

If a product gives maximum service, people must purchase it otherwise not. Durability influences purchase of solar water heaters. When users purchase solar water heater, life of product stated by seller is important.

The above table shows that the 71.60% of users agreed that solar waters life time is 21-30 years. This clearly explains that even though initial investment is high, service provided by the solar water heater is very high. It almost provides you benefit for one generation i.e. 20-30 years.

Table-4.31: Maintenance cost incurred per year for solar water heater

Rs	Number	%
1-100	2	1.20
101-200	2	1.20
201-300	0	0.00
301-400	0	0.00
401-500	0	0.00
501-above	0	0.00

For getting maximum life of any product there is requirement of maintenance. Human tendency is that he doesn't like break down of product. Once a person uses a product than he gets habit of that product, once a person gets in habit then he cannot accept non-availability of the product. But maintenance cost does matter. In this context there is requirement to know what the maintenance cost of solar water heaters.

From the above table, In order to maintain the solar water heater some cost will be incurred. But this cost is not high at all in a year. And very few respondents give response to this question. This shows that solar water heaters are maintenance free. It is beneficial in point of view of users and promoters of solar water heaters.

Table-4.32: Solar water heaters are hazard free

Response	No. of respondents	%
Yes	250	100.00
No	0	0.00

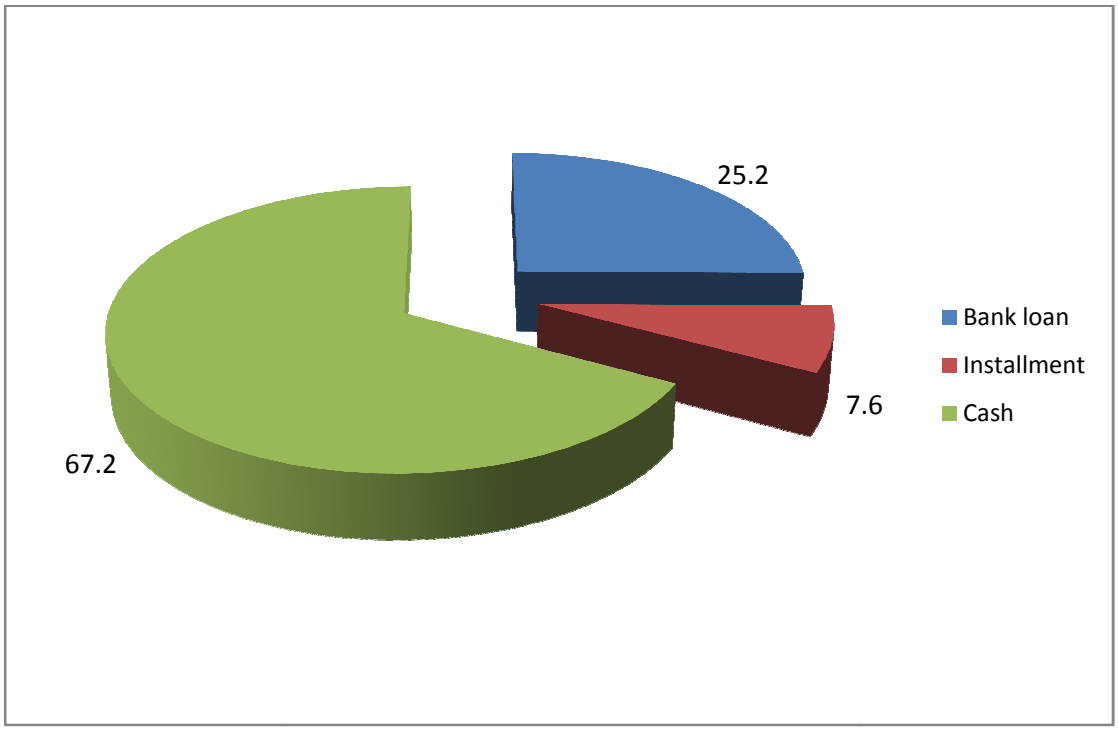
Many times there are accidents due to electricity. Many products create dangerous situation. If product is hazard free then all family members may use the product easily. In house there may be senior citizens or children who don't have knowledge about use of product and accidents may happen. The view of users of solar water heaters about hazard is very important. If solar water heaters are hazard free then only maximum persons will buy them.

