

A GENERAL STUDY ON DIFFUSION LEVEL OF SOLAR HOT WATER SYSTEM:

IN COIMBATORE: WITH REFERENCE TO SUDARSHAN SAUR

A PROJECT REPORT

Submitted by

V.GOVINDARAJAN

Reg No: 68107202104

In partial fulfillment of the requirement for the award of the degree

Of

MASTER OF BUSINESS ADMINISTRATION

MBA - AUGUST - 2009

KCT BUSINESS SCHOOL,

Department of Management Studies

Kumaraguru College of Technology,

(An Autonomous Institution Affiliated to Anna University, Chennai)

Coimbatore - 641 006.

DEPARTMENT OF MANAGEMENT STUDIES

Kumaraguru College of Technology - Coimbatore

BONAFIDE CERTIFICATE

Certified that this project titled "A GENERAL STUDY ON DIFFUSION LEVEL OF SOLAR HOT WATER SYSTEM: IN COIMBATORE: WITH REFERENCE TO SUDARSHAN SAUR", is the bonafide work of Mr.V.Govindarajan, who carried out this research under my supervision, certified further, that the best of my knowledge the work reported herein does not from part of any other project reports or dissertation on the basis of which a degree or award was conferred on an earlier occasion on this or any other certificate.



Faculty Guide

(Mr. Thomas Michel)

SENIOR LECTURER

DR.NGP INSTITUTE OF TECHNOLOGY

Evaluated and viva - voce conducted

On _____

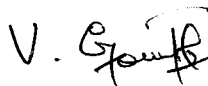


SIGNATURE OF PROJECT INCHARGE

(DR.S.V. DEVANATHAN)

PROFESSOR & DIRECTOR

DIRECTOR
KCT BUSINESS SCHOOL
KUMARAGURU COLLEGE OF TECHNOLOGY
COIMBATORE - 641 006

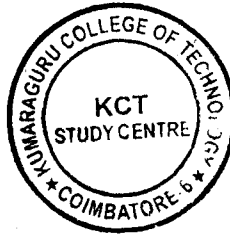


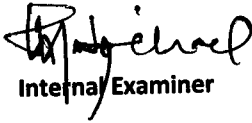
(V.GOVINDARAJAN)

Roll no: 0702MBA0743

Certificate of Viva-voce Examination

This is to certify that Thru. V.Govindarajan (Roll no: 0702MBA0743: Register No: 68107202104) has been subjected to Viva-voce Examination on 12-9-09 (Date) at 11.15 AM (Time) at the Study centre Kumaraguru College of Technology, Coimbatore.

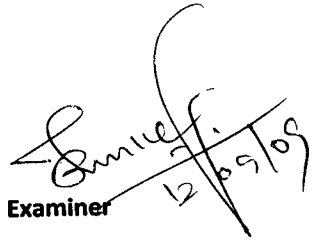



Internal Examiner

Name: Mr. THOMAS MICHAEL

Designation: Senior Lecturer

Address: DR. NRP Institute of Technology - CBE.


12/09/09

External Examiner

Name: Dr. K. RAMAMOORTHY

Designation: Prof. & Head of Dept
MBA

Address: Coimbatore Institute of Technology - CBE.

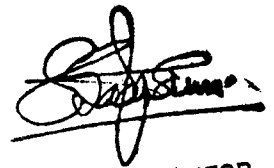
Coordinator

Study Centre

Name: Dr.S.Sadasivam

Designation: Dean Academic

Address : KCT Study Centre, Coimbatore.



CO-ORDINATOR,
KCT STUDY CENTRE,
CDF ANNA UNIVERSITY CHENNAI.
KUMARAGURU COLLEGE OF TECHNOLOGY
COIMBATORE 641 006.

ABSTRACT

Solar energy is found to be the enormously available renewable energy. Its usage will help to maintain green & healthy environment. Developed countries like USA, German are started to talk about controlling of Global warming, it requires to save the earth for our future generation. Solar Thermal energy & solar electric energy are the two forms of energy we can avail from nature which is free and non polluting energy source.

In this study I have focused to conduct survey about the diffusion level of solar hot water system in Coimbatore and its current usage level. Also focused study the business opportunity available in the domestic market.

In this study I used Survey type methodology to do the analysis. Primary data's are collected through the filled questionnaire from the respondent. Each respondent personally interviewed and the forms are filled. I have chosen 140 respondent using convenience sampling method. Questionnaire prepared with 1) yes or no type questions 2) multiple choice questions.

Survey findings having been concluded with percentage analysis with chi-square test confirmation of the result.

Survey findings are:

1. Diffusion level of the system in Coimbatore is only 5%.
2. Business opportunity is another 25 – 30%.

Table of contents:

| CONTENTS | PAGE NUMBERS |
|---|---------------------|
| 1. List of Tables | 3 |
| 2. List of Figures | 3 |
| 3. Chapter 1 - Introduction | 4 |
| 4. Chapter 2 - Literature Survey | 14 |
| 5. Chapter 3 - Methodology | 24 |
| 6. Chapter 4 - Data Analysis & Interpretation | 30 |
| 7. Chapter 5 - Conclusions | 38 |
| Appendices: | |
| 8. Appendix A - Sample Questionnaire | 42 |
| 9. Appendix B - Bibliography | 44 |

List of tables

| TABLE | PAGE NUMBERS |
|--|---------------------|
| 4.2.1 Occupation vs. Awareness | 31 |
| 4.2.2 Income vs. Acceptance | 32 |
| 4.2.3 Usage of hot water vs. Acceptance | 33 |
| 4.2.4 Amount can Invest vs. Acceptance | 34 |
| 4.2.5 Back up coil system vs. Acceptance | 35 |

List of figures

| FIGURES | PAGE NUMBERS |
|--|---------------------|
| 4.2.1 Occupation vs. Awareness | 31 |
| 4.2.2 Income vs. Acceptance | 32 |
| 4.2.3 Usage of hot water vs. Acceptance | 33 |
| 4.2.4 Amount can Invest vs. Acceptance | 34 |
| 4.2.5 Back up coil system vs. Acceptance | 35 |

A GENERAL STUDY ON DIFFUSION LEVEL OF SOLAR HOT WATER SYSTEM:
IN COIMBATORE WITH REFERENCE TO SUDARSHAN SAUR

CHAPTER 1 – Introduction:

1 Research back ground: Profile of the Company being associated with study:

Name of the organization : **Sudarshansaur Pvt Ltd.**

Registered office address : 5, Tarak Colony,

Opp. Ramakrishna Mission Ashram,

Beed by-pass, Aurangabad – 431005(M.S. India)

Phone Number : 91-240-2376609/10

Company Profile :

- They have successful track record of manufacturing Solar Water Heating Systems, since 1989.
- They are the top most leader company manufacturing Sudarshan Saur brand Solar Products. Mainly Solar Water heating systems.

Product Range :

- They produce wide range of Solar Water Heating Systems and Solar Lighting System.
- Their various models i.e. Delite, Marvel, Wonder, SLS are suitable for different applications & they are time proven, working successfully at thousands of satisfied customers all over the Country.

Manufacturing Setup :

- They have well equipped manufacturing setup in which World Class Solar Product is produced using latest International Technology, under ISO 9001: 2000 Quality Management System, supported by skilled staff.
- They have advanced black chrome selective coating plant for coating of solar absorber fins, which is designed with full technical support from National Aerospace Lab. (NAL), Bangalore.

- By using Ultrasonic Bonding Technology we produce high strength and efficient Solar Absorber Fins.
- They are the only company using special Non Stick Lining for Hot Water Storage Tank.
- Special Stainless Steel manufacturing & puffing setup with some special purpose machines to manufacture tanks for ETC Systems.
- Unique comparative R & D Test Rig is developed for testing of system performance & to develop high efficient solar water heating system
- They have 100% in-house manufacturing facilities to produce top quality World Class Solar Products.

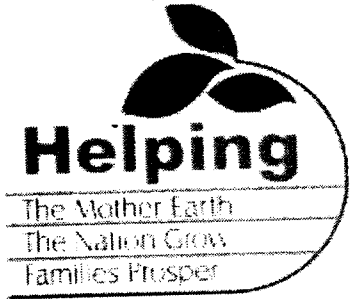
Marketing Network & After Sales Supports :

- They have widely spread well trained dealers network all over the country.
- At the major cities, they have Solar Shopees for customer awareness towards Solar Energy Products.
- They have fully fledged team of Solar Technicians and Supervisors for installation, servicing & training purpose.

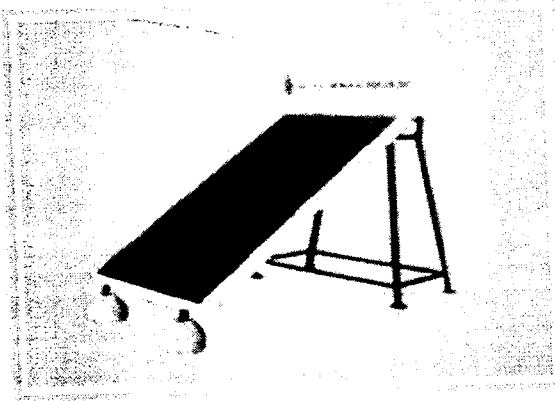
Foreign Collaboration :

- To manufacture World Class Solar Products, we have adopted latest technology in collaboration with internationally renowned companies.

their Mission :

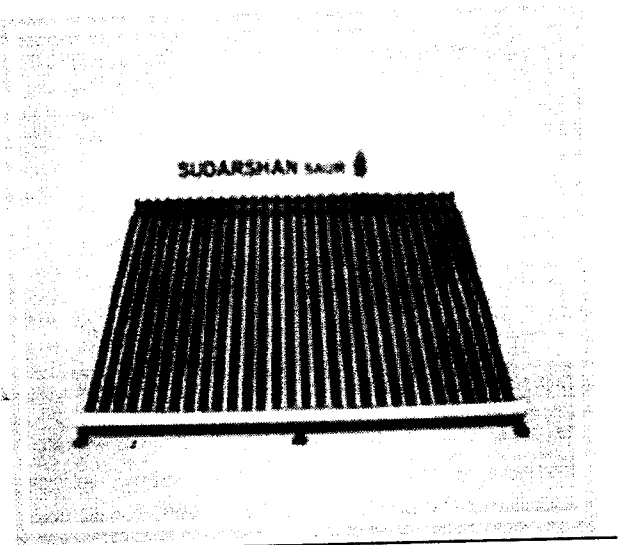


Product Photographs:



Flat Plate Collectors:

Evacuated Tube Collectors:



2. Need for this Study & Identified problem:

The reasons for thinking about energy like solar power as follows:

Resource depletion-(Non-renewable Energy)

Normally, resources will not become totally exhausted at some particular moment, but rather will diminish until the price of continued exploitation becomes so high that it is no longer economical. According to Hubbert peak theory, the rate of exploitation follows a sort of bell-shaped curve. The Hubbert peak theory article discusses predictions for some resources.

Estimates for when various resources will run out if exploitation continues at present rates are somewhat controversial, but for some resources, the estimated time left is rather short.

Non-renewable Energy:

A non-renewable resource is a natural resource that cannot be produced, re-grown, regenerated, or reused on a scale which can sustain its consumption rate. These resources often exist in a fixed amount, or are consumed much faster than nature can recreate them. Fossil fuel (such as coal, petroleum and natural gas) is an example. In contrast, resources such as timber (when harvested sustainably) or metals (which can be recycled) are considered renewable resources.

A non-renewable resource is always drawn down with anabolic processes that use up energy.

Renewable energy is enormous:

A natural resource is a renewable resource if it is replaced by natural processes at a rate comparable or faster than its rate of consumption by humans. Solar radiation, tides, winds and hydroelectricity are perpetual resources that are in no danger of long-term availability. Renewable resources may also mean commodities such as wood, paper, and leather, if harvesting is performed in a sustainable manner.

Some natural renewable resources such as geothermal power, fresh water, timber, and biomass must be carefully managed to avoid exceeding the world's capacity to replenish them. A life cycle assessment provides a systematic means of evaluating renewability.

The term has a connotation of sustainability of the natural environment. Gasoline, coal, natural gas, diesel, and other commodities derived from fossil fuels are non-renewable. Unlike fossil fuels, a renewable resource can have a sustainable yield.

Global warming:

Global warming is the increase in the average temperature of the Earth's near-surface air and oceans since the mid-20th century and its projected continuation. Global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) during the last century. The Intergovernmental Panel on Climate Change (IPCC) concludes that increasing greenhouse gas concentrations resulting from human activity such as fossil fuel burning and deforestation are responsible for most of the observed temperature increase since the middle of the 20th century.[1] The IPCC also concludes that natural phenomena such as solar variation and volcanoes produced most of the warming from pre-industrial times to 1950 and had a small cooling effect afterward. These basic conclusions have been endorsed by more than 45 scientific societies and academies of science,[B] including all of the national academies of science of the major industrialized countries.

Climate model projections summarized in the latest IPCC report indicate that the global surface temperature will probably rise a further 1.1 to 6.4 °C (2.0 to 11.5 °F) during the twenty-first century. The uncertainty in this estimate arises from the use of models with differing sensitivity to greenhouse gas concentrations and the use of differing estimates of future greenhouse gas emissions. Some other uncertainties include how warming and related changes will vary from region to region around the globe. Most studies focus on the period up to the year 2100. However, warming is expected to continue beyond 2100 even if emissions stop, because of the large heat capacity of the oceans and the long lifetime of carbon dioxide in the atmosphere.

Product History:

Flat-plate collectors for solar water heating were popular in Florida and Southern California in the 1920s. Levi Yissar built the first prototype Israeli solar water heater and in 1953 he started NerYah Company, Israel's first commercial manufacturer of solar water heaters. Despite the abundance of sunlight in Israel, solar water heaters were used by only 20% of the population by 1967. Following the energy crisis in the 1970s, the Israeli Knesset passed a law requiring the installation of solar water heaters in all new homes (except high towers with insufficient roof area). As a result, Israel is now the world leader in the use of solar energy *per capita* (3% of the primary national energy consumption).

During this time, there was some resurgence of interest in solar heating in North America. Technical innovation has improved performance, life expectancy and ease of use of these systems. Installation of solar hot water heating has become the norm in countries with an abundance of solar radiation, like Cyprus, Israel and Greece, as well as in Japan and Austria, where there is less.

Solar hot water systems have become popular in China, where basic models start at around 1,500 yuan (US\$190), much cheaper than in Western countries (around 80% cheaper for a given size of collector). It is said that at least 30 million Chinese households now have one, and that the popularity is due to the efficient evacuated tubes which allow the heaters to function even under gray skies and at temperatures well below freezing.^[8]

In 1980, Israel became the first country in the world to require solar thermal systems installation in new construction. 85% of the households today use solar thermal systems and the use of it, saves 3% of the yearly electricity consumption in Israel.

In 2005, Spain became the first country in the world to require the installation of photovoltaic electricity generation in new buildings, and the second (after Israel) to require the installation of solar hot water systems in 2006. Australia adopted the mandatory regulation for solar thermal for new construction in 2006 as well.