Solar water heaters are hazard free since its not generate power. There is no chance of short circuit and energy loss etc. Thus solar water heaters are hazard free, all the users agreed the same.

Table-4.33: Way the respondents purchased solar water heaters

Mode	No. of respondents	%
Bank loan	63	25.20
Installment	19	7.60
Cash	168	67.20
Total	250	100

Graph 4.14: Way the respondents purchased solar water heaters



Though there is facility of soft loan before few days to purchase solar water heater how many purchase by this way, it is very important for further development. Persons don't use this facility to purchase means that there are some drawbacks.

Many respondents told in interview that the service of nationalize banks is not good. Always they create problems in that process and they make to buy with cash.

The above table shows how the users purchased solar water heaters. Though the prices of solar water heaters are high; most of the users purchased the water heaters by cash. The second way followed by the users is bank loan.

In particular 67.2% solar water heater users purchased by cash. This shows that bank loan facility is not used or not given by the banks due to their own interest. Nowadays government stops soft loan scheme and stared subsidy. Subsidy scheme is very popular now days and all purchase done by cash. It is improve speed of solar water heaters market.

Table-4.34: Money spend on each solar water heater

Rs.	No. of Respondents	%
300-1000	0	0.00
1001-5000	0	0.00
5001-10000	0	0.00
10001-15000	1	0.40
15001-20000	20	8.00
20001-25000	120	48.00
25001-30000	30	12.00
30001-35000	36	14.40
35001-40000	14	5.60
40001-45000	15	6.00
45001-50000	8	3.20
50001-above	6	2.40
Total	250	100

After discussion with respondents researcher come to know solar water heaters have high price though respondents purchased solar water heater. This question is raised to know actually how much respondents invest in solar water heater.

Above table shows solar water heaters are available in different price range. Price of solar water heater starts from 10001-15000. Majority 48.00% respondent invest Rs. 20001-25000. There are some respondents who invest more than 25000 in solar water heater. It is observed that solar water heater is within the reach of the people while some of them seem to be costly.

Table-4.35: Main cause behind purchase of solar water heaters

Cause	No. of respondents	%
Save energy & money	136	54.40
Comfort	33	13.20
Use renewable energy	21	8.40
For prestige	3	1.20
Solve energy problem	51	20.40
Other	6	2.40
Total	250	100

People buy the product due to many reasons which motivate them or compel them in thinking of buying the product. Solar water heaters are related to saving factors but to know what are other factors can be considered while promoting the product.

It is observed from the above table that because of shortage and high cost of non renewable energy, 54.4% users use solar water heaters to save energy and money. 20.4% users for solving energy problem and 13.2% for comfort.

Table-4.36: Way of motivating others

Way	No. of respondents	%
Stating usefulness	78	31.20
Showing saving	73	29.20
Stating benefits	98	39.20
Other	1	0.40
Total	250	100

Solar products are useful to the society and nature too. People are aware about the usefulness of product but it is also necessary that they should motivate other people to use the product.

It is observed from the table that users are motivating other people to use solar water heaters through explaining its benefits (39.2%), stating usefulness (31.2%) and showing saving (29.2%). This three factors are important in terms of promotion of solar water heaters.

Table-4.37: Suggestion to others

Suggestion	No. of respondents	%
Use it	250	100.00
If possible use it	0	0.00
Don't use	0	0.00
Other	0	0.00

Mouth publicity is the fast way for the promotion of any product. All the users' suggestion to others is to use solar water heaters since they realized the benefits of solar water heaters.

Table-4.38: Suggestions to government to promote use of solar water heaters

Suggestion	No. of respondents	%
make more advertisement	82	32.80
Make it compulsory	37	14.80
Give low interest loan	95	38.00
Give subsidy to manufacturer	8	3.20
Other	28	11.20
Total	250	100

Since many countries are facing energy problems, it is the duty of the government to promote solar products since it is a renewable energy. From the table it is observed that important suggestions to government

are do more advertisement, do legal compulsions and give low interest loans. These all suggestions are very important to government for promoting solar water heaters. In interview researcher come to know majority respondents wants again start the policy of low interest loan.