Israel's use of solar water heaters is estimated to save the country two million barrels of oil a year, and the country has the highest per capita use in the world. In the 1950s there was a fuel shortage in the new Israeli state, and the governments forbid heating water between 10 p.m. and 6 p.m. As the situation worsened, engineer Levi Yissar proposed that instead of building more electrical generators, homes should switch to solar water heaters. He built a prototype in his home, and in 1953 he started NerYah Company, Israel's first commercial manufacturer of solar water heaters. By 1967 around one in twenty households heated their water with the sun and 50,000 solar heaters had been sold. However, cheap oil from Iran and from oil fields captured in the Six Day War made Israeli electricity cheaper and the demand for solar heaters dropped. With the 1970s oil crisis, Harry Zvi Tabor, the father of Israel's solar industry, developed the prototype solar water heater that is now used in over 30%-40% of Israeli homes.

In 1980, the Israeli Knesset passed a law requiring the installation of solar water heaters in all new homes (except high towers with insufficient roof area). As a result, Israel is now the world leader in the use of solar energy *per capita* (3% of the primary national energy consumption).

As of the early 1990s, all new residential buildings were required by the government to install solar water-heating systems, and Israel's National Infrastructure Ministry estimates solar panels for water-heating already satisfy 4% of the country's total energy demand. Israel and Cyprus are the per capita leaders in the use of solar hot water systems with over 30%-40% of homes using them.

1.3 Research Problem:

In India we have good source of Solar Energy throughout the year. It is required to use this as alternate energy resource. Recently USA passed out decision in legislates to get nearly 85% of their total energy from the Renewable energy resource with in 2050. This is the only way to reduce Global warming.

Indian government now planned to install more Solar Power Fields in order to get environmental friendly energy to save our earth.

Diffusion level of Renewable energy use in India is not getting momentum.

Definition: Diffusion of Technology

Diffusion of Innovations is a theory of how, why, and at what rate new ideas and technology spread through cultures. The concept has been first studied by the French sociologist Gabriel Trade (1890) and by German and Austrian anthropologists as Friedrich Ratzel or Leo Frobenius. Its basic epidemiological or internal-influence form was described by H. Earl Pemberton, who provided examples of institutional diffusions as postage stamps or compulsory school laws. The publication of a study of Ryan and Gross on the diffusion of hybrid corn in Iowa was the first sustainably visible contribution in a broader interest in innovations which was especially popularized by the textbook of Everett Rogers (1962), Diffusion of Innovations. He defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system."

1.4 Significance of this study:

Solar energy is the radiant light and heat from the Sun that has been harnessed by humans since ancient times using a range of ever-evolving technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydroelectricity and biomass account for most of the available renewable energy on Earth. Only a minuscule fraction of the available solar energy is used.

Solar power provides electrical generation by means of heat engines or photovoltaic's. Once converted, its uses are limited only by human ingenuity. A partial list of solar applications includes space heating and cooling through solar architecture, potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes.

Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute sunlight. Active solar techniques include the use of photovoltaic panels and solar thermal collectors (with electrical or mechanical equipment) to

convert sunlight into useful outputs. Passive solar techniques include orienting a building to the sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air.

1.5 Objective of the study:

- The objective of the study is to check the Diffusion Level & the opportunity available for the business of solar water heaters.

Supportive lines for Objective:

- The entire world is talking about Global warming and the necessity of Renewable Green energy systems. Solar Thermal energy is one such energy source.

- In Developed countries like German, France, Brazil & Israel about 35% to 40% of the houses are using Solar water heaters.

- In India its usage is not much popular, so this study is focused on to know the business opportunity & usage level of this system.

Hypotheses of this study:

This study involves the hypotheses like,

1. Relation between Income level and acceptance of this product.
2. Users of hot water with the acceptance mode.
3. Accepters of this product with loan acceptance level.

CHAPTER 2 - Literature Review

- Renewable energy books and magazines are referred to collect details about the product.
 - Magazines are referred to get information about the economic viability of this product.
 - Reports of various Government and Private Institutions are reviewed to get the information's like usage and popularity nationally and internationally.
- All are added in the following few pages.

1. Why Solar Energy?

India is one of the few countries with long days and plenty of sunshine. The Sun is the single largest source of energy for the entire solar system. In less than 1 hour of daylight, the SUN releases upon the Earth an amount of energy that is consumed by the entire population of the planet in 1 year. This energy is clean, it is renewable, it is free, it is abundant and it is everywhere. This makes it one of the most promising alternatives to the conventional energy sources.

2. What is Solar Water Heater? How it works?

Solar Water Heater is a device that uses solar energy to heat water. A solar water heater comprises a blackened flat plate collector with associated metal tubing, facing the sun. The collector is provided with a transparent glass cover and a layer of thermal insulation beneath the plate. The collector tubing is connected by a pipe to an insulated tank that stores hot water during non sunny periods.

Basically it is a thermo siphon system works on principle that warm water rising above, it is also known as natural convection. As water in the collector heats, it becomes lighter and rises naturally into the tank above. Cold water flows from the bottom of the storage tank to the

collector, from which heated water rises to the top of the storage tank.

3. Why Solar Water Heater?

After initial investment at the time of installation of the system, there are no operating costs, no or very low maintenance, hence it gives hot water free of cost after installation. Whoever invests in a solar heating system is also investing in the future. In addition to that using solar water heating system, one is actively contributing to the lowering of environmentally harmful CO² emissions.

4. Why Solar Water heating is a better alternate than Gas or Electricity?

| | Electric Heater | Gas Heater | Diesel Boiler | Solar Heater |
|----------------------------------|------------------------|--------------------|----------------------|---------------------|
| Initial Setup Cost | Rs 4000 | Rs 5000 | Rs 4,500 | Rs 19,000 |
| Life Time | 5 to 7 Years | 4 to 5 Years | 5 to 7 Years | Up to 15 Years |
| Fuel Consumption | Electrical | Butane\Natural gas | Diesel | None |
| Fuel Efficiency | 90% | 60% | 70% | 80% |
| Fuel Expense/Year | Rs 9,000 | Rs 4,600 | Rs 9,300 | Rs 0,000 |
| Total Cost After 10 Years | Rs 94,000 | Rs 51,000 | Rs 97,5000 | Rs 25,000 |

Countries using solar water heater successfully and the relevant data's:

- | | | |
|-----------|---|-----------------------------|
| 1. German | - | 40% to 45% houses installed |
| 2. Israel | - | Nearly 50% |
| 3. Brazil | - | 25% |
| 4. France | - | 35% |

2.2 How They Work

Solar water heating systems include storage tanks and solar collectors. There are two types of solar water heating systems: active, which have circulating pumps and controls, and passive, which don't.

Most solar water heaters require a well-insulated storage tank. Solar storage tanks have an additional outlet and inlet connected to and from the collector. In two-tank systems, the solar water heater preheats water before it enters the conventional water heater. In one-tank systems, the back-up heater is combined with the solar storage in one tank.

2.3 Three types of solar collectors are used for residential applications:

- Flat-plate collector

Glazed flat-plate collectors are insulated, weatherproofed boxes that contain a dark absorber plate under one or more glass or plastic (polymer) covers. Unglazed flat-plate collectors—typically used for solar pool heating—have a dark absorber plate, made of metal or polymer, without a cover or enclosure.

- Integral collector-storage systems

Also known as ICS or *batch* systems, they feature one or more black tanks or tubes in an insulated, glazed box. Cold water first passes through the solar collector, which preheats the water. The water then continues on to the conventional backup water

heater, providing a reliable source of hot water. They should be installed only in mild-freeze climates because the outdoor pipes could freeze in severe, cold weather.

- **Evacuated-tube solar collectors**

They feature parallel rows of transparent glass tubes. Each tube contains a glass outer tube and metal absorber tube attached to a fin. The fin's coating absorbs solar energy but inhibits radioactive heat loss. These collectors are used more frequently for U.S. commercial applications.

- **There are two types of active solar water heating systems:**

- **Direct circulation systems**

Pumps circulate household water through the collectors and into the home. They work well in climates where it rarely freezes.

- **Indirect circulation systems**

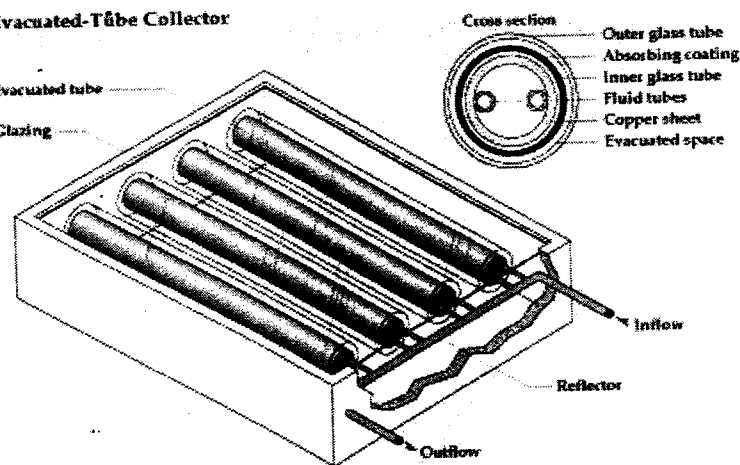
Pumps circulate a non-freezing, heat-transfer fluid through the collectors and a heat exchanger. This heats the water that then flows into the home. They are popular in climates prone to freezing temperatures.

2.4 Industrial applications of Solar water heaters:

1. Dyeing and Garment industries.
2. Hotels
3. Swimming pools
4. Pharmaceutical industry
5. Chemical Industry
6. Sugar factories

How it works:

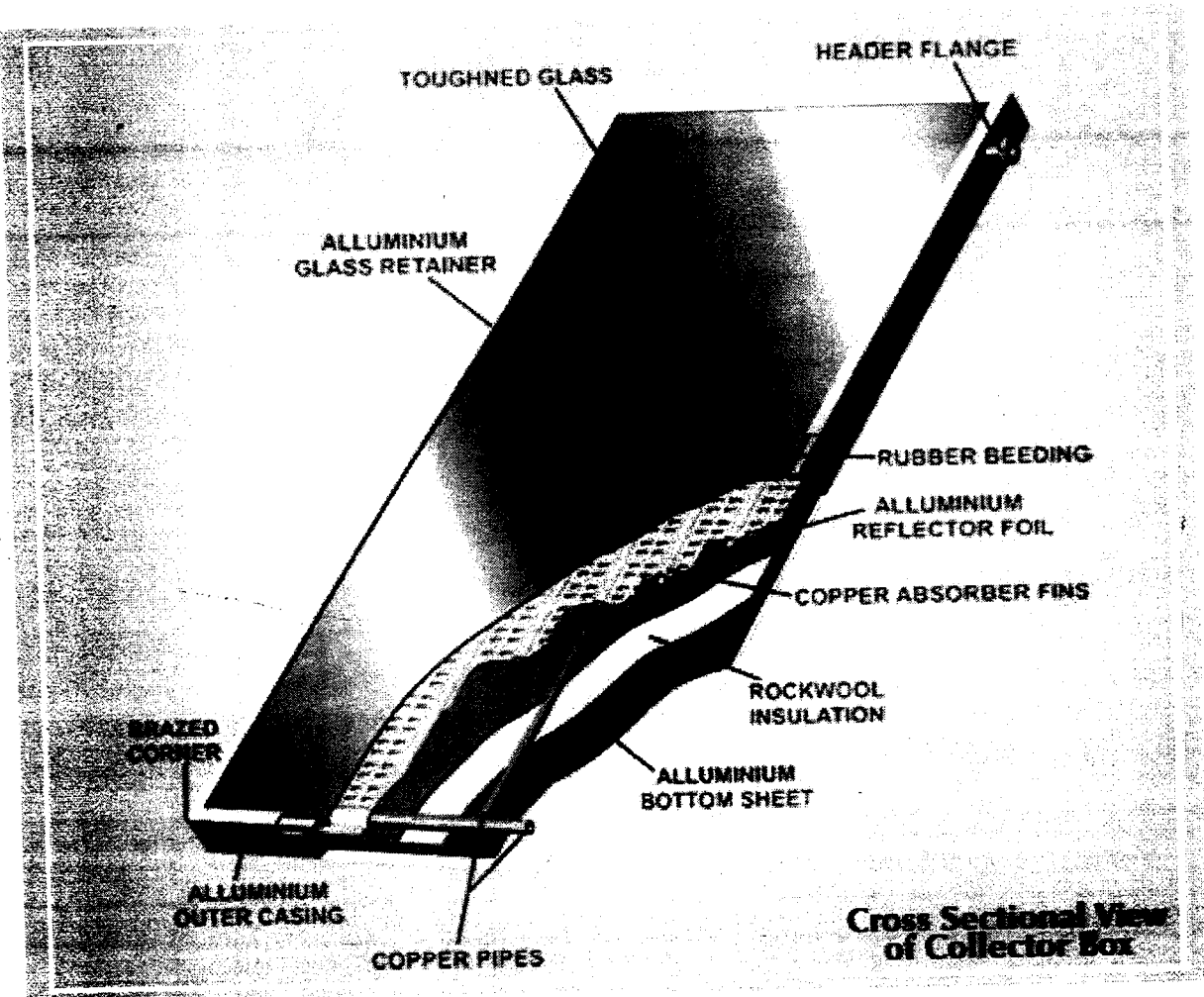
Evacuated tube collector



Evacuated (or vacuum) tubes panel.

Evacuated tube collectors are made of a series of modular tubes, mounted in parallel, whose number can be added to or reduced as hot water delivery needs change. This type of collector consists of rows of parallel transparent glass tubes, each of which contains an absorber tube (in place of the absorber plate to which metal tubes are attached in a flat-plate collector). In some cases, the tubes are covered with a special light-modulating coating. In an evacuated tube collector, sunlight passing through an outer glass tube heats the absorber tube contained within it. The absorber can either consist of copper (glass-metal) or specially-coated glass tubing (glass-glass). The glass-metal evacuated tubes are typically sealed at the manifold end, and the absorber is actually sealed in the vacuum, thus the fact that the absorber and heat pipe are dissimilar metals creates no corrosion problems. Some systems use foam insulation in the manifold. Soda-lime glass is used in the higher quality evacuated tubes manufacture.

Flat-plate collector:



A typical flat-plate collector is a metal box with a glass or plastic cover (called glazing) on top and a dark-colored absorber plate on the bottom. The sides and bottom of the collector are usually insulated to minimize heat loss.

Sunlight passes through the glazing and strikes the absorber plate, which heats up, changing solar energy into heat energy. The heat is transferred to liquid passing through pipes attached to the absorber plate. Absorber plates are commonly painted with "selective coatings,"

which absorb and retain heat better than ordinary black paint. Absorber plates are usually made of metal—typically copper or aluminum—because the metal is a good heat conductor. Copper is more expensive, but is a better conductor and less prone to corrosion than aluminum. In locations with average available solar energy, flat plate collectors are sized approximately one-half to one-square foot per gallon of one-day's hot water use.