Table-4.39: Suggestions to manufacturing companies

Suggestion	**No. of respondents**	**%**
Improve quality	33	30.80
Make new research	27	15.20
Introduce low cost product	148	59.20
Give better after sales service	29	24.80
Oter	13	5.20
Total	250	100

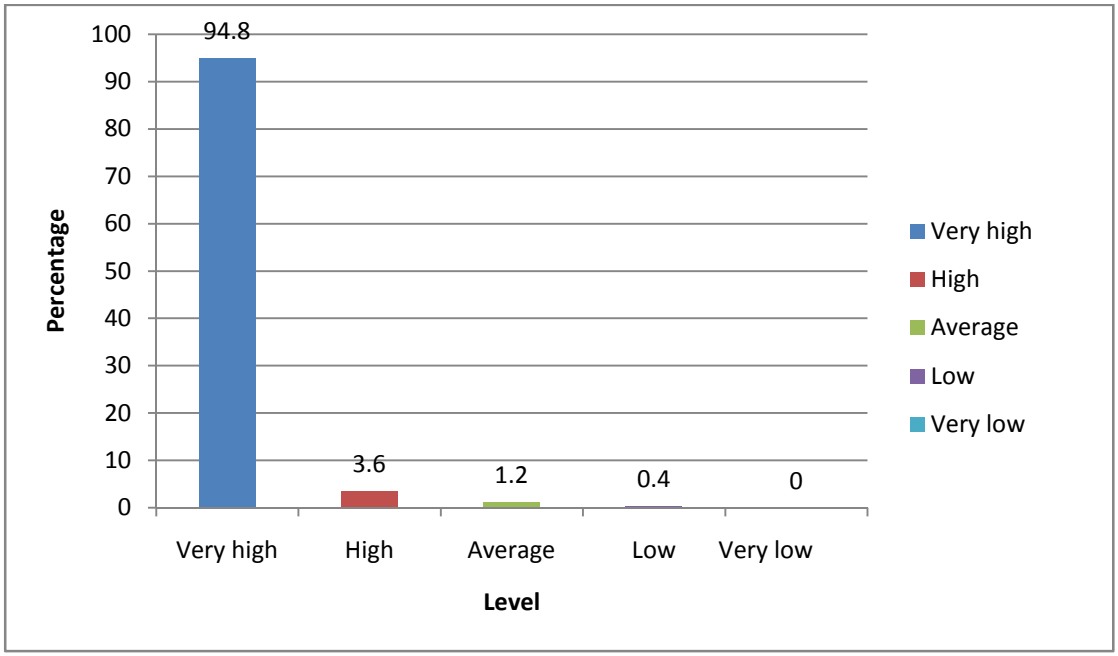
The objective of this question is to know the various suggestions to the manufacturers that the users made.

From the analysis, it is observed that, since the cost of solar water heaters are high, majority of the users (59.20%) are suggesting manufacturing companies to introduce low cost product. This is possible by proper research and development. Also they are requiring better after sales service whenever necessary.

Table-4.40: Users satisfaction level about solar water heaters

Level	Numbers	%
Very high	237	94.80
High	9	3.60
Average	3	1.20
Low	1	0.40
Very low	0	0.00
Total	250	100

Graph 4.15 : Users satisfaction level about solar water heaters



If the customers are happy about the product then they think to motivate others.

From the analysis, the researcher observed that all the users of solar water heater got very high satisfaction. It is a good for the solar water heaters promoters if the users do mouth publicity.

Chapter 5

FINDINGS AND SUGGESTIONS

Chapter 5
FINDINGS AND SUGGESTIONS

Objective- 03

To identify strengths, weaknesses, opportunities and threats (SWOT analysis) of market of solar water heaters in Satara District.

Strength –

1) Researcher came to know through discussion that there are 24 dealers supplying solar water heaters of various companies in satara district.
2) Majority of the users and non users agreed that solar water heaters are very useful and also agreed that solar water heaters are economical compared to non renewable energy.
3) Solar water heaters are durable; they almost provide benefits for one generation i.e. 20 to 30 years.
4) Majority users agreed solar water heater have very low maintenance cost.
5) Majority users realized that benefits of solar water heaters, they suggest others to use solar water heaters.

Weaknesses -

1) Researcher comes to know that solar water heaters are durable. Users are looking at technicians for maintenance but there is less number of technicians available.
2) Majority of the non users are not aware of solar water heaters. It indicates that proper publicity is not done. There is a lack of awareness caused by law level of promotional activity.

3) Majority of the non users agreed that the prices of solar water heaters are very high it is very big hurdle in solar water heaters market.