2.5 Government organizations working on Renewable Energy & their profile:

IREDA:

IREDA is a Public Limited Government Company established in 1987, under the administrative control of Ministry of New and Renewable Energy (MNRE) to promote, develop and extend financial assistance for renewable energy and energy efficiency/conservation projects with the motto: “ENERGY FOR EVER”

OBJECTIVES OF IREDA:

- To operate a revolving fund for promotion, development and commercialization of New and Renewable Sources of Energy (NRSE)
- To assist in up gradation of technologies
- To extend financial support to Energy Efficiency & Conservation projects and schemes

2. TEDA:

Tamil Nadu Energy Development Agency
EVK Sampath Maaligai (V Floor)
68, College Road, Chennai - 600 006
Phone : +91-44-28224830, +91-44-28236592
Fax : +91-44-28222971

The Government of Tamil Nadu realized the importance and need for renewable energy, and set up a separate Agency, as registered society, called the Tamil Nadu Energy Development Agency (TEDA) as early as 1985, as per G.O.Ms.No.163, P. & D. (EC) Department, dated 29.11.1984 with the following specific objectives:-

- i. To promote the use of new and renewable sources of energy (NRSE) and to implement projects therefore.
- ii. To promote energy conservation activities.
- iii. To encourage research and development on renewable sources of energy.

2.6 Loan provided by banks for this product:

Features of the scheme:

a. Eligible systems: Solar Water Heaters with both Flat Plate or Evacuated Tubular Collectors (of any size)

b. Borrowers: Any end user such as Individuals, institutions, non-commercial organizations/commercial organizations (hotels, hospitals etc).

c. Loan amount: Up to 85% of the cost of the project as per cost indicated in the enclosed sheets. No separate ceilings stipulated.

In order to be eligible for claiming the Interest Subsidy, the equipment has to be purchased from manufacturers/suppliers approved by the MNES. Details of such "approved" vendors are appended to this circular.

The borrowers are free to select vendors of their choice taking into consideration competitive pricing, after sales service etc.

d. Duration of loan Repayment starts 3 months after the release of funds to the consumers. Maximum repayment period Five years inclusive of this 3 months moratorium period. Repayment would be in Equated Monthly Installments.

e. Rate of interest

2% p.a to domestic users,

3% p.a to institutional user's not availing accelerated depreciation and

5% p.a to industrial/commercial users availing depreciation.

Bank may charge penal interest as applicable in case of default.

The list of Banks offering Loans:

1. Canara Bank.
2. Syndicate Bank.
3. Bank of Baroda.
4. Union Bank of India.
5. Vijaya Bank.
6. Dena Bank.
7. Bank of Maharashtra.
8. Punjab & Singh bank.
9. Some Co-operative & Urban banks.

CHAPTER 3 – Methodology of study:

3.1 Type of project:

Type of project is **Survey type** project. It has been focused to conduct personal Interview with the respondents to get the details like scope of the product, Business opportunities. It is being associated with manufacturer cum seller of the product.

3.2 Methodology followed in this study:

Market Survey for Solar water heater users in Coimbatore estimates the relative strengths in the market and the diffusion level of this technology. The survey is conducted on a sample basis in all urban areas with populations of 9, 00,000 and more. The survey targets only privately initiated structures with at least three income level group people, which have been on the market for at least three months. The survey collects market usage rate, available and acceptance unit data for all sampled structures. Most data contained in this study refer to randomly chosen people from the city places like,

- 1) Peelamedu
- 2) Periyanaikanpalayam
- 3) Ramanathapuram
- 4) Kavaundampalayam &
- 5) Vadavalli.

The survey is conducted by a combination of personal interviews and site visits, and information is obtained from the owner, manager, or building superintendent. The survey is conducted during the first two weeks of May/June, and the results reflect market conditions at that time.

3.3 Sampling method used for data collection:

Convenient sampling method is used in this project to collect data from respondents.

Definition of Convenience sampling:

Convenience sampling (sometimes known as grab or opportunity sampling) is a type of non probability sampling which involves the sample being drawn from that part of the population which is close to hand. That is, a sample population selected because it is readily available and convenient. The researcher using such a sample cannot scientifically make generalizations about the total population from this sample because it would not be representative enough. For example, if the interviewer was to conduct such a survey at a shopping center early in the morning on a given day, the people that he/she could interview would be limited to those given there at that given time, which would not represent the views of other members of society in such an area, if the survey was to be conducted at different times of day and several times per week. This type of sampling is most useful for pilot testing. Several important considerations for researchers using convenience samples include:

1. Are there controls within the research design or experiment which can serve to lessen the impact of a non-random, convenience sample whereby ensuring the results will be more representative of the population?
2. Is there good reason to believe that a particular convenience sample would or should respond or behave differently than a random sample from the same population?
3. Is the question being asked by the research one that can adequately be answered using a convenience sample?

In social science research, snowball sampling is a similar technique, where existing study subjects are used to recruit more subjects into the sample.

4 Scope & Questionnaire design for this study:

Scope of this project is to estimate the diffusion level of solar water technology and to find the Business opportunity for this product.

Questionnaire designed as to get the maximum and optimal information from the respondent which can be used for analysis and decisions making process later part of this study. Also it contains easy to answer questions formed in a easily understandable format. It contains following type of questions.

1. Yes or No type questions.
2. Yes or No type questions also provided space to give their opinion to justify their answers.
3. Multiple options questions to choose their status for the question.
4. It contains only two pages of questions, which will not be boredom to the respondent.

3.5 Number of Respondents Interviewed and details:

- **140 respondents** are chosen from the population of 9, 00,000 in Coimbatore city for survey in various parts of city by random sampling method.
- All are interviewed personally and questionnaire got filled.

3.6 Duration of study:

- From June –2009 First week to Third week data's are collected.
- From March – 2009 to June Last week data's are collected and analyzed using analysis tools like,
 - 1) Chi square test.
 - 2) Percentage analysis

3.5 Sources of Information:

Primary Data:

Definition

- - Data observed or collected directly from first-hand experience.

Data's are collected through questionnaire. The advantages are:

- Can be used as a method in its own right or as a basis for interviewing or a telephone survey.
- Can be posted, e-mailed or faxed.
- Can cover a large number of people or organizations.
- Wide geographic coverage.
- Relatively cheap.
- No prior arrangements are needed.
- Avoids embarrassment on the part of the respondent.
- Respondent can consider responses.
- Possible anonymity of respondent.
- No interviewer bias.

3.6 Tools and Techniques used for Analysis:

Collected data's are thoroughly sorted and arranged in order to carry out the analysis in the following two methods. Decisions and conclusions are arrived based on the results of the following two tests.

Data analysis is a process of gathering, modeling, and transforming data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains.

1. Chi-square test

A chi-square test (also chi-squared or χ^2 test) is any statistical hypothesis test in which the sampling distribution of the test statistic is a chi-square distribution when the null hypothesis is true, or any in which this is asymptotically true, meaning that the sampling distribution (if the null hypothesis is true) can be made to approximate a chi-square distribution as closely as desired by making the sample size large enough.

2. Percentage Analysis:

It is Simple analysis method followed to analyze number of respondents for one particular option and coming to a conclusions based on the percentage of acceptance of one particular option. Conclusions are arrived on the basis of strong acceptance by seeing it is percentage of acceptance by comparing one with the other.

3. Quantitative Analysis

A business or financial analysis technique that seeks to understand behavior by using complex mathematical and statistical modeling, measurement and research. By assigning a numerical value to variables, quantitative analysts try to replicate reality mathematically.