Opportunities –

1) Majority users and non users are aware of solar energy and they are looking for alternative energy such as solar e. g. solar water heaters.
2) Majority of respondents felt that non renewable energy is costly so there is scope for promoting solar water heaters to save money and energy.
3) Majority of users and non users respondents are unhappy on present non renewable energy supply it is very good opportunity for promotion of solar water heaters.
4) Majority of non users are highly interested in purchasing solar water heaters and there scope of market for solar water heaters.

Threats –

1) As solar water heaters are capital investment and required own house, people who do not have their own houses are not interested in solar water heaters.
2) The geographical condition in Satara district is such as there is a heavy rainfall; nearly about 3-4 months and solar water heaters do not work satisfactorily during rainy season.

After analyzing the data on domestic user and non user of solar water heaters, the following inferences are drawn.

1. The survey has been conducted in 11 talukas of Satara district and covered 500 respondents. Of which 250 are non-users and 250 are users of solar equipments.

2. The target group of customers for the solar water heaters can be described as follows:

Users and non users of solar water heaters are belong to 31-50 age group. Major purchasers belong to trading, self-employed and Retired category. Their monthly income is around Rs. 20,000.

It is a fact that those who are educated will come to know the importance of renewable energy. The respondents found to be graduates and postgraduates. Also majority of the respondents are from Arts, science and commerce discipline.

Job transfer does affect use of solar water heaters. It is observed that 76-99 % respondent's job is not transferable. The use of solar water heaters depends on the house type i.e. rented or own house. Those who have own house will purchase solar water heater. Transferable jobs influence purchase of solar water heaters.

Family size matters the use of solar water heaters. As family size increases consumption of energy will increase. So in order to get alternative energy, they can use solar water heater. Family income affects the use of solar water heater.

3. There are different energy sources use to get hot water. The main sources used by the non-users are LPG, electricity. Whereas majority of the users use when solar water heaters not works in rainy and cloudy days, that time they use LPG and electricity. Nither they use always solar water heater to get hot water. Regarding the present non renewable energy supply, majority of the respondents are unhappy because of non renewable energy is costly. They are looking for alternative energy sources. There is scope to motivate them to use solar energy by purchasing solar water heater.

4. It is observed that majority of the respondents use hot water all the seasons for bathing, soaking clothes etc. Majority of them use about 101 to 150 liters hot water daily. In order to prepare hot water maximum non-users are using LPG and electricity. Majority of user respondents are using solar water heater. In case absence of these, users use LPG and electricity.
5. It is interesting to note that majority of non-users are aware of solar water heaters. Usefulness of the solar water heater on the efficiency. It is observed that majority of the non-users (72.40%) agreed that solar water heaters are highly useful. At the same time majority of the users (96.80%) also agreed that solar water heaters are highly useful.
6. As the prices of solar water heaters are high and the majority of the respondents are aware of solar solar water heaters, both the users and non-users agreed that the prices of solar water heaters are high.
7. Non-users of solar water heaters might have heard about savings by use of solar water heaters through mouth publicity. Near about all the users agreed that they are saving money after using solar water heater. Majority of non-users also have the same opinion.
8. Since they have an opinion that they can save by using solar water heaters, majority of the non-users are interested in purchasing solar water heaters. 40.4% non-users have interest in purchasing of solar water heaters. It is observed that majority of them (25.20%) want to purchase solar water heater some days. 22% of them decided to purchase after five years and 16% non user want to purchase in one year. So there is scope to promote solar water heaters in the coming years. Reason for not interest in

purchasing of solar water heaters asked to non user said they have no own house and they are not fully convinced.

9. Majority of users purchased solar water heater from satara, karad and phaltan. There is need avaibility of solar water heater in various places of satara district. It is weakness of solar water heaters market.
10. The respondents were asked for suggestions regarding savings. All the respondents agree. They get saving after using solar water heater. and they agreed solar water heaters are economical compare to non renewable energy .
11. The users realized the saving after using the solar water heaters and 78.4 percent users agreed that they are saving and they (98.80%) agreed solar water heaters are economical to compare with non renewable energy. It is the fact that solar water heaters are economical compare to non renewable energy source. Economical in the sense that they will give maximum benefit at minimum cost. Also they are efficient. The analysis shows that majority of the users responded that solar water heaters are economical and very efficient.
12. The major sources of information about solar water heaters are news papers (44.40%) and solar dealers (39.60%) . The other sources are mouth publicity and exhibitions. The roll of T.V. advertisement is very low.
13. Factors influenced to purchase solar water heater are advantage of solar water heater (47.40%) influenced by users (34.80%) and motivated by the solar dealer (15.60%). The users considered price (84.40%), after sales service (77.60) of solar water heaters as major factors while purchasing. The second category factors under consideration are brand and capacity.

14. The efficiency of solar water heaters depends on the number of days the solar water heaters being used and the maintenance cost to be spent on those. It is observed that the users (95.60%) are using solar water heater up to 271-365 days in a year and the cost of maintenance is about Rs. 200 which is very less. Majority of users agreed that life time of solar water heater is about 11-30 years.
15. All the users agreed that solar water heaters are hazard free and environment friendly. Petrol, diesel consumption generates carbon emissions and they are non renewable energies. But solar energy is environment friendly. It will not pollute the environment.
16. Since the solar water heaters are costly, people are looking at subsidies in the form of low interest loans. It is observed that majority of the users are aware of government schemes such as low interest loans. However, the users are aware of soft loans availability on solar water heater. Though due to not proper service of banks. Majority of the users purchased with cash. Now days subsidy scheme is very popular and due to this all purchase done by cash.
17. Majority of the users purchased solar equipments to save energy and money. The others purchased for comfort and prestige. Majority of the users of solar water heater spent Rs. 20000-25000. There are few users who spent more than Rs. 50,000 on solar water heater.
18. Majority of the users felt that the cost of solar water heater is high. Thus they suggested that government should give more subsidy to customers and give low interest loans. They opined they purchase solar water heater for save energy and money.

19. Mouth publicity is the effective channel for promotion of solar water heaters and all the users are suggesting and motivating others by stating the usefulness by showing saving and by explaining its benefits.
20. Users suggest to government as -

    38% respondents advise the government to provide low interest loans and simplify the process. 32.80% respondents advise to advertise the benefits of solar water heaters. Some respondents are in favor of making use of solar solar water heaters compulsory. Some respondents also advise to give subsidies to the manufacturers to bring down the prices of the solar water heaters.
21. Users also suggest manufacturing companies to improve quality of the products and make new research to produce all type of products so that they can introduce low cost product. They require better after sales service from manufacturing companies.
22. Regarding the satisfaction, all the users of solar water heaters got very high satisfaction. It is very good for solar water heaters promoters.

SUGGESTIONS

Awareness about solar water heaters is high among the non-user category. Main reason for non use is a high cost of the solar water heater as perceived by the customer. In order to overcome this problem government required to take few steps. The market of solar water heater is very huge.

After analyzing researcher come to know solar water heater have very good opportunity in market.

1) Customers do not buy the product features but they buy benefits of the product. The benefits provided by the solar water heaters are understood and received by the users. Non users have to depend upon the information provided by the dealer. This may act as marketing ploy. Dealer should keep record of each customer and track of saving generated by the user. Dealer can show their results on paper. He can arrange visit to the users place. This strategy will boost the desire to buy the products.

2) Normally the non-users have opinion towards solar water heaters as it is costly product. Using suggestion 1 this opinion change can be carried out. This is done through “social marketing approach”. Due to this approach positive opinion about solar product can be made in an effective and gradual manner. Solar water heaters are not only eco-friendly but also national friendly. Hence in coming years, people will definitely think of buying solar water heaters.

3) Suggestion to the Government-

    1. Government should provide more subsidy to consumers of solar water heater.

2. Government must advertise solar water heaters for their promotion and awareness among the people.
3. Government must think to introduce laws for use of solar water heaters in domestic purpose.
4. Government must provide zero interest loan facility to potential users of solar water heaters through banks.

4) Suggestion to manufacturing companies-

1. Manufacturing companies must introduce low cost solar water heaters.
2. Manufacturing companies must carry out research to develop new models of solar water heaters.
3. Manufacturing companies must provide better after sale service whenever necessary.

5) Suggestion to society

1) Sun is the powerhouse of universe. It is the initial and ultimate source of global energy, the only energy which can be directly utilized without disturbing the natures cycle. This source of energy for well being of mankind so go for it.
2) Maximum use of solar water heaters saves non renewable energy so use solar water heater.
3) When researcher interview various users of solar water heaters. He come to know solar water heaters are economical, hazard free, maintance free, no recurring cost requires, give hot water near about full year, government subsidy available, pollution free, nature saving and more benefits so using solar water heaters is national mission so use more and more solar water heaters.