CHAPTER 4 – Data analysis and inferences:

1 Sample of Questionnaire attached in Appendix-A

2. Graphical representation of the Percentage Analysis & Table of data's:

Table 4.2.1 – Occupation of the respondent vs. Awareness of the product

| Sl no | Occupation | % of respondent in conducted survey | % of awareness among the respondent |
|-------|---------------|-------------------------------------|-------------------------------------|
| 1 | Professionals | 40 | 10 |
| 2 | Employees | 40 | 10 |
| 3 | Business | 20 | 10 |

Figure 4.2.1 Occupation of the respondent vs. Awareness of the product

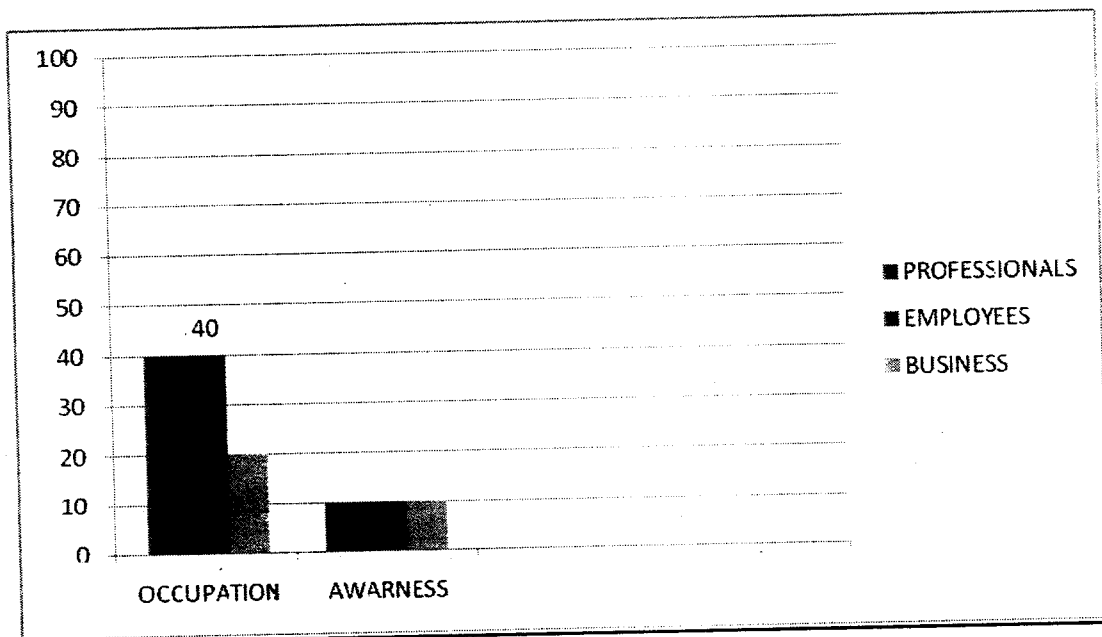


Table 4.2.2 Annual Income of the respondent vs. Acceptance of product:

| Sl no | Income Group | % of respondent in conducted survey | % of acceptance for the product among the respondent |
|-------|--------------------|-------------------------------------|--|
| 1 | Lower middle class | 40 | 30 |
| 2 | Middle class | 35 | 30 |
| 3 | Upper middle class | 25 | 30 |

Figure 4.2.2 Annual Income of the respondent vs. Acceptance of product:

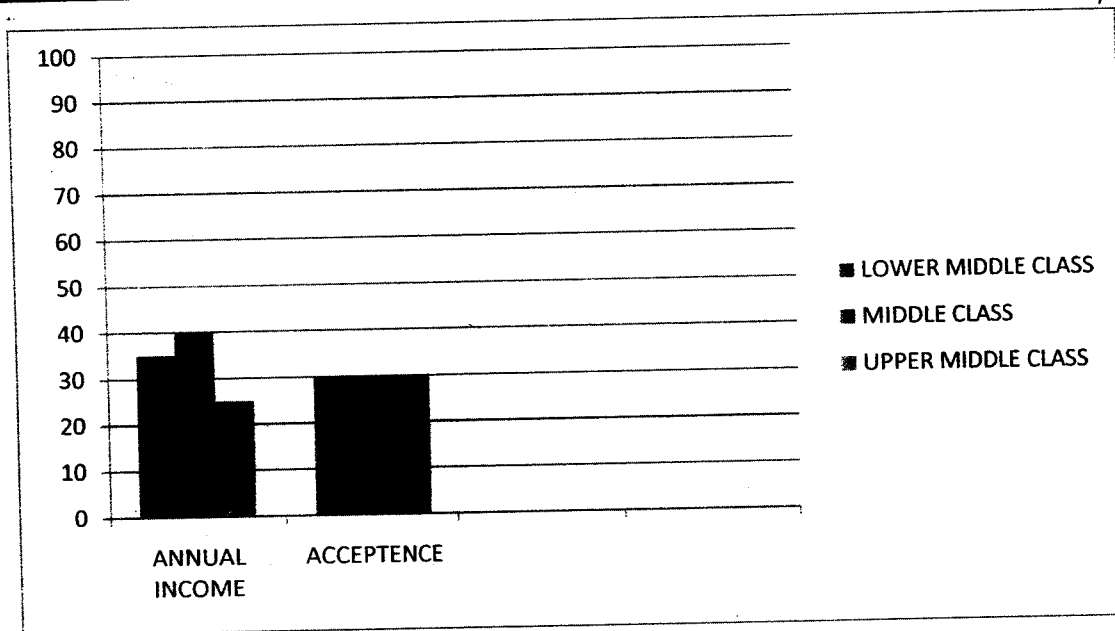


Table 4.2.3 Usage of Hot water for bathing purpose vs. Acceptance of the product

| Sl no | Hot water users category | % of respondent in conducted survey | % of acceptance for the product among the respondent |
|-------|--------------------------|-------------------------------------|--|
| 1 | Not prefer | 4 | 25 |
| 2 | 2-3 months in a year | 35 | 15 |
| 3 | 4 -11 months in a year | 58 | 60 |

Figure 4.2.3 Usage of Hot water for bathing purpose vs. Acceptance of the product

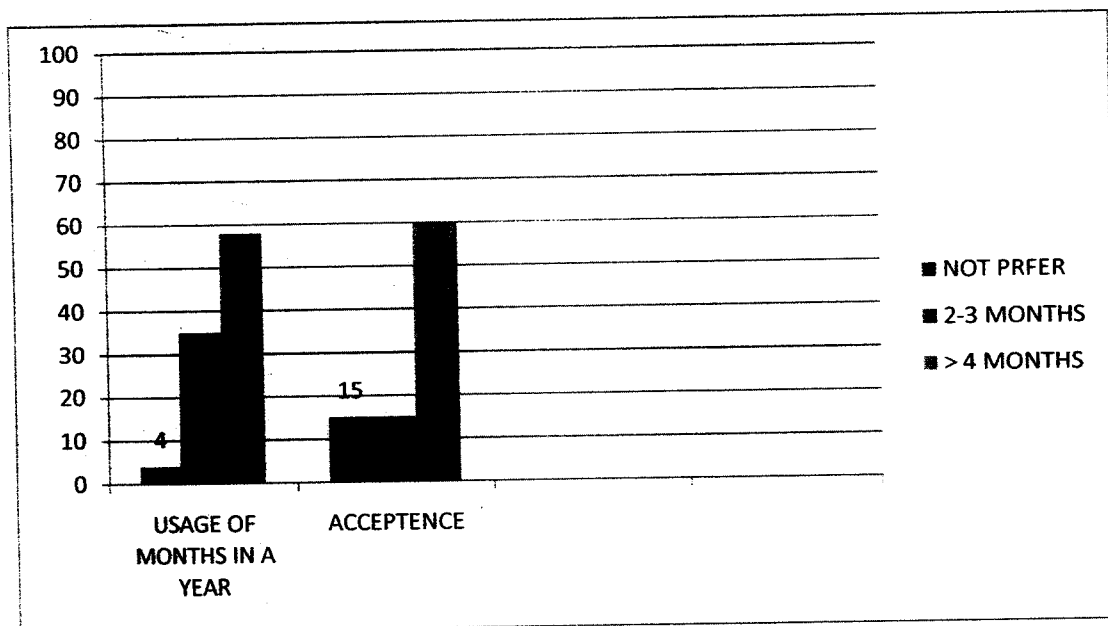


Table 4.2.4 The Amount ready to Invest on this system vs. Acceptance of the product:

| Sl no | Amount respondent ready to invest on this product | % of respondent in conducted survey | % of acceptance for the product among the respondent |
|-------|---|-------------------------------------|--|
| 1 | <10,000 | 47 | 0 |
| 2 | >10,000 & <20,000 | 47 | 45 |
| 3 | >20,000 | 4 | 100 |