Chapter 6

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ANNEXURE

QUESTIONNAIRE

ANNEXURE

QUESTIONNAIRE

1) Name-

2) Address-

3) Age-

4) Occupation-

1) Trading ☐ 2) Industry ☐ 3) Self-employed ☐

4) Govt.service ☐ 5) Private service ☐ 6) Retired person ☐

7) Semi Govt. service ☐ 8) Agri☐ 9) Any other _____

5) Income Per month Rs _____

6) Education-

1) Undergraduate ☐ 2) Graduate ☐ 3) Post Graduate ☐

4) Diploma ☐ 5) others _____

7) Discipline - 1) Arts ☐ 2) Science ☐ 3) Commerce ☐

4) Engineering ☐ 5) Medical Science ☐

6) Agricultural ☐ 7) Any others _____

8) Gender- Male ☐ Female ☐

9) Is your job transferable?

_____

10) Have you own house?

_____

11) Total number of family members : ☐ Male ☐ Female ☐

12) Which sources of energy do you use?

1) Kerosene ☐ 2) Coal ☐ 3) Wood ☐

4) Electricity ☐ 5) Biogas ☐ 6) LPG ☐

7) Any other _____

13) How much happy you are with present non renewable energy supply? 1) Very happy ☐ 2) Happy ☐ 3) Not decided ☐

4) Unhappy ☐ 5) Very unhappy ☐

14) Do you feel non renewable energy is costly?

1) Yes ☐ 2) No

15) Are you looking for any alternative of energy?

1) Yes ☐ 2) No ☐

16) For what purpose do you use hot water?

1) Bathing ☐ 2) Soaking cloths ☐

3) Washing utensils ☐ 4) Any other ☐

17) How many liters (approx) of hot water do you use in your home everyday?

Liters _____

18) When do you use hot water for bath?

1) Only winter ☐ 2) Winter, rainy days ☐

3) Winter rainy summer ☐ 4) No any season ☐

19) How much you aware about solar water heater?

1) Very well ☐ 2) Know some extent ☐ 3) Not at all ☐

20) If you know about solar water heater, what is your opinion about?

	High				Low	Can't say
Usefulness	5	4	3	2	1	
Price	5	4	3	2	1	
Savings	5	4	3	2	1	
Interest in buying	5	4	3	2	1	

21) When will you buy solar water heater?

1) After some days ☐ 2) By one year ☐

3) By five years ☐ 4) Yet not decided ☐

22) Reason for not interested in solar water heaters.

_____

23) From where you purchase solar water heater?

_____

24) After using solar water heater do you get saving?

1) Yes ☐ 2) No ☐ 3) Don't know ☐

25) Compare to conventional energy source do you feel solar water heater are economical?

1) Very ☐ 2) Some extent ☐ 3) No ☐

26) How do you come to know about solar water heater?

1) Newspaper advertisement ☐ 2) TV advertisement ☐

3) Friends/ relative information ☐ 4) Exhibitions ☐

5) Solar dealer ☐ 6) Any other _____

27) What made you to take decision about solar water heater?

1) Advertisement ☐ 2) Influenced by user ☐

3) Advantages of solar influenced me ☐

4) Motivated by dealer ☐ 5) Any other _____

28) Which factors did you consider while purchasing solar water heater?

1) Capacity ☐ 2) Price ☐ 3) Service ☐

4) Brand ☐ 5) Any other _____

29) How many days in year solar water heater works efficiently?

_____

30) How much company give you life of solar water heater?

_____

31) How much you paid maintenance charges per year for solar water heater?

_____

32) After using solar water heater do you feel it is hazard free?

1) Yes ☐ 2) No ☐ 3) Don't know ☐

33) How did you purchase the solar water heater?

_____

34) How much did you paid for the solar water heater?

_____

35) Main cause behind purchase of solar water heater

_____

36) How you motivate other peoples to use solar water heater?

_____

37) What is your suggestion to people about using solar water heater?

_____

38) What is your suggestion to government to promote use of solar water heater?

_____

39) Do you have any suggestions to companies to which manufacturers of solar water heater?

_____

40) Are you satisfied with solar water heater?

_____