Figure 4.2.4 The Amount ready to Invest on this system vs. Acceptance of the product:

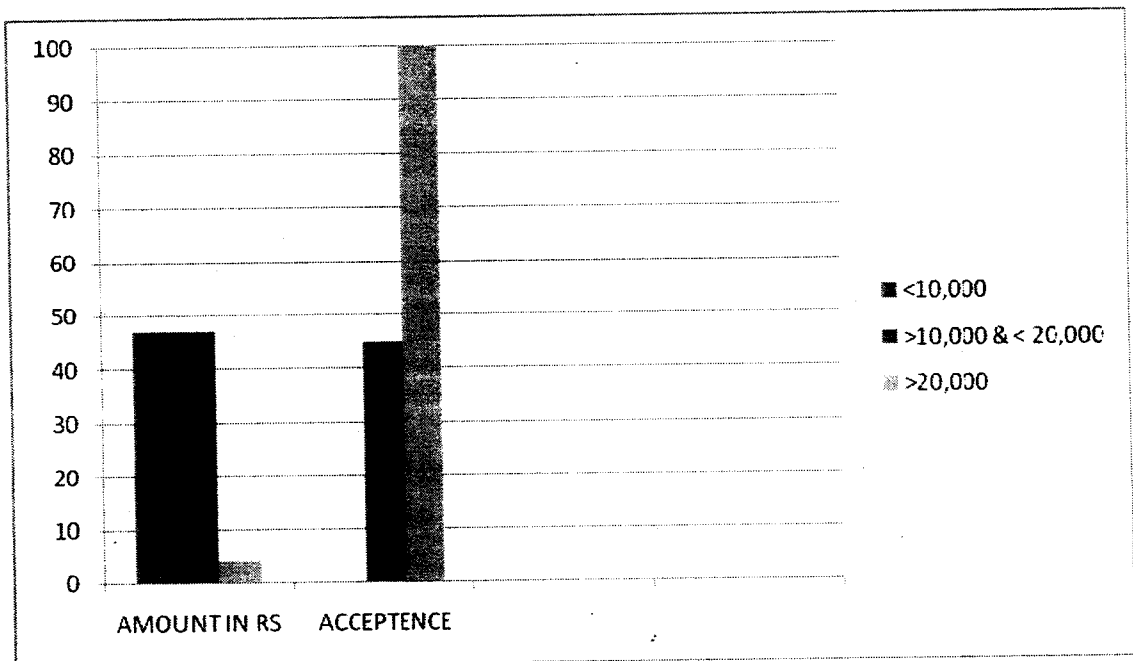


Table 4.2.5 Preference of this system with electrical coil attached vs. Acceptance of the

system:

| Sl no | Amount respondent ready to invest on this product | % of respondent in conducted survey | % of acceptance for the product among the respondent |
|-------|---|-------------------------------------|--|
| 1 | System with back up | 70 | 50 |
| 2 | Stand alone | 30 | 10 |

Figure 4.2.5 Preference of this system with electrical coil attached vs. Acceptance of the

system:

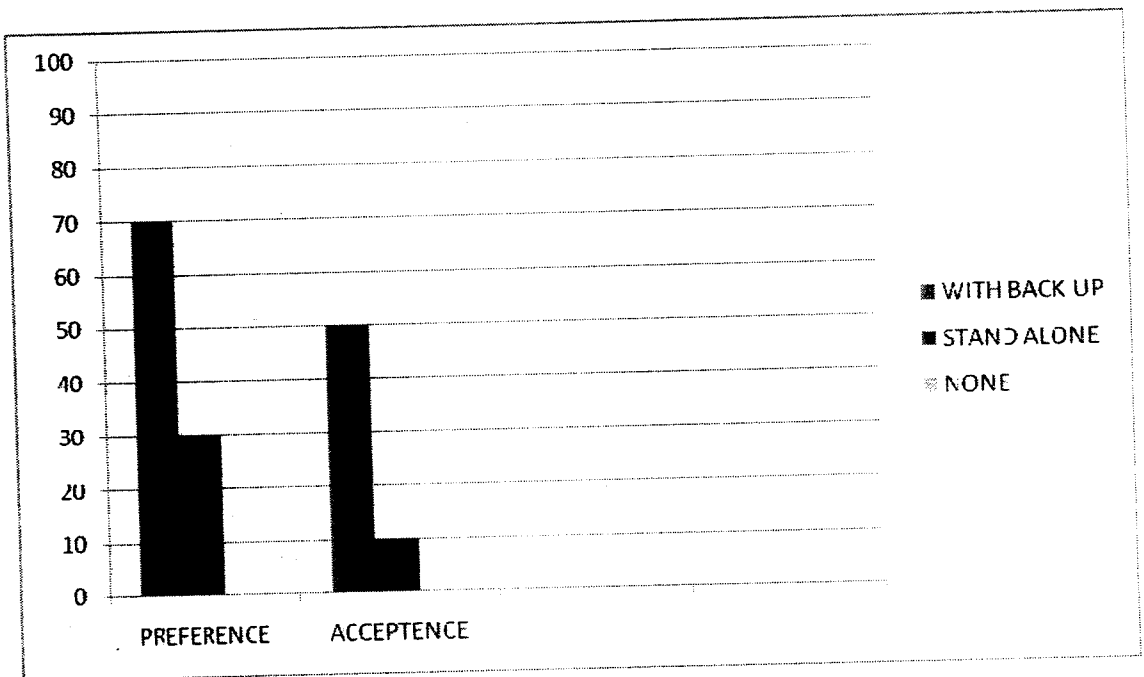
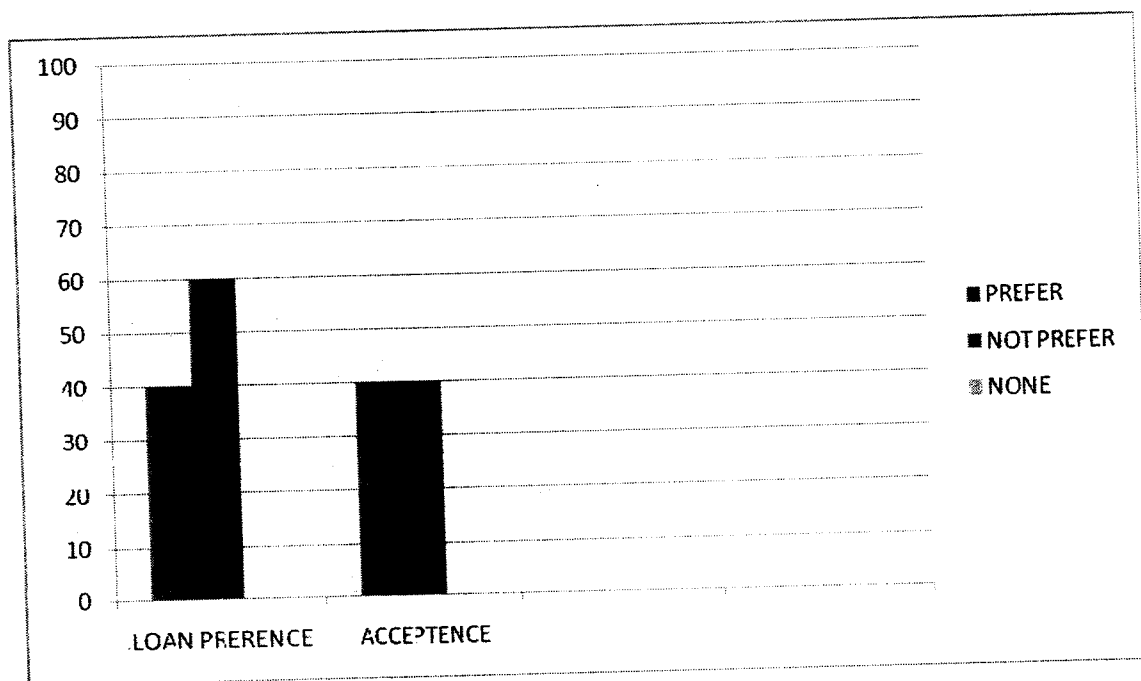


Table 4.2.6 Preference of Loan availability vs. Acceptance of this product:

| Sl no | Loan preference among respondents | % of respondent in conducted survey | % of acceptance for the product among the respondent |
|-------|-----------------------------------|-------------------------------------|--|
| 1 | Yes | 40 | 40 |
| 2 | No | 60 | 40 |

Figure 4.2.6 Preference of Loan availability vs. Acceptance of this product:



.3 Chi square test:

The following hypotheses are statistically analyzed Using **Chi-square test** by using the survey data's.

List of hypotheses tested and concluded:

1. Acceptance level among high income group.
 - **Null Hypothesis:** Income level will not affect the preference of the product.
 - **Alternative Hypothesis:** Income level will affect the preference of the product.
2. Loan availing motive among the respondents who is willing to buy.
 - **Null Hypothesis:** Giving loan will make the product to be preferred.
 - **Alternative Hypothesis:** Giving loan will not affect the preference of the product.

Likewise all the results of Percentage analysis have been confirmed with Chi-square test.

CHAPTER 5 -Summary & Conclusions:

5.1 Survey findings:

- According to the survey data, the product Diffusion level in Coimbatore is about – 5% only. It is very low compared to the population of 9, 00, 000 in Coimbatore.
- Survey data shows this business has good potentiality. The total business opportunity stands another 25 – 30% level with respect to the conducted survey data.
- Study includes all groups of people like professionals, employees, house wife's etc. But the popularity of the brands is nearly 10%. So, we can assume that the product is not reached the public yet.
- Also the conducted survey data shows that the people are worried about the cost of the product and the rate of return. About 70% of the people who are not preferred the product due to the cost of the product.

5.2 Suggestions to the organization:

- Since the awareness level are low in accordance to the survey report, it is better to give more demos or product information hand outs in order to improve the business. Most of the companies are not involved in full fledged marketing activity.
- Survey data shows that the business opportunity is 25 – 30% level is available, but it is required to give proper direction of use to the user. Also it requires after market activities like customer satisfaction survey.
- It is required to give more information about its usage and service facility availability to the public. Because the survey shows that the dealers and brand availability information reached among the people is very less.
- Making loan arrangement to the people will boost the business quickly. The acceptance level stands 40% in overall if price is around Rs 10, 000/-. Since people expect product for less price, it will be easy for us to promote product by

making them to buy with low interest rate loans. So that they can reconsider the plan of purchasing the product.

5.3 Conclusion:

I would like conclude the project with special thanks to my project guide and all the respondents who are all given valuable opinion which was helping me to complete my work.

I have successfully conducted survey among 140 people in the city and all are personally interviewed to get the required information. All the collected information's are sorted and grouped as six main categories. All the six categories of information used to carry out percentage analysis and also confirmed with chi-square test for confirmation of the findings are done.

Survey data's are showing that the following findings:

1. Business opportunity stands 25-30% in Coimbatore.
2. Acceptance level of the product stands about 40%.
3. Current usage level is nearly 5%.

I hope that this study report will give better idea about the market potential and will help to form a business strategy to do the business successfully. In future the study may be extended to industry level for getting good business.

Appendix - A

A GENERAL STUDY ON DIFFUSION LEVEL OF SOLAR HOT WATER SYSTEMS: IN COIMBATORE

QUESTIONNAIRE FOR SURVEY

1. NAME :
2. OCCUPATION :
3. WHAT IS YOUR NATIVE PLACE? :
4. HOW MUCH IS YOUR TOTAL FAMILY ANNUAL INCOME?
 Rs 1, 50,000 to 2, 00,000
 Rs 2, 00,001 to 3, 00,000
 Above Rs 3, 00,001
5. DO YOU HAVE OWN HOUSE? : YES NO
6. HOW MANY MONTHS IN A YEAR YOU USE HOT WATER FOR TAKING BATH?
 NOT PREFER
 1-2 MONTHS
 2-3 MONTHS
 3-4 MONTHS
 ABOVE 4 MONTHS
7. DO YOU HAVE A SOLAR WATER HEATER IN YOUR HOUSE? YES NO

If YES, please give your opinion about it is use & necessity to others.

If No, please give the reasons for not buying & any plan to buy in future?

8. NAME FEW BRANDS OF SOLAR WATER HEATERS YOU KNOW?

9. SOLAR HEATED WATER CAN BE USED FOR THE FOLLWING PURPOSES.
THIS WILL REDCUE THE CONSUMPTION OF OTHER ENERGY FUELS.
THIS WILL BE AN ADDED ECONOMIC VALUE FOR THIS SYSTEM.

Which of the following purpose you know already?

- BATHING
- COOKING
- WASHING
- VESSEL CLEANING

10. HOW MUCH IS THE AMOUNT YOU CAN INVEST ON SOLAR WATER HEATER SYSTEM?

Rs. _____

11. WOULD YOU LIKE TO AVAILE LOAN FOR THE PRODUCT? YES NO

12. DO YOU PREFER A SOLAR HEATER ATTACHED WITH CONVENTIONAL HEATING COILS

SYSTEM? YES NO

13. WOULD YOU LIKE TO GET ANY MORE INFORMATION ABOUT THE PRODUCT?

YES NO

If YES, What are they?

Appendix - B

BIBLIOGRAPHY

1. The Solar House - Passive Heating and Cooling - by Daniel D. Chris
- Published by Chelsea Green publishing company - 2008.
2. The Renewable Energy Hand book - by William H.Kemp
- Published by Prentice Hall of India.
3. Solar Power your home for Dummies - by Rik De Gunther
- Published by Wiley publishing inc - 2007.
4. Solar energy - Principles & Thermal collection & Storage - by S.P.Sukantame & J.K. Nayak
- Published by Tata Mc Graw hill - 2008.
5. Opinion and Market Survey Methodology - by P.T.Harris
- Published by Block well publishing - 1996.
6. Principles Of Statistical Methods - by Pratihba Bala, Farhat Mohsin, Sandeep Kumar
- Published by Oscar Publications - 2005.

Web sites referred:

- <http://en.wikipedia.org>
- <http://www.ireda.in>
- <http://www.teda.gov.in/